# LUBBOCK PRESTON SMITH INTERNATIONAL AIRPORT

## 2ND FLOOR RENOVATIONS

ISSUED FOR BIDDING

**PROJECT MANUAL**

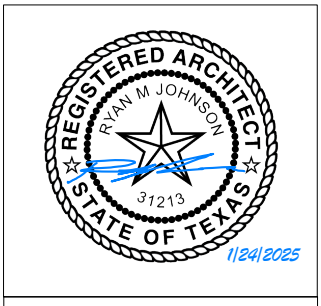
JANUARY 24, 2025

RS&H

# LUBBOCK PRESTON SMITH INTERNATIONAL AIRPORT

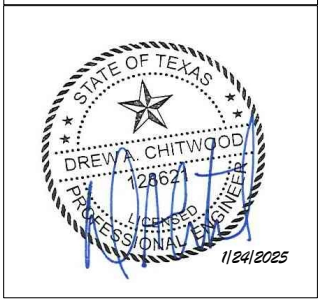
## 2ND FLOOR RENOVATIONS

## BID DOCUMENTS




ARCHITECTURAL


TECHNOLOGY




ELECTRICAL

January 24, 2025
Lubbock, Texas

RS&H No.:
2023-1874-017

Prepared by RS&H, Inc. at the direction of the Lubbock Preston Smith International Airport

RS&H

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# SUMMARY OF WORK

## PART 1 - GENERAL

### 1.1 PROJECT DESCRIPTION

A. Project Identification:
   1. Name of the Project: 2nd Floor Renovations
   2. Project Location: Lubbock Preston Smith International Airport
   3. Owner: City of Lubbock
   4. Architect / Engineer: RS&H
   5. Contract Documents Dated: January 24, 2025

B. This Base Bid scope of work for this project is comprised of:
   1. Selective Demolition
   2. Interior Paint
   3. Tile Carpeting
   4. Acoustical Tile Ceilings
   5. Resilient Base and Accessories
   6. IT, network and video conferencing upgrades
   7. Replacement of select light fixtures

C. Subsequent Bid Packages: None Anticipated

D. The Work under the Base Bid this contract will be constructed under a Single Lump Sum Bid Price (single prime contract).

### 1.2 CONTRACTOR USE OF PREMISES

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

   1. Ownership of Property: Do not perform work, disturb or trespass upon properties not possessed by the Owner.

### 1.3 OTHER

A. Builders Risk – By Contracting entity

B. Security and Badging – While several of the project work areas lie outside the secure areas of the airport, other elements of the work of the project will require construction within the secure area of the Airport. Badging restrictions and security requirements will be implemented for this work.

C. CONFORMANCE DOCUMENTS: Provided upon contract execution (Digital Copies will be provided) The set will include drawings and specifications. Conformance documents incorporate all bid addenda and clarifications. Any hard copy documents will be purchased by the Contractor.

D. Project Schedule anticipates a 4 month overall schedule for Substantial Completion.

PART 2. - PRODUCTS (Not Applicable)

PART 3. - EXECUTION

**GENERAL NOTES FOR 2ND FLOOR RENOVATIONS CONTRACT PACKAGE**

*General Supplement*

SEE DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL INFORMATION AND DETAILS.

**I. SCOPE OF WORK INCLUDED WITH THIS BID PACKAGE**:

A. The work of this Agreement shall include, but not be limited to, all labor, material, tools, equipment, plant, supplies, samples, shop drawings, layout, transportation, supervision, contributions, insurance, taxes compliance with all agencies (City, County, State, Federal as may be required), all other services and facilities and other things necessary for the performance of the Work as shown, detailed, and / or implied by the Contract Documents defined in the bid documents and as defined herein.
   1. All Specifications
   2. Project Drawings

B. The Schedule Dates within the Milestone Project Schedule are to be used as a guideline for bidding purposes to provide sufficient manpower and material to complete the work within the specified time frames. Neither the Architect / Engineer (also referred to as A/E - RS&H and consultants) nor the Owner is responsible for assumptions made by the Contractor. The Contractor shall cooperate at all times and provide timely information to other Contractors to ensure coordination and timely completion of the work. The successful Contractor will be required to submit a detailed construction schedule that demonstrates its own approach to sequencing of the work and completion dates. This schedule must be coordinated with the A/E and Owner. The Construction Schedule must accommodate Airport operations. It is understood alternative sequencing and approaches may be viable to achieving the critical dates and Bidders/Successful Contractor are encouraged to explore opportunities for efficiencies and schedule improvements that will be mutually beneficial.

C. This Contractor should be prepared to start any task within any area at all times in order to meet the Owner's Schedule. This Contractor will work with the Owner, Owner's Representative and other Contractors to develop a detailed schedule coordinated with related trades and site activities to execute the work as promptly as possible to expedite job progress and final completion.

D. Upon the Owner's direction of intent to award, this Contractor will proceed immediately with preparing and submitting critical calculations and shop drawings required for commencing the work so as to expedite the work.

E. It is this Contractor's responsibility for the entire scope of this Bid Package and coordination between All Trades of this Bid Package and other Bid Packages.

F. The more stringent details of the specifications, plans, bid package, and supplementary provisions will be enforced.

G. The scope of work shall **INCLUDE**, but not be limited to, furnishing and installing the following:

***General Requirements***

A. Any temporary roads, stone, or crane mat requirements are the responsibility of this Contractor.

B. Prior to erection, a complete certification for all cranes will be submitted verifying proper use and integrity of equipment. Monthly logs for crane inspections and repairs are to be maintained and copies submitted to Architect and / or Owner's Representative regularly.

C. Any FAA required lighting and flagging for cranes is to be included.

D. Construction equipment must have a maximum height as noted in the project plans (75'). Should the use of construction equipment with heights greater than those noted be required, including cranes, submit FAA Form 7460-1 to the FAA for approval. The FAA must provide approval prior to the use of the requested equipment. FAA response time may take 90-120 days.

E. Within twenty (20) days of award and / or issuance of contract, provide a schedule indicating the duration for shop drawings, submittals, fabrication, delivery and erection for each section of the building. A preliminary copy of your fabrication and erection schedule must be included with bid proposal**.**

F. This Contractor is aware of the project substantial completion date and shall work with the Owner and Architect to develop the overall progress schedule and perform this work to meet the final firm date established.

G. The contractor shall provide all necessary traffic control, escort details, street closures, flagmen, etc. for this work to meet the requirements of the jurisdictional requirements.

H. Compliance with the overall Owner Safety Program and guidelines. Contractor implementation of a positive safety attitude is mandatory.

I. The Airport operations may require construction shutdown at any time due to extenuating circumstances (examples – military operations, dignitary visits, etc). This Contractor will be required to shutdown any / all work as required. The Contractor will not be allowed additional compensation for the shutdown time, extra general conditions, or additional demobilization / remobilization.

J. The bid documents are to be fully reviewed by all bidding trade contractors. All trade contractors are responsible for all items pertaining to their work on all documents, whether shown in their specific discipline drawings or not. No additional compensation will be allowed for items that are shown on another discipline's documents, but not on the trade contractor's discipline documents.

***Engineering and Coordination***

A. Contractor to provide Pre-Erection Photographs and Report stating status of existing conditions before commencing of any Work.

B. Welder's certifications must be submitted prior to mobilizing for erection.

C. Provide engineered design of all designated structural steel connections as required by the specifications, stamped by a registered Structural Engineer licensed in the State of Texas.

D. Upon intent to award, Contractor will immediately proceed with preparing all critical submittals and shop drawings as required by Specifications to meet scheduled completion dates. Submission of all submittals shall occur no later than fifteen (15) days after award. Provide complete engineering design of all components required in the specifications

including calculations indicating system loading and loads, and engineered shop drawings stamped by a registered Structural Engineer licensed in the State of Texas.

E. Prior to fabrication, perform all field measurements required to coordinate the metal fabrications with other construction in place. Some work may proceed based on guaranteed dimensions. This Contractor is responsible for any comeback or corrective work required to fully coordinate the metal fabrication installation with the work of other trades.

F. Coordinate work sequence with the work of all other contractors, including those whose contracts have not yet been awarded, but who will be performing work simultaneously. Out of sequence work is to be expected and will be required to successfully complete a coordinated installation.

G. This Contractor shall furnish and install all bracing, shoring, and reinforcing, as required, to support or stabilize the work. Where above-ceiling mechanical, piping, electrical, fire protection, or plumbing work is installed before this Contractor's work, this Contractor will furnish and install additional bracing and kickers as required to avoid damage to the work-in-place and firmly attach the supports to the structure above.

H. Provide and pay for all permits, inspection and re-inspection fees required for your work.

I. Contractor to Provide and pay for building permit. This is to be secured prior to the start of construction.

J. This Contractor will be responsible for maintaining and providing necessary repairs / replacement to the storm water prevention measures that were previously provided and installed by others.

K. This Contractor is responsible to secure any and all permits and special routing, which may be required for the delivery and shipping of structural steel sections and erection equipment.

***Housekeeping***

A. Street cleaning for debris and dirt caused by this Contractor, workers, or suppliers as required to keep roads and walkways safe to the satisfaction of the Owner. Provide barricades as required.

B. The Contractor will be responsible to provide all clean-up of rubbish and debris that results from this operation to the Contractor's furnished rubbish container. Rubbish removal and hauling is the responsibility of this Contractor.

C. This Contractor shall include all costs associated with performing this work and all associated cleaning and protection for this work. All ramps, roadways, parking areas, loading areas, pedestrian areas, etc. must be well maintained.

D. Daily cleanup for debris removal generated by this work, including labor.

E. All areas accessible for events and loading must be kept clean. Any work not performed daily will be performed by the Owner. All of these associated non-performance costs including an additional multiplier of five (5) times the actual costs will be back charged to the applicable Contractor including any associated management costs.

***Fabrication / Erection / Installations***

A. Furnishing, installing, maintaining and removal of any and all enclosures and / or temporary facilities that may be required to protect this Work from any kind of weather and other perils, including the provision of adequate temporary heating to maintain proper temperature control as long as the conditions warrant same.

B. All Layout required to complete this work is by this Contractor (layout for framed openings, mechanical openings, stair openings, elevator openings, and additional openings that are typical to this type of construction are to be included whether shown or not. No additional surveying or control will be provided by the Owner or A/E.

C. This Contractor shall not burn or create any holes/openings within the existing or proposed structure without the Structural Engineer's approval.

D. This Contractor shall prime and / or paint metal as specified at shop. Exterior metal will be galvanized unless noted otherwise.

E. Review schedule for project requirements. Provide equipment and manpower (multiple crews and / or shift work, working on concurrent activities) as necessary to meet the schedule dates.

F. Covering, securing and maintaining all floor openings with appropriate signage to meet the requirements of governing authorities.

G. Covering, securing, and maintaining any openings made by this Contractor that poses a fall hazard with appropriate signage to meet the requirements of governing authorities.

H. Perimeter protection, protection (railing) at elevator shafts, floor levels, all roofs, railing protection at stair openings, mechanical shafts, electrical shafts, and any other openings posing fall risks per OHSA requirements. Maintenance of protection will be by this Contractor during the entire duration of this Contract. This Contractor will leave the cabling and railing in place at the conclusion of this Contract. Protection includes toe boards, cable, and flagging at shaft openings and perimeter. In addition to OHSA requirements, Contractor shall provide protection for any transition greater than one foot.

I. Flagperson(s) and signage for Work as required.

J. Contractor to provide adequate quantity, with a maximum of 100' of distance of travel between fire extinguishers, of fire extinguishers including stand-alone stands to be dispersed throughout the project site.

K. Contractor to provide fire extinguishers, fire blankets, curtain shields, etc. for all torch and welding operations.

L. Contractor will be required to prepare a site logistics plan prior to mobilization. The logistics plan will require flexibility to accommodate Owner operations. Updated logistics plans will be required as work progress and conditions change.

M. On-site parking will be allowed as Directed by the Owner.

N. The Contractor shall notify the Owner/Owner's Representative of all deliveries a minimum of forty-eight (48) hours prior to delivery.

O. Furnish all fabrication testing and reports required for this scope.

P. Proper notification of testing procedures and time of test. Contractor will be required to coordinate and accommodate Owner Testing that includes structural steel / bolts / welds,

etc.

Q. Coordinate with the Owner, Local Authorities, and Utilities having jurisdiction for all inspections required.

R. Include any additional materials and methods as may be necessary for out of sequence work called out in the documents, required as means to complete this work, or specifically noted in this scope document.

S. Multiple mobilizations may be necessary to complete work.

AA. Notify Owner/Owner's Representative a minimum of seventy-two (72) hours prior to any shut down of existing or temporary utilities. Contractor must coordinate with local authorities and have Owner approval prior to any disruption of utility services.

BB. Contractor is to provide/furnish all temporary utilities for generators, lights, trailers, etc for this project. The Owner will assist in locating connection points for these items, but will not provide hook-up or pay the consumable portion for the service. Any anticipated disruptions to operational existing occupied adjacent (Tenant) spaces, shall be coordinated with Owner/Owner;s Representative and Tenant(s). These services will need to be applied for and paid by the Contractor directly to the utility.

CC. Contractor is responsible for storing and staging all equipment, structural steel, and miscellaneous metal off the ground surface utilizing dunnage or similar material.

DD. This Contractor shall be responsible for the repair of any damage to existing utilities and utility structures, curbs, sidewalks and paving which are damaged as the result of this work.

EE. Contractor is responsible for removal, layout, making openings, and patching of all systems in order to complete their Work including but not limited to brick, block, etc. type systems. Preservation of existing materials to be re-used/re-located shall be coordinated with Owner/Owner's representative.

FF. This Contractor shall include any required demolition, patching, etc. to perform this work.

GG. Secure and purchase all permits required for this work. The Owner will begin the process of securing the Building Permit. Upon Award, this Contractor is to complete the process, pay for, and pick up the Building Permit. All other permits or inspection fees are the responsibility of this Contractor also.

JJ. This Contractor is responsible for the replacement of any material removed.

KK. Contractor to provide a minimum of 48 hours notice to Testing Services Contractor before all applicable tests. Contractor assumes all responsibility for testing services, if notice is not properly given.

LL. Contractor is responsible for all snow removal within the construction fence / barricades including the project site and staging / parking areas in order to perform their work.

MM. Contractor to submit all Hot and Cold Weather operation plans prior to work

NN. Contractor to provide shop drawings stamped "APPROVED FOR FIELD USE" during field operations, which shall include all A/E comments.

OO. Contractor to provide weather protection of all structural components (including but not limited to anchor bolts and structural steel connection bolts) and building construction

materials.

PP. All blueprinting and reproduction costs associated with shop drawings, submittals, as-builts, operation manuals, etc. are the responsibility of this Contractor.

QQ. This Contractor to maintain updated As-Built documents at all times and to make these documents immediately available upon request. Any As-Built documents not updated during each billing period will be grounds for the Owner to reject the entire payment application for that billing period.

RR. Storage of all materials on and off-site will be the responsibility of this Contractor.

SS. All materials, debris, equipment, etc. must be stored off site or within construction areas. No materials to be stored in non-approved areas.

TT. All hoisting, scaffolds, lifts, ladders, cranes, etc. to perform this Work are to be included by this Contractor.

UU. All structural concrete floors and S.O.G. floors are finished surfaces and shall not be damaged by any operations. No Hilti-type loads shall be shot into the exposed finish floors or walls. No stains will be allowed on the concrete floors. All equipment utilized on concrete to remain should have non-skid tires.

VV. This Contractor to provide all necessary lighting and emergency egress routes/equipment during this Work.

WW. Contractors are responsible for providing fire retardant backer boards / blankets in all interior areas where torching and welding operations occur.

XX. Protection for all adjacent work or clean after installation.

YY. This Contractor to provide expansion / control joints as required.

ZZ. Prior to starting the work, this Contractor will review the scope and review the details to coordinate finish and interface details with other work. Any known discrepancies or foreseeable field conditions are to be addressed to the A/E prior to proceeding with the Work.

AAA. This Contractor will periodically visit the site prior to beginning the work to be familiar with project conditions and identify any potential conflicts in advance to allow for proper planning. Any recognized discrepancies between existing conditions and proposed work, shall be presented to Owner/A/E in a timely manner and coordinated as required.

BBB. This Contractor has visited the site and is aware of existing field conditions and surrounding environment. Any recognized discrepancies between existing conditions and proposed work, shall be presented to Owner/A/E in a timely manner and coordinated as required.

**II. UNDERSTANDINGS AND STIPULATIONS**:

A. It is understood that there will be no additional costs for removing and / or trucking equipment to and from the jobsite.

B. Coordination and field sequencing with other trades will be required. The successful contractor will be required to attend and participate in the preparation of “Contractors Coordination Drawings” and weekly coordination meetings with other trades where requirements, conflicts and coordination issues will be discussed and resolved.

Attendance is mandatory. Dimensions outlined on drawings or other Contract Documents may require adjustment to accomplish coordinated and workable layout without further compensation.

C. Contractor will follow the Contract Documents with regard to “listed and approved” suppliers and manufacturers. The Contractor acknowledges and represents that the Contractor has visited the site of the Project to become familiar with the existing improvements and physical conditions of the site.

D. The Contractor acknowledges and represents that the Contractor has examined and fully understands the Contract Documents.

E. The Contractor acknowledges and represents that the Contractor has had sufficient opportunity to request changes, clarifications and interpretations of errors, ambiguities, omissions and other issues contained in the Contract Documents. The Contractor will submit all required bid proposal documentation that is required in the invitation to bid. Bidders that do not provide all required documentation are subject to disqualification by the Owner.

F. The Contractor will ensure compliance with and a good faith effort towards the Owner’s Disadvantaged Business Enterprise goals as established in the invitation to bid.

## MILESTONE SCHEDULE

Contractor shall commence the Work when notified to do so by the Owner/Owner’s Representative and shall diligently and continuously progress, coordinate and complete the Work, in accordance with the project schedule and any other scheduling requirements listed in this Agreement, so as not to delay the commencement, progress or completion of the whole or any part of the Work on the Project.
The Contractor shall develop a detailed project schedule providing information for the scheduling of the times and sequence of operations required for its Work to meet the Owner's overall Project Construction Schedule requirements, shall continuously monitor the detailed project schedule as to be fully familiar with the timing, phasing and sequence of operations of the Work and of the other work on the Project, and shall execute the Work in accordance with the requirements of the detailed project schedule including any revisions thereto.

Within twenty (20) days after notification of award of Contract the Contractor shall submit to the Owner/Architect a bar chart of his operations (including samples and shop drawing submissions, fabrication time, delivery time, installation time, etc.) required to meet the Project Construction Schedule. This schedule must include a minimum amount of information and detail as outlined in Specification Section 013300. This schedule, when approved by the Architect/Engineer, shall be reviewed during the progress of the work and revised if necessary to meet the completion dates.

Should the progress of the Work or of the Project be delayed by any fault or neglect or act or failure to act of the Contractor or any of its officers, agents, servants, employees, subcontractors or suppliers so as to cause any additional cost, expense, liability or damage to the Owner or any damages or additional costs or expenses for which the Owner may or shall become liable, the Contractor shall and does hereby agree to compensate the Owner for and indemnify them against all such costs, expenses, damages and liability.

END OF SECTION 011000

# SUBSTITUTION PROCEDURES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.
B. Related Requirements:
   1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

### 1.3 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.

### 1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. 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 facsimile of form provided in Project Manual.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      A. Statement indicating why specified product or fabrication, or installation method cannot be provided, if applicable.
      B. Coordination of 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 substitutions 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. Samples, where applicable or requested.
      F. Certificates and qualification data, where applicable or requested.

G. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
H. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
I. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
J. Cost information, including a proposal of change, if any, in the Contract Sum.
K. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
L. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within fourteen days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fourteen 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.

## 1.5 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.

## 1.6 PROCEDURES

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

## 1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than fifteen 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 sixty days after the Notice to Proceed. 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 is consistent with the Contract Documents and will produce indicated results.
C. Substitution request is fully documented and properly submitted.
D. Requested substitution will not adversely affect Contractor's construction schedule.
E. Requested substitution has received necessary approvals of authorities having jurisdiction.
F. Requested substitution is compatible with other portions of the Work.
G. Requested substitution has been coordinated with other portions of the Work.
H. Requested substitution provides specified warranty.
I. 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 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

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# CONTRACT MODIFICATION PROCEDURES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including other Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing contract supplements and modifications.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 1, Section 012900 - APPLICATIONS FOR PAYMENT for administrative procedures governing Applications for Payment.
2. Division 1, Section 013300 - SUBMITTALS for requirements for the Contractor's Construction Schedule.
3. Division 1, Section 012500 - PRODUCTS AND SUBSTITUTIONS for administrative procedures for handling requests for substitutions made after award of the Contract.

C. The Architect / Engineer will be reimbursed for an unreasonable number of RFI's and CCA's.

### 1.3 CONTRACT DOCUMENT SUPPLEMENTS

A. Clarification / Supplemental Instructions (C): Shall provide further detail to requirements inferred in the Contract Documents or authorize minor changes in the work, not involving an adjustment to the Contract Sum or Contract Time, and will be issued by the Architect with supplemental or revised drawings and specifications, if necessary. Clarifications / Supplemental Instructions issued by the Architect-Engineer shall become binding and a part of the Contract as minor changes in the work unless the Contractor notifies the Architect-Engineer within twenty-one (21) days that the instructions result in changes that affect the Contract Cost or Contract Time.

B. Request for Information / Supplemental Instructions (RFI): Shall be initiated by the Contractor when necessary for performance of the work. The Architect's reply will constitute further detail to requirements if inferred in the Contract Documents or interpretations of the requirements. Requests for information must describe all document references that pertain to the issue and any conflicts and must include the contractor's interpretation or proposed action that would be made if there was not a process to obtain the information from the Architect. Requests for information that do not include this, or that request information already included in the contract documents without conflict, will be returned without action (RWA). The Architect will record the time expended to process such requests and notify the Contractor of the charges. The owner shall deduct any such compensation due the Architect from the Contractor's monthly periodic pay requests in accordance with the compensation terms for cost, overhead and profit in the Owner / Architect agreement.

C. Contractor Corrective Action Proposals (CCA): Shall be initiated by the Contractor when deviation from the contract requirements has been constructed. The Contractor shall provide a fully detailed proposal for his corrective or remedial work. The Architect's reply will indicate approval of the proposed action as detailed, approval with certain modifications, or rejection of the proposal. Use forms provided by the Architect. The Contractor shall maintain a sequentially numbered log of all such proposals. Upon notification of a deviation and request

for a CCA the Contractor shall submit one promptly. Should this not occur in a timely fashion which, in the judgment of the Architect, will allow time for processing and correction ahead of other advancing elements of work, the Architect will initiate a CCA giving direction for correction. If the Architect initiates the CCA or must provide significant direction to a Contractor initiated CCA, due to a lack of a fully detailed proposal, the Architect will record the time expended and notify the Contractor of the charges. The owner shall deduct any such compensation due the Architect from the Contractor's monthly periodic pay requests in accordance with the compensation terms for cost, overhead and profit in the Owner / Architect agreement.

1.4 PROPOSAL / CHANGE ORDER REQUESTS

A. Request for Proposal (RFP): The Architect will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Proposal requests issued by the Architect are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.
   2. Unless otherwise indicated in the proposal request, within twenty (20) days of receipt of a proposal request, submit an estimate of cost necessary to execute the change to the Architect for the Owner's review.
      a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
      b. Itemize labor charges by time and category.
      c. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      d. Indicate overhead and profit charges.
      e. Include a statement indicating the effect the proposed change in the work will have on the Contract Time.

B. Contractor-Initiated Change Order Requests (RCO): When latent or unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
   1. Include a statement outlining the 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 Contract Time.
   2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Comply with requirements in Section 012500 - PRODUCTS AND SUBSTITUTIONS if the proposed change requires substitution of one product or system for a product or system specified.
   5. Change Order Request Form: Use forms provided by the Architect. The Contractor shall maintain a sequential log of all Requests for Change Orders.

1.5 ALLOWANCES

A. Allowance Adjustment: For allowance-cost adjustment, base each Change Order Proposal on the difference between the actual purchase amount and the allowance, multiplied by the final measurement of work-in-place. Where applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
   1. Include installation costs in the purchase amount only where indicated as part of the allowance.

2. When requested, prepare explanations and documentation to substantiate the margins claimed.
3. The Owner reserves the right to establish the actual quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or the Contractor's handling, labor, installation, overhead, and profit. Submit claims within twenty (20) days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. The Owner will reject claims submitted later than 20 days.
1. Do not include the Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in Contract Documents.
2. No change to the Contractor's indirect expense is permitted for selection of higher or lower-priced materials or systems of the same scope and nature as originally indicated.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When the Owner and the Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Architect may issue a Construction Change Directive. The Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. The Construction Change Directive will contain a complete description of the change in the work and designate the method to be followed to determine change in the Contract Sum or 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 the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.7 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Change Order Proposal Request, the Architect will issue a Change Order for signatures of the Owner and the Contractor on AIA Form G701, or similar, as provided in the Conditions of the Contract. Submit claims within twenty (20) days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. The Owner will reject claims submitted later than twenty (20) days.

1.8. CHANGE ORDER MARK-UP

A. The amount of overhead and profit allowed to the Contractor on a contract modification will be as follows:
1. Unit Price - If there is a proposed increase or decrease in a scope item that has a Unit Price in the Contract Documents, no additional mark-up will be allowed for overhead, profit, safety, insurance or bonds. In addition, no reduction in overhead and profit will be taken for the scope change.
2. Proposal Basis (Additive) – If there is a proposed increase in the scope of work, the Contractor will be allowed a 10% mark-up for overhead and profit for all direct work (work by his/her own forces) and for subcontractors' costs. This mark-up includes overhead, profit, safety and insurance costs. The Contractor will be paid for the increase in Bond amount equal to his / her actual bonding rate as stated in the bid form. This is to be added for all scope / cost changes.
3. Proposal Basis (Deductive) – If there is a proposed decrease in the scope of work, the Contractor will be required to provide a 0% mark-down for overhead and profit for all direct work (work by his / her own forces) and subcontractors' costs. This

mark-down includes overhead, profit, safety and insurance costs. The Contractor will provide a deduction for the decrease in Bond amount equal to his / her actual bonding rate as stated in the bid form. This is to be deducted for all scope / cost changes.

4. Time & Material (Additive) - If there is a proposed increase in the scope of work due to time and material work directed by the Owner, the Contractor will be allowed a 10% mark-up for overhead and profit for all direct work (work by his/her own forces) and subcontractors' costs. This mark-up includes overhead, profit, safety and insurance costs. The Contractor will be paid for the increase in Bond amount equal to his / her actual bonding rate as stated in the bid form. This is to be added for all scope / cost changes.

B. All Subcontractors will be required to adhere to the same allowable mark-ups / downs as the Contractor. The Contractor is responsible for reviewing and confirming that all Subcontractors have adhered to the allowable mark-ups / downs as stated above.

C. The Contractor will be required to provide detailed back-up for all costs associated with the scope change. This includes, but is not limited to material invoices from suppliers, hourly wage rate sheets including all fringe benefits, certified payrolls and bonding amount certification from his / her bonding company.

D. Equipment – The Contractor will be paid for all equipment (other than small hand tools) as currently defined by the Illinois Department of Transportation "Schedule of Average Annual Equipment Ownership Expense with Operation Cost." No additional mark-up for overhead and profit will be allowed over and above the costs listed in this book. If equipment is not listed in this book, the Contractor is to provide rental agreement / invoices for the equipment.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012600

# APPLICATIONS FOR PAYMENT

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including other Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
   1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.

B. Related Sections: The following Sections contain requirements that relate to this Section.
   1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in Division 1 Section 013300 - SUBMITTALS.

### 1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
      a. Contractor's Construction Schedule.
      b. Application for Payment forms, including Continuation Sheets.
      c. List of subcontractors.
      d. Schedule of allowances.
      e. Schedule of alternates.
      f. Schedule of submittals.
   2. Submit 3 copies of the Schedule of Values to the Architect for approval at the earliest possible date but no later than twenty-one (21) days before the date scheduled for submittal of the initial Applications for Payment.
   3. Subschedules: Where Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
   1. Identification: Include the following Project identification on the Schedule of Values:
      a. Project name and location.
      b. Name of the Architect.
      c. Project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
      a. Related Specification Section and Division.
      b. Description of Work / generic name of the item.
      c. Name of subcontractor.
      d. Name of manufacturer or fabricator.
      e. Name of supplier.

f. Change Orders (numbers) that affect value.
g. Dollar value.
h. Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in sufficient detail, acceptable to the Architect, to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
4. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing, if required.
6. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Margins of Cost: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at the Contractor's option.
8. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
   1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

B. Payment Application Times: The "date" for each progress payment is as indicated in the Owner-Contractor Agreement or, if none is indicated therein, it is the 25th day of each month. The period of construction work covered by each payment request is the period indicated in the Owner-Contractor agreement or, if none is indicated therein, starting the day following the end of the preceding period. Refer to General Conditions and other Contract Documents for other dates related to payment application times.

C. Payment-Application Forms: Use AIA Document G702 and Continuation Sheets G703 as the form for Applications for Payment.

D. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Architect will return incomplete applications without action.
   1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
   2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit five (5) signed and notarized original copies of each Application for Payment to the Architect by a method ensuring receipt within twenty-four (24) hours. One copy shall be complete, including waivers of lien and similar attachments.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect.

F. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics liens from every entity who may lawfully be entitled to file a mechanics lien arising out of the Contract, including but not limited to subcontractors, sub-subcontractors and suppliers, for the construction period covered by the previous application.
   1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
   2. When an application shows completion of an item, submit final or full waivers.
   3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Waiver Delays: Submit each Application for Payment with the Contractor's waiver of mechanics lien for the period of construction covered by the application.
      a. Submit final Applications for Payment with or proceeded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
   5. Waiver Forms: Submit waivers of lien on forms and executed in a manner acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment, include the following:
   1. List of subcontractors.
   2. List of principal suppliers and fabricators.
   3. Schedule of Values.
   4. Contractor's Construction Schedule (preliminary if not final).
   5. Schedule of principal products.
   6. Schedule of unit prices.
   7. Submittal Schedule (preliminary if not final).
   8. List of Contractor's staff assignments.
   9. List of Contractor's principal consultants.
   10. Copies of building permits.
   11. Copies of authorizations and licenses from governing authorities for performance of the Work.
   12. Certificates of insurance and insurance policies.
   13. Performance and payment bonds.
   14. Data needed to acquire the Owner's insurance.
   15. Initial settlement survey and damage report, if required.

H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.
   1. This application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
   2. Administrative actions and submittals that shall precede or coincide with this application include:
      a. Occupancy permits and similar approvals or certifications by governing authorities, assuring Owner=s full access and use of the completed work.
      b. Warranties (guarantees) and maintenance agreements.
      c. Test / adjust / balance records.
      d. Maintenance instructions.
      e. Meter readings.
      f. Start-up performance reports.

g. Change-over information related to Owner's occupancy, use, operation, and maintenance.
h. Final cleaning.
i. Application for reduction of retainage and consent of surety.
j. Advice on shifting insurance coverages, including proof of extended coverages as required.
k. Final progress photographs.
l. List of incomplete Work recognized to be completed by the Contractor, as exceptions to Architect's Certificate of Substantial Completion.

I. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:
1. Completion of Project closeout requirements.
2. Completion of items specified for payment application at time of Substantial Completion (regardless of whether such application was made).
3. Assurance, satisfactory to Owner, that unsettled claims will be settled and that work not actually completed or accepted will be completed without undue delay.
4. Transmittal of required Project construction records to the Owner.
5. Certified property, building, foundation, site improvements survey in an electronic format.
6. Proof, satisfactory to Owner, that taxes, fees, and similar obligations of the Contractor have been paid.
7. Removal of temporary facilities and services.
8. Removal of surplus materials, rubbish, and similar elements.
9. Change of door locks and other Contractor access to Owner's property.
10. Consent of Surety for Final Payment.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012900

# PROJECT MANAGEMENT & COORDINATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including other Division 1 Specification Sections, apply to this section.

### 1.2 SUMMARY

A. This section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:
   1. General project coordination procedures.
   2. Coordination Drawings.
   3. Administrative and supervisory personnel.
   4. Cleaning and protection.

B. Related Sections: Refer to other Division 1 sections for coordination requirements regarding field engineering services, project meetings, Contractor's construction schedule, general installation and contract closeout.

### 1.3 COORDINATION

A. Coordinate construction operations included in various sections of these Specifications to assure efficient and orderly installation of each part of the work. Coordinate construction operations included under different sections that are dependent upon each other for proper installation, connection, and operation.
   1. Schedule construction operations in the 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 assure maximum accessibility for required maintenance, service, and repair.
   3. Make provisions to accommodate items scheduled for later installation.

B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
   1. Prepare similar memoranda for the Owner and separate contractors where 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 assure orderly progress of the work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of schedules.
   2. Installation and removal of temporary facilities.
   3. Delivery and processing of submittals.
   4. Progress meetings.
   5. Project closeout activities.

### 1.4 SUBMITTALS

A. Coordination Drawings: Prepare coordination drawings as careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.

1. Show the relationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.
3. Comply with requirements contained in Section 013300 - SUBMITTALS.
4. Refer to Divisions 15 and 16 for additional requirements.

B. Staff Names: Within 15 days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

C. Subcontractor / Supplier Names: Within 15 days of commencement of construction operations, submit a listing of Contractor’s principal subcontractors and suppliers, naming persons and listing their addresses and phone numbers.

1.5 SITE USE PLAN

A. Within ten (10) working days of Contract award, the Contractor shall develop and submit for Owner’s approval a site use plan. This plan shall clearly describe the proposed temporary facilities, staging areas, ramps and major traffic ways, hazardous material storage, provisions for site services, safety and security. Changes to the site plan shall be submitted for review and approval five (5) working days prior to effecting the changes.

1.6 TRADESPERSONS AND WORKMANSHIP STANDARDS

A. General: Instigate and maintain procedures to ensure that persons performing work at site are skilled and knowledgeable in methods and craftsmanship needed to produce required quality levels for workmanship in completed work. Remove and replace work which does not comply with workmanship standards as specified and as recognized in the construction industry for applications indicated. Remove and replace other work damaged or deteriorated by faulty workmanship or its replacement.

B. Availability of Tradespersons: At each progress or coordination meeting, review availability of tradespersons and projected needs to accomplish work as scheduled. Require each entity employing personnel to report on events which might affect progress of work. Where possible, consider alternatives and take actions to avoid disputes and delays.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

C. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

D. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

E. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.

F. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

G. Recheck measurements and dimensions, before starting each installation.

H. Install each component during conditions of temperature, humidity, exposure, forecasted weather and status of project completion that will ensure the best possible results, in coordination with entire work. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

3.2 CLEANING AND PROTECTION

A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

C. 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. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining, and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High-speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.

27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

3.3 ENVIRONMENTAL PROTECTION

A. Soil Disposal and / or Borrow: Conduct all soil disposal and / or borrow work in accordance with requirements of local regulatory authorities. Dispose of all excess soil in a legal manner off site.

B. Solid, Liquid and Gaseous Contaminants: Contractor shall be responsible for the proper disposal of all solid, liquid and gaseous contaminants in accordance with all local codes and regulations, together with the following requirements.
   1. Discharge gaseous contaminants so that they will be sufficiently diluted with fresh air to reduce the toxicity to an acceptable level.
   2. Liquid contaminants may, subject to local utility standards, be diluted with water to a level of quality acceptable in the local sewer system or shall be contained in approved vessels for disposal at approved sites.

C. Disposal of Refuse: Remove refuse resulting from construction operations from the site. Burning on the site is not permissible.

D. Hazardous Waste: All hazardous waste generated by the Contractor and the Contractor's subcontractors during the course of construction shall be stored, transported and disposed of in accordance with 40 CFR 260. The Contractor and his subcontractors shall be responsible for all documentation related to hazardous waste generated as a result of this Contract and that documentation shall be in accordance with 40 CFR 260.

E. Construction Site Maintenance:
   1. Store all supplies and equipment on project site so as to preclude mechanical and climatic damage. Maintain site in a neat and orderly manner.
   2. Contractor shall be responsible for maintaining the temporary structures and construction enclosure (fence) in good repair and visually pleasant. Contractor shall further provide adequate security, supplementing the existing fencing as necessary, to prevent the presence of unauthorized persons on the site and to keep gates secured when not in actual use to ensure the integrity of the barrier as well as for property security.

F. Noise Control: Comply with all applicable state and local laws, ordinances and regulations relative to noise control.

END OF SECTION 013100

# SUBMITTAL PROCEDURES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including other Division 1 Specification Sections, apply to this section.

### 1.2 SUMMARY

A. This section includes administrative and procedural requirements for submittals required for performance of the work, including the following:

1. Contractor's construction schedule.
2. Submittal schedule.
3. Daily construction reports.
4. Construction photographs.
5. Shop Drawings.
6. Product Data.
7. Samples.
8. Quality assurance submittals.

B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Permits.
2. Applications for Payment.
3. Performance and payment bonds.
4. Insurance certificates.
5. List of subcontractors.

C. Related Sections: The following sections contain requirements that relate to this section:

1 Division 1, Section 012900 - APPLICATIONS FOR PAYMENT specifies requirements for submittal of the Schedule of Values.

2. Division 1, Section 013100 - COORDINATION specifies requirements governing preparation and submittal of required Coordination Drawings.

4. Division 1, Section 014000 - QUALITY CONTROL specifies requirements for submittal of inspection and test reports.

5. Division 1, Section 017700 - CONTRACT CLOSEOUT specifies requirements for submittal of Project Record Documents at project closeout.

1.3 QUALITY ASSURANCE

A. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.4 SUBMITTAL PROCEDURES

A. Build America, Buy America (BABA) Compliance Statement: To facilitate the orderly documentation to the Owner of compliance with this requirement, the Contractor shall include with all product data submittals a signed Compliance Statement, together with supporting documentation for the following:
   1. All iron and steel used in the project are produced in the United States. This means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.
   2. All manufactured products used in the project are produced in the United States. This means the manufactured product was manufactured in the United States, and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation.
   3. All construction materials are manufactured in the United States. This means that all manufacturing processes for the construction material occurred in the United States.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

   2. Coordinate transmittal of different types of submittals for related elements of the work so processing will not be delayed by the need to review submittals concurrently for coordination.

      a. .The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
   3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
      a. Allow 2 weeks plus time in transit for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Architect will advise the Contractor when a submittal being processed must be delayed for coordination.
      b. If an intermediate submittal is necessary, process the same as the initial submittal.
      c. Allow two (2) weeks plus time in transit for reprocessing each submittal.
      d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the work to permit processing.

   4. The Architect will review up to 2 submissions (original and one resubmission) of shop drawings and other data submitted by the Contractor. Thereafter, additional reviews will be at the expense of the Contractor. These two referenced submissions shall be the only two whose associated review costs shall be borne by the Owner, regardless of whether a different product is submitted in

subsequent submittals and regardless of whether a product is submitted as an equal product or substitution. The Architect will record the time required by him or his consultants in reviewing and approving submission in excess of the original and one 1 resubmission and notify the Contractor of the charges therefore. The Owner shall deduct any such expenses of the Architect from the Contractor's monthly periodic pay requests in accordance with the compensation terms for cost, overhead and profit in the Owner / Architect-Engineer agreement.

a. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

B. Provide a space approximately 4 by 5 inches on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
1. Include the following information on the label for processing and recording action taken.
2. Project name.
3. Date.
4. Name and address of the Architect.
5. Name and address of the Contractor.
6. Name and address of the Subcontractor.
7. Name and address of the supplier.
8. Name of the manufacturer.
9. Number and title of appropriate Specification section.
10. Drawing number and detail references, as appropriate.

C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using the standard transmittal form. Submittals received from sources other than the Contractor will be returned without action. A separate transmittal shall be used for each required submittal and the contents shall be itemized separately thereon to allow indication of disposition for each element of the submittal.

D. Contractor's Action: Each shop drawing sheet and the cover sheet of bound packets of product data shall bear a stamp indicating the Contractor's disposition following his review and checking. The disposition shall be indicated as "approved," "approved as noted," or similar as applicable. The stamp shall include the Contractor's name, the signature of the reviewer and the date checked. The notated sample shall be construed as evidence the Contractor has performed the review, check, verification and coordination as required by the Owner. Shop drawing submittals received without this stamp (executed) will be returned to the Contractor with no action taken.

## 1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, Contractor's construction schedule. Submit within thirty (30) days after the date established for "Commencement of the Work."

1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week.
2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As work progresses, place a contrasting mark in each bar to indicate actual completion

3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
4. Secure time commitments for performing critical elements of the work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the work.
5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other schedules.
6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.

B. Phasing: On the schedule, show how requirements for phased completion to permit work by separate Contractors and partial occupancy by the Owner affect the sequence of work.

C. Work Stages: Indicate important stages of construction for each major portion of the work, including submittal review, testing, and installation.

D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the work. Indicate where each element in an area must be sequenced or integrated with other activities.

1. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.

E. When revisions are made, distribute 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 construction activities.

1. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.6 SUBMITTAL SCHEDULE

A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within ten (10) days of the date required for establishment of the Contractor's Construction Schedule.

1. The submittal schedule shall include all product data, shop drawings, samples, inspection reports, test reports and similar items as called out in the individual specification sections, to be submitted by the Contractor during the course of the project.
2. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule.
3. Prepare the schedule in chronological order; include submittals required during the first 90 days of construction. Provide the following information:

a. Scheduled date for the first submittal.
b. Related section number.
c. Submittal category.
d. Name of the subcontractor.
e. Description of the part of the work covered.
f. Scheduled date for resubmittal.
g. Scheduled date for the Architect's final release or approval.

B. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.
1. When revisions are made, distribute 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 construction activities.

C. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.7 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to the Architect at weekly intervals:
1. List of subcontractors at the site.
2. Approximate count of personnel at the site.
3. High and low temperatures, general weather conditions.
4. Accidents and unusual events.
5. Meetings and significant decisions.
6. Stoppages, delays, shortages, and losses.
7. Meter readings and similar recordings.
8. Emergency procedures.
9. Orders and requests of governing authorities.
10. Change Orders received, implemented.
11. Services connected, disconnected.
12. Equipment or system tests and startups.
13. Partial Completions, occupancies.
14. Substantial Completions authorized.

1.8 SHOP DRAWINGS

A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information submitted without being specifically tailored to this Project is not a Shop Drawing.

B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:

1. Dimensions.
2. Identification of products and materials included.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.
6. 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 36 by 48 inches.
7. Submittal Quantity and Type: Submit one correctable, translucent, reproducible print and three blueline or blackline prints for the Architect's review. The Architect will return the reproducible print.
8. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

## 1.9 PRODUCT DATA

A. Collect product data into a single submittal for each element of construction or system. Product data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves. Where product data must be specially prepared because standard printed data is not suitable for use, submit as "shop drawings."

B. Mark each copy to show applicable choices and options. Where printed product data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
   1. Manufacturer's printed recommendations.
   2. Compliance with recognized trade association standards.
   3. Compliance with recognized testing agency standards.
   4. Application of testing agency labels and seals.
   5. Notation of dimensions verified by field measurement.
   6. Notation of coordination requirements.

C. Do not submit product data until compliance with requirements of the Contract Documents has been confirmed.
   1. Submittals: Submit 6 copies of each required submittal. The Architect will retain 3 and will return the others marked with action taken and corrections or modifications required.
   2. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.(a) Do not proceed with installation until an applicable copy of product data is in the Installer's possession.

D. Do not permit use of unmarked copies of product data in connection with construction.

## 1.10 SAMPLES

A. Submit full-size, fully fabricated samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.

B. Mount, display or package samples in the manner to facilitate review of qualities indicated. Prepare samples to match the Architect's sample. Include the following:

1. Specification section number and reference.
2. Generic description of the sample.
3. Sample source.
4. Product name or name of the manufacturer.
5. Compliance with recognized standards.
6. Availability and delivery time.

C. Submit samples for review of size, kind, color, pattern, and texture. Submit samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
1. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
2. Refer to other Specification sections for requirements for samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

D. Preliminary Submittals: Where samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
1. Preliminary submittals will be reviewed and returned with the Architect's notation indicating selection and other action.

E. Submittals: Except for samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 3 sets. The Architect will return one set marked with the action taken.
1. Maintain sets of samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
2. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
3. Sample sets may be used to obtain final acceptance of the construction associated with each set.

F. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the work. Show distribution on transmittal forms.
1. Field samples specified in individual sections are special types of samples. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the standard by which the work will be judged.
2. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

## 1.11 QUALITY ASSURANCE SUBMITTALS

A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other sections of the Specifications.

B. Certifications: Where other sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.
2. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1, Section 014000 - QUALITY CONTROL.

1.12 CONSTRUCTION PHOTOGRAPHS

A. General: Provide construction progress photographs taken one day each month to coincide with monthly pay request, until Substantial Completion. Take photographs at Substantial Completion as specified.
1. Photographer Qualifications: A professional commercial photographer acceptable to the Owner.
2. Format: Color photographic prints in 8-inch by 10-inch size, smooth surface, glossy finish and in a plastic jacket with a left hand binding margin.
3. Provide 3 copies of each monthly set, with negatives, to the Architect, within five (5) working days of taking photograph.
4. Label each photograph, in lower right-hand corner, with the name of the project, date and time of the exposure, description of the view, Contractor’s name and other pertinent data.
5. Consecutively number each exposure from beginning of project through Substantial Completion.

B. Quantity:
1. Monthly: Until Substantial Completion, take photographs of four (4) representative views of the project showing, as much as possible, the work installed during the previous month. Architect reserves the right to determine location of photographs.
2. At Substantial Completion: Take photographs of the project from ten (10) locations as selected by the Owner and Architect.

1.13 ARCHITECT'S ACTION

A. Except for submittals for the record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return in accordance with the Article "Submittal Procedures."

B. Compliance with specified characteristics is the Contractor's responsibility.

1. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

2. Final Unrestricted Release: When submittals are marked "Approved," the work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final acceptance and payment depends on that compliance.

3. Final-But-Restricted Release: When submittals are marked "Approved as Noted," the work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final acceptance and payment depends on that compliance.

4. Returned for Resubmittal: When submittals are marked "Not Approved" or "Returned for Correction", do not proceed with work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark. Do not permit submittals so marked to be used at the project site or elsewhere where work is in progress.

5. Other Action: Where a submittal is for information or record purposes, special processing or other activity, the submittal will be returned marked "Returned Without Action."

C. Unsolicited Submittals: The Architect will return unsolicited submittals to the sender without action.

D. Except for verification of finishes, colors and other aesthetic matters left to the Architect's discretion by the Contract Documents, Architect's review of shop drawings is only for the convenience of the Owner in following the work and shall not relieve the Contractor from responsibility for any deviations from the requirements of the Contract Documents.

E. The Architect's review shall not be construed as a complete check nor shall it relieve the Contractor from responsibility for errors of any sort in shop drawings or schedules or from the necessity of furnishing any work required by the Contract Documents which may have been omitted on the shop drawings. The Architect's review of a separate item shall not indicate review of the complete assembly in which it functions.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 013300

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# SECURITY PROCEDURES

## PART 1 - GENERAL

### 1.1 REQUIREMENTS INCLUDED

A. Establish and maintain Project Security Program to:

1. Protect Work, Stored Products, and Construction Equipment against Theft and Vandalism.

2. Protect Premises against entry by Unauthorized Persons.

B. Protect Owner's operations at Site against Theft, Vandalism, interference or Damage by Contractor's work or employees.

### 1.2 MAINTENANCE OF SECURITY

A. Initiate Security Program promptly after job mobilization.
B. Maintain Security Program throughout construction period, until Owner-occupancy or Owner-acceptance precludes the need for Contractor-security.

### 1.3 GENERAL AIRPORT SECURITY REQUIREMENTS

A. Comply with Airport Security Requirements stipulated below and any other governing requirements of Transportation Security Administration(TSA).
B. Contractor shall maintain security against unlawful access to "secure areas" of Airport Terminal Building and Airfield Area.
C. Compliance with specified requirements will not relieve Contractor of responsibility for maintaining proper security, nor shall Contractor construe specified requirements as limiting Contractor's obligation to undertake reasonable action to establish and maintain secure conditions at Project Site.
D. If Contractor, Subcontractor, or their Workers should breach security requirements, Contractor will be held responsible for Fines and Costs resulting from breach.

## PART 2 - PRODUCTS

Not used

## PART 3 - EXECUTION

### 3.1 CONTRACTOR BADGING

A. The Contractor is responsible for Owner-issued security badging as follows:
   1. The Contractor is responsible for obtaining photo-identification security badges issued by the Owner for each superintendent of each work crew working within the AOA and terminal. The Contractor must obtain Owner-issued security badges for at least one (1) member of each

work crew working in separate areas of the AOA and terminal. All Contractor personnel must either obtain and display an Owner-issued security badge or be escorted and under the responsibility of an individual displaying a current Owner-issued security badge. Badges issued for construction will be good for the duration of the project.

2. The Contractor is responsible for completing the required Owner-issued security badge application forms, and for submitting the forms to the Owner for their review as early in the project as possible to avoid construction delays. Forms must be submitted at least two (2) weeks in advance of issuance of a badge. Forms will be made available by the Owner after award of the project. The Contractor must designate an authorized signature holder (ASH) responsible for all Contractor badge applications. The ASH designee must complete training to become the authorized ASH, after which all Owner-issued security badge applications must be reviewed and approved via signature by the ASH.
3. The Contractor may obtain Owner-issued security badges from the operations department at the Airport. The Owner reserves the right to limit the number of security badges issued to the Contractor. The Owner will charge the Contractor a non-refundable fee for each Owner-issued security badge issued. An additional non-refundable fee will be charged for lost or destroyed badges.
4. Owner-issued security badges must be worn in an easily visible location on the person issued the badge at all times while working within the AOA and terminal. The badge holder must be familiar with and must obey all security and safety rules and regulations. Owner-issued security badges may be confiscated, and all security rights revoked by the Owner upon the breach of any security or safety regulations at the discretion of the Owner. The holder of an Owner-issued security badge must surrender the badge at the completion of this project, upon transfer or termination of employment, or at any other time at the request of the Owner.
5. Badge holders may only use Owner-issued security badges for access to the AOA and terminal when actively working on this specific project.
6. Any expired or altered badge, or any badge bearing a photograph not matching the bearer, must be brought to the attention of the Owner, and will be immediately confiscated by the Owner or the airport police.
7. At the completion of this project, the Contractor must return all Owner-issued security badges to the Owner. All Owner-issued security badges must be accounted for and surrendered at the completion of this project. Failure to account for and surrender all Owner-issued security badges will constitute grounds for withholding retainage from the final pay estimate amount.

## 3.2 EXECUTION INTERIOR BARRICADING, MARKING, AND LIGHTING

A. Proper barricading, marking, and lighting of interior construction areas are the responsibility of the Contractor. This will include closing off interior construction areas from public access and properly marking and lighting these areas. Life Safety paths of egress must be continually illuminated and kept clear of all construction materials.

## 3.3 CONSTRUCTION CONTROL

A. A primary and alternate responsible Contractor's representative must be designated by the Contractor. The Contractor's representatives must be available locally on a 24-hour basis. Names of the primary and alternate, including phone number, must be made available to the A/E and the Owner by the Contractor. The Contractor must insure that the names and phone numbers are kept current and made available to the A/E and the Owner.

## 3.4 CONSTRUCTION TECHNIQUES

A. Construction must be planned and conducted throughout this project in such a manner as to maintain safe airport operations. Every effort must be made to reduce the impact of construction activity on overall airport operations. To this end, the Contractor's activities must be conducted in such a manner to preclude, except where absolutely required, open excavations, trenches, ditches, and above ground obstacles such as booms on cranes. The primary responsibility for assuring that safe construction techniques are followed rests with the contractor.

END OF SECTION 013553

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# QUALITY CONTROL

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including other Division 1 Specification Sections, apply to this section.

### 1.2 SUMMARY

A. This section includes administrative and procedural requirements for quality-control services.

B. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

D. Requirements of this section relate to customized fabrication and installation procedures, not production of standard products.

1. Specific quality-control requirements for individual construction activities are specified in the sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.

2. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.

3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this section.

### 1.3 RESPONSIBILITIES

A. Contractor Responsibilities: Owner shall provide inspections, tests, and similar quality-control services where specifically indicated to be provided by Owner elsewhere in the Contract Documents. Costs are not included under the contract sum. The contractor shall be responsible for all other inspections, tests and similar quality control services specified in the Contract Documents or required by authorities having jurisdiction and for coordination of the Owner' agencies.

B. Contractor’s Convenience Testing: Inspecting and testing performed exclusively for the Contractor’s convenience shall be the sole responsibility of the Contractor.

C. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.

1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests were performed on original construction.

D. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:

1. Provide access to the work.

2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.

3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.

4. Provide facilities for storage and curing of test samples.

5. Deliver samples to testing laboratories.

6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.

7. Provide security and protection of samples and test equipment at the Project Site.

E. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual sections shall cooperate with the Architect and the Contractor in performance of its duties and shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Architect and the Contractor promptly of irregularities or deficiencies observed in the work during performance of its services.

2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the work.

3. The agency shall not perform any duties of the Contractor.

F. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition, the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.4 SUBMITTALS

A. The independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Architect and the Contractor.

1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

2. Report Data: Written reports of each inspection, test, or similar service shall include, but not be limited to, the following:

a. Date of issue.

b. Project title and number.

c. Name, address, and telephone number of testing agency.

d. Dates and locations of samples and tests or inspections.

e. Names of individuals making the inspection or test.

f. Designation of the work and test method.

g. Identification of product and specification section.

h. Complete inspection or test data.

i. Test results and an interpretation of test results.

j. Ambient conditions at the time of sample taking and testing.

k. Comments or professional opinion on whether inspected or tested work complies with Contract Document requirements.

l. Name and signature of laboratory inspector.

m. Recommendations on retesting.

## 1.5 QUALITY ASSURANCE

A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.

1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

# PART 2 - PRODUCTS (Not Applicable)

# PART 3 - EXECUTION

## 3.1 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.

C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 014000

# REFERENCES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including other Division 1 Specification Sections, apply to this section.

### 1.2 DEFINITIONS

A. General: Basic contract definitions are included in the Conditions of the Contract.

B. "Indicated:" The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. No limitation on location is intended.

C. "Directed:" Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases. However, no such implied meaning will be interpreted to extend the Architect’s responsibility into Contractor’s area of construction supervision.

D. "Approved:" The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.

E. "Regulations:" The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish:" The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install:" The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide:" The term "provide" means to furnish and install, complete and ready for the intended use.

I. "Installer:" An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. Trades: Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

J. "Project Site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

K. "Testing Agencies, Laboratories or Service:" All terms interchangeably refer to an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

L. "Nationally Recognized Testing Laboratories:" The term "nationally recognized testing laboratory (NRTL)" shall mean a firm or organization which is recognized by OSHA in accordance with 29 CFR Part 1910.7 to test and approve (i.e., certify, label or list) equipment or materials as being safe for the intended use. Labeling and / or listing of products by NRTL is acceptable wherever a reference to the UL or FMRC label is made in the specifications.

M. "Label:" The label must be provided by a nationally recognized testing laboratory. The Contractor shall provide a statement from the testing laboratory attesting that the laboratory has been approved by OSHA to certify the category of product(s) being submitted for approval.

## 1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Content: These 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. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
   2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.
      a. 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.

## 1.4 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.
   1. Reference standards (standards referenced directly in the contract documents) take precedence over standards that are not referenced but generally recognized in the industry for applicability to the work.
   2. Unreferenced Standards: Except as otherwise limited by the contact documents, standards not referenced but recognized in the construction industry as having direct applicability will be enforced for performance of the work. The decision as to whether an industry code or standard is applicable, or as to which of several standards are applicable, is the sole responsibility of the Architect.

B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents.
   1. Updated Standards: Submit a change order proposal where an applicable industry code or standard has been revised and reissued after the date of the Contract Documents and before the performance of the work affected. The Architect will decide whether to issue a change order to proceed with the updated standard.

C. Conflicting Requirements: Where 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 uncertainties and requirements that are different but apparently equal to the Architect for a decision before proceeding.
   1. 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 the requirements. Refer uncertainties to the Architect for a decision before proceeding.
   2. The Architect is the sole interpreter of what constitutes "minimum requirements" in any given situation. Exceeding minimum requirements in one or more aspects of any given specification does not cancel or replace the need to meet minimum requirements of any other aspect of that specification.

D. Copies of Standards: Each entity engaged in construction on the Project must 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, the Contractor shall obtain copies directly from the publication source and make them available on request.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

## 1.5 GOVERNING REGULATIONS AND AUTHORITIES

A. The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents. Contact authorities having jurisdiction directly for information and decision having a bearing on the work.

## 1.6 SUBMITTALS

A. Permits, Licenses, and Certificates: For the 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.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 014200

# PRODUCT REQUIREMENTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes 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 012500 "Substitution Procedures" for requests for substitutions.

### 1.3 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 by Architect 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 single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications. Submit a comparable product request, if applicable.

1.4 ACTION SUBMITTALS

A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design 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 seven days of receipt of a comparable product request. Architect will notify Contractor 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 Architect's Approval of Submittal: As specified in Section 013300 "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 013300 "Submittal Procedures." Show compliance with requirements.

1.5 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. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
   2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
   1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
   2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
      A. Name of product and manufacturer.
      B. Model and serial number.
      C. Capacity.
      D. Speed.
      E. Ratings.

   3. See individual identification sections in Divisions 21, 22, 23, and 26 for additional identification requirements.

1.6 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.
   5. Coordinate delivery such that Owner operations are minimally impacted.

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. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   6. Protect stored products from damage and liquids from freezing.
   7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 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. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 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 meeting 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.
      A. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:
   1. Sole 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.
      A. Sole manufacturer/source may be indicated by the phrase: "Subject to compliance with requirements, provide products by the following: …"

   2. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
      A. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: …"
   3. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, which complies with requirements.
      A. Non-limited list of products is indicated by the phrase: "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following: …"

   4. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
      A. Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: …"

   5. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, which complies with requirements.

A. Non-limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following: …"

6. 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.
   A. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

## 2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: 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 proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
   2. Evidence that proposed product provides specified warranty.
   3. Samples, if requested.

B. Submittal Requirements: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

# PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

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# EXECUTION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Cutting and patching.
   5. Coordination of Owner-installed products.
   6. Progress cleaning.
   7. Starting and adjusting.
   8. Protection of installed construction.

B. Related Requirements:
   1. Section 011000 "Summary" for limits on use of Project site.
   2. Section 013300 "Submittal Procedures" for submitting surveys.
   3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
   4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

### 1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

### 1.4 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 Architect of locations and details of cutting and await directions from Architect 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.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

## PART 2 - PRODUCTS

### 2.1 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

### 3.1 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. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

## 3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
B. 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.
C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
D. 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 013100 "Project Management and Coordination."

## 3.3 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.
    3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
    4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 96 inches in unoccupied spaces.

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: Where possible, select tools or equipment that minimize production of excessive 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 portions of the 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. Repair or remove and replace damaged, defective, or nonconforming Work.
   1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

## 3.4 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 011000 "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 prevent 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 and Masonry: 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.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   A. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

## 3.5 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 017419 "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 ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

## 3.6 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

## 3.7 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. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
C. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

# WARRANTIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including other Division 1 Specification Sections, apply to this section.

### 1.2 SUMMARY

A. This section specifies general administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Contractor's period for correction of the work and special warranty of workmanship and materials.

B. The Contractor will provide a warranty on all project work (including that added by subsequent change order after execution of the construction contract) for a period of one (1) year following the formal declaration of Substantial Completion. This one (1) year warranty will be separate from and in no way affect other standard product / manufacturer or workmanship warranties that extend beyond this one (1) year period for goods and services provided to this project.

C. Related Sections: The following sections contain requirements that relate to this section:

1. Division 1, Section 013300 - SUBMITTALS specifies procedures for submitting warranties.

2. Division 1, Section 017700 - CONTRACT CLOSEOUT specifies contract closeout procedures.

3. Divisions 2 through 41 sections for specific requirements for warranties on products and installations specified to be warranted.

4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

D. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

### 1.3 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace other work that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

B. Reinstatement of Warranty: When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the Owner has benefited from use of the work through a portion of its anticipated useful service life.

D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

E. Where the Contract Documents require a special warranty, or similar commitment on the work or part of the work, the Owner reserves the right to refuse to accept the work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

## 1.4 SUBMITTALS

A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the work, or a designated portion of the work, submit written warranties upon request of the Architect.

1. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within fifteen (15) days of completion of that designated portion of the work.

B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.

1. Refer to Divisions 2 through 41 sections for specific content requirements and particular requirements for submitting special warranties.

C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

D. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the 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 the Installer.

2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES AND BONDS," Project title or name, and name of the Contractor.

3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017400

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# CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

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

### 1.3 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. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

### 1.4 MATERIALS OWNERSHIP

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

## PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, 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 at designated spoil areas on Owner’s property.

C. Burning: Do not burn waste materials.

END OF SECTION 017419

# CLOSEOUT PROCEDURES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, other Division 1 Specification Sections, apply to this section.

### 1.2 SUMMARY

A. This section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:
   1. Inspection procedures.
   2. Project record document submittal.
   3. Operation and maintenance manual submittal.
   4. Submittal of warranties.
   5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate sections in Divisions 2 through 41.

C. Definitions: Closeout is hereby defined to include general requirements near the end of Contract time, in preparation for final acceptance, final payment, normal termination of contract, occupancy by Owner and similar actions evidencing completion of the work. Specific requirements for individual units of work are specified in sections of Division 2 through 41. Special requirements for mechanical and electrical work are specified in Divisions 23 and 26 sections, respectively. Time of closeout is directly related to "Substantial Completion" and, therefore, may be either a single time period for entire work or a series of time periods for individual parts of the work which have been certified as substantially complete at different dates. That time variation (if any) shall be applicable to other provisions of this section, regardless of whether resulting from "phased completion" originally specified by the Contract Documents or subsequently agreed upon by Owner and Contractor.

### 1.3 SUBSTANTIAL COMPLETION

A. Certificates of Substantial Completion: Certificates of Substantial Completion will be filled out with punch lists attached and shall define the areas of the work which are being accepted. Procedures required to call for inspections and to request certificates shall be as required in this section.

B. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, for either the entire work or portions thereof, complete the following. List exceptions in the request.
   1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the work claimed as substantially complete.
      a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.

b. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the work is not complete.

2. Advise the Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
4. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Deliver tools, spare parts, extra stock, and similar items.
6. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
7. Complete startup testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue or change over and remove temporary facilities and services from the site, along with mockups, construction tools, and similar elements.
8. Complete final cleanup requirements, including touchup painting. Touch up and otherwise repair and restore marred, exposed finishes.

C. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Architect will repeat inspection when requested and assured that the work is substantially complete.
2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, endorsed and dated by the Architect.
4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the work.
5. Submit consent of surety to final payment.
6. Submit a final liquidated damages settlement statement.
7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
8. Submit record documents, final project photographs, property survey and similar final record information.

B. Reinspection Procedure: The Architect will reinspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Architect.

1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance. If the work is incomplete, the Architect will advise the Contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, reinspection will be repeated. Contractor will promptly reimburse the Architect for all incurred costs.

1.5 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Architect's reference during normal working hours.

B. Record Drawings & Specifications: Follow requirements of Section 017839 Project Record Documents

C. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Architect for the Owner's records.

D. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch, 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Provide the Architect with two (2) copies of each manual. Include the following types of information:
1. Emergency instructions.
2. Spare parts list.
3. Copies of warranties.
4. Wiring diagrams.
5. Recommended "turn-around" cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.
8. Fixture lamping schedule.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.
6. Fuels.

7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:
1. Startup.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

3.2 FINAL CLEANING

A. General: The General Conditions require general cleaning during construction. Regular site cleaning is included in Division 1, Section 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.

B. 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. Comply with manufacturers' instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.
a. Remove labels that are not permanent labels.
b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces. Leave concrete floors broom clean. Vacuum carpeted surfaces.
d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
e. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.
f. Remove debris and surface dust from limited access spaces including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.

C. Removal of Protection: Remove temporary protection and facilities installed for protection of the work during construction, where applicable.

D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remain after completion of associated work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION 017700

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# OPERATION AND MAINTENANCE DATA

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory manuals.
   2. Systems and equipment operation manuals.
   3. Systems and equipment maintenance manuals.
   4. Product maintenance manuals.

B. Related Requirements:
   1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

### 1.3 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.

### 1.4 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:
   1. Submit on digital media acceptable to Architect or by email to Architect. Enable reviewer comments on draft submittals.

C. Final Manual Submittal: Submit each manual in final form within 15 days of completing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

D. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
   1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
   2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
   1. Binders: Heavy-duty, three-ring, vinyl-covered, post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      A. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
      B. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
   2. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
   3. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
   4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
      A. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
      B. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
   1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
   2. 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.
   3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.7 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
   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.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   2. Performance and design criteria if Contractor has delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.
   7. Control diagrams.
   8. Piped system diagrams.
   9. Precautions against improper use.
   10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:
   1. Product name and model number. Use designations for products indicated on Contract Documents.
   2. Manufacturer's name.
   3. Equipment identification with serial number of each component.
   4. Equipment function.
   5. Operating characteristics.
   6. Limiting conditions.
   7. Performance curves.
   8. Engineering data and tests.
   9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:
   1. Startup procedures.
   2. Equipment or system break-in procedures.
   3. Routine and normal operating instructions.
   4. Regulation and control procedures.
   5. Instructions on stopping.
   6. Normal shutdown instructions.
   7. Seasonal and weekend operating instructions.
   8. Required sequences for electric or electronic systems.
   9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed and identify color coding where required for identification.

1.8 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
   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.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment 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.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins; 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.
      A. 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.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

1.9 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
B. 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.
C. 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.
D. Product Information: Include the following, as applicable:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Color, pattern, and texture.
   4. Material and chemical composition.
   5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   1. Inspection procedures.
   2. Types of cleaning agents to be used and methods of cleaning.
   3. List of cleaning agents and methods of cleaning detrimental to product.
   4. Schedule for routine cleaning and maintenance.
   5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

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# PROJECT RECORD DOCUMENTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes 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 017700 "Closeout Procedures" for general closeout procedures.
   2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

### 1.3 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:
      Submit PDF electronic files of scanned record prints and one of file prints.
      B. Final Submittal:
      Submit PDF electronic files of scanned record prints and three set(s) of prints.

### 1.4 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 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. Depths of foundations.
D. Locations and depths of underground utilities.
E. Revisions to routing of piping and conduits.
F. Revisions to electrical circuitry.
G. Actual equipment locations.
H. Duct size and routing.
I. Locations of concealed internal utilities.
J. Changes made by Change Order or Construction Change Directive.
K. Changes made following Architect's written orders.
L. Details not on the original Contract Drawings.
M. Field records for variable and concealed conditions.
N. 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. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file.
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.
E. Name of Contractor.

## 1.5 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store record documents 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 reference during normal working hours.

## PART 2 - PRODUCTS

## PART 3 - EXECUTION

END OF SECTION 017839

# SECTION 017900 - DEMONSTRATION AND TRAINING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

### 1.3 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.

B. Qualification Data: For instructor and videographer.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

### 1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two (2) copies within seven (7) days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Architect.
d. Name of Construction Manager.
e. Name of Contractor.
f. Date of video recording.

2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
4. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

B. A/V Summary Sheets: Provide three (3) laminated 8-1/2” x 11” summary sheets indicating clear instructions (front and back) on how to start and operate the audio/visual systems. The intent is to use these as quick start guides for daily use. Clearly indicate how to start-up the systems and how to perform each major function of the systems.

## 1.5 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. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Preinstruction Conference: Conduct conference to review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.

## 1.6 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 have been reviewed and approved by Architect.

## 1.7 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 criteria.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.
    g. Warranties and bonds.
    h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.
    g. Instructions on stopping.
    h. Normal shutdown instructions.
    i. Operating procedures for emergencies.

j. Operating procedures for system, subsystem, or equipment failure.
k. Required sequences for electric or electronic systems.
l. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. 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.

8. 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.

## 1.8 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 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

## 1.9 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. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will furnish Contractor with names and positions of participants.

C. 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 (7) days' advance notice.

D. 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.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and turn over to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

## 1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.

1. Submit two (2) copies of video recordings on CD-ROM or thumb drives.
2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:

    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. Email address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

    a. Produce segments to present a single significant piece of equipment per segment.
    b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.

c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

**PART 2 - PRODUCTS**

**PART 3 - EXECUTION**

END OF SECTION 017900

# SAFETY AND SECURITY

## PART 1 - GENERAL

### 201-1.1 SCOPE OF WORK.

A. General. The provisions of this specification and associated procedures are applicable within the boundaries of the Airport only. This work consists of complying with the provisions of this specification, the Construction Safety and Phasing Plan (CSPP), and other safety and security requirements of the contract documents. A complete understanding of all safety and security procedures and requirements contained in the contract documents is required to ensure safety during construction. The CSPP is a part of this contract and deviations from the requirements established herein will be sufficient cause for contract termination. The CSPP can be found as an attachment to the Project Manual.

B. Standards and Regulations: Required reference material associated with this specification and CSPP includes the current versions of the following documents:

1. *FAA AC 150/5370-2, Operational Safety on Airports During Construction, current edition, latest change*.
2. *FAA AC 150/5210-5, Painting, Marking and Lighting of Vehicles Used on an Airport, current edition, latest change*.
3. *FAA AC 150/5340-1, Standards for Airport Markings, current edition, latest change*.

C. Copies of these documents are available for download at www.faa.gov.

### 201-1.2 CONTRACTOR SAFETY AND SECURITY OFFICER (CSSO).

A. The Contractor must appoint its onsite construction superintendent or other qualified individual(s) as its duly authorized representative to serve as Contractor Safety and Security Officer (CSSO) for the duration of the project. The CSSO must thoroughly understand the safety and security requirements of the project, the necessity for them and must have sufficient authority to implement its provisions without significant deviation. The Contractor must notify the RPR in writing of the name of the individual(s) selected for the assignment.

The CSSO must represent the Contractor on safety and security requirements compliance. The CSSO must be especially knowledgeable regarding the requirements of *FAA AC 150/5370-2*.

B. Responsibilities of the CSSO: Prior to the desired date for commencement of any work on the project, the CSSO must accomplish the following:

1. Develop and submit in writing a detailed work sequence schedule with dates and times specified for all milestone events. This sequence schedule is subject to the

approval of the RPR. To assure adequate time for coordination, this document must be submitted no later than the date of the pre-construction conference.

2. Develop and submit in writing a Safety Plan Compliance Document (SPCD). See the Contract Documents for requirements and guidelines regarding the SPCD. The SPCD must, as a minimum, be a detailed outline of the procedures to be followed showing how the Contractor will comply with the CSPP. The SPCD must detail, but not be limited to, how the Contractor plans to maintain safety and security of both Contractor operations and the integrity of airport landside and airside operations during the prosecution of contract work and the procedures to be followed in the event of an emergency or accident. These procedures will be subject to the approval of the RPR and reflect any change as may be deemed necessary. To assure adequate time for coordination, this document must be submitted no later than the date of the pre-construction conference. The development of the required SPCD is considered incidental to the work of this specification.

3. The Contractor must maintain a copy of the CSPP and SPCD at the project site at all times for reference by the RPR and by all Contractor and subcontractor employees.

4. Conduct at least one (1) meeting of all Contractor supervisory personnel prior to the start of contract work. The purpose of this meeting is to review the approved work sequence, schedule, and safety and security procedures. Attendance at this meeting by the CSSO and all Contractor supervisory personnel is mandatory. This meeting must also be open to the Owner, RPR, and any other governing authority that would like to attend. Minutes of this meeting must be taken by the CSSO, copies provided to each supervisor, and kept on file in the Contractor's construction office for periodic review and updating.

5. Brief all employees of the Contractor and subcontractors that will be used on the project. A similar briefing will be given to new employees prior to their use on contract work. In addition, the CSSO will be responsible for briefing, from time to time, all Contractor personnel on any changes to safety and security measures deemed necessary.

201-1.3 CONTRACTOR BADGING.

A. The Contractor is responsible for Owner-issued security badging as follows:

1. The Contractor is responsible for obtaining photo-identification security badges issued by the Owner for each superintendent of each work crew working within the AOA. The Contractor must obtain Owner-issued security badges for at least one (1) member of each work crew working in separate areas of the AOA. All Contractor personnel must either obtain and display an Owner-issued security badge or be escorted and under the responsibility of an individual displaying a current Owner-issued security badge. Badges issued for construction will be good for the duration of the project.

2. The Contractor is responsible for completing the required Owner-issued security badge application forms, and for submitting the forms to the Owner for their review as early in the project as possible to avoid construction delays. Forms must be submitted at least two (2) weeks in advance of issuance of an Owner-issued security badge. Forms will be available through the Owner after award of the project. The Contractor must designate an authorized signature holder (ASH) responsible for all Contractor badge applications. The ASH designee must complete training to become the authorized ASH, after which all Owner-issued security badge applications must be reviewed and approved via signature by the ASH.

3. The Contractor may obtain Owner-issued security badges from the operations department at the Airport. The Owner reserves the right to limit the number of security badges issued to the Contractor. The Owner will charge the Contractor a non-refundable fifty-dollar ($50.00) fee for each Owner-issued security badge issued. An additional non-refundable fifty-dollar ($50.00) fee will be charged for lost or destroyed badges. Individuals that lose two (2) badges will not be issued a third badge.

4. Owner-issued security badges must be worn in an easily visible location on the person issued the badge at all times while working within the AOA. The badge holder must be familiar with and must obey all security and safety rules and regulations. Owner-issued security badges may be confiscated and all security rights revoked by the Owner upon the breach of any security or safety regulations at the discretion of the Owner. The holder of an Owner-issued security badge must surrender the badge at the completion of this project, upon transfer or termination of employment, or at any other time at the request of the Owner.

5. Badge holders may only use Owner-issued security badges for access to the AOA when actively working on this specific project.

6. Any expired or altered badge, or any badge bearing a photograph not matching the bearer, must be brought to the attention of the Owner and will be immediately confiscated by the Owner or the airport police.

7. At the completion of this project, the Contractor must return all Owner-issued security badges to the Owner. All Owner-issued security badges must be accounted for and surrendered at the completion of this project. Failure to account for and surrender all Owner-issued security badges will constitute grounds for withholding retainage from the final pay estimate amount.

## PART 2 - EXECUTION

### 201-2.1 CONSTRUCTION SEQUENCING

A. Construction Sequence: The Contractor must prepare a construction schedule and submit to the RPR no later than the date of the pre-construction conference.

B. Closing Work Areas: The Contractor must acquaint his / her supervisors and employees with the sequence of construction and its relationship to airport activity and aircraft operations that are inherent to this airport. No runway, taxiway, apron, aircraft gate, passenger boarding bridge, any portion of the terminal, or airport roadway may be closed without the written approval of the Owner, to enable necessary NOTAMS and/or advisories to airport fixed based operators (FBOs), tenants and users. Contractor personnel and equipment are not allowed within project work areas until the area has been closed to aircraft and NOTAMS have been issued. The CSPP and plans detail the work areas of the project with respect to impacted or adjacent Runway Safety Areas (RSA), Taxiway / Taxilane Object Free Areas (TOFA / TLOFA), and Taxiway / Taxilane Safety Areas (TSA).

201-2.2 Airfield Marking and Lighting. Proper marking and lighting of areas on the airfield associated with construction is the responsibility of the Contractor. This will include properly marking and lighting closed pavements, the limits of construction, material storage areas, equipment storage areas, haul routes, parking areas, and other areas defined as required for the Contractor's exclusive use. The Contractor must erect and maintain around the perimeter of these areas suitable marking and warning devices visible for day and night use. The type and location of marking and warning devices will be as shown on the plans and approved by the RPR.

Special emphasis must be given to open trenches, excavations, heavy equipment marshalling areas, and stockpiled material located in the Airport Operations Area (AOA), which must be predominantly marked by the Contractor with flags and lighted by approved light units during hours of restricted visibility and darkness. All markings must be in accordance with *FAA AC 150/5340-1.*

201-2.3 SPCD ENFORCEMENT.

A. Furnish and install the components of the SPCD at the appropriate times as specified in the Contract Documents. Inspect every aspect of the SPCD on at least a daily basis and ensure all components are functioning properly. Immediately correct deficiencies noted by the RPR. Visually check barricade and / or temporary security fencing flashing lights on a daily basis, 30 minutes before sunset for proper operations. The system elements that must be inspected are as follows:

1. Barricades and / or temporary security fencing set properly and all flashing warning lights operating properly.
2. All Contractor personnel, AOA security gates manned, and security procedures in place.
3. All vehicles and equipment lighted / marked in accordance with the requirements of the Contract Documents.
4. Contractor use of unauthorized AOA security gates checked.

The Owner’ representative will notify the Contractor in writing of the above safety and security items identified as deficient. Make a concerted effort to ensure all safety and security items are in proper working order each day due to the security status of the airport.

201-2.4 TRAFFIC CONTROL

A. Vehicle and Equipment Identification: The Contractor must establish and maintain a list of Contractor and subcontractor vehicles and equipment authorized to operate on the site. Contractor employee vehicles will be restricted to the Contractor's temporary construction staging area or at otherwise shown on the plans and are not allowed in the AOA at any time. To be authorized to operate on the airport, each Contractor or subcontractor vehicles and equipment must:

1. Display either:

   a. A yellow, flashing, dome-type light on the uppermost part of the vehicle structure. The light must be visible from any direction, day and night, including from the air. Lights must have peak intensity within the range of 40 to 400 candelas (effective) from zero (0) degrees (horizontal) up to 10 degrees above the horizontal and for 360 degrees horizontally. From 10 degrees to 15 degrees above the horizontal plane, the light output must be one-tenth of peak intensity or between four (4) and 40 candelas (effective). Lights must flash at 75 ± 15 flashes per minute.

   b. A three (3) feet x three (3) feet or larger, international orange and white checkerboard construction safety flag, each checkerboard color being one (1) foot x one (1) foot, fixed on a staff, may be attached to the vehicle so that the flag is readily visible to supplement the flashing light or for transient vehicles or those specifically onsite for the day to complete a specific task during daytime operations only.

   Vehicles and equipment operating in the AOA during the hours of darkness must be equipped with a yellow, flashing, dome-type light.

2. Be identified with a sign / placard with company logo and phone number of the Contractor and be of sufficient size to be identified at a distance of 150 feet. Vehicles needing intermittent identification could be marked with tape or with commercially available magnetically attached markers. Vehicles that are not appropriately identified must be escorted by a vehicle that conforms to this requirement. Vehicles requiring escort must be identified on the list furnished to the gate guard.

All costs associated with vehicle and equipment identification are part of the equipment provided by the contractor and are subsidiary to the various bid items of the project.

B. Contractor Escorts: Contractor escorts must meet the following requirements:

1. Contractor escort vehicle drivers must receive AOA driver training.

2. All vehicles responsible to the Contractor entering the AOA must be escorted by an Owner-approved Contractor escort vehicle from the point of AOA entry to the construction site.

3. To facilitate safe movement of Contractor escort vehicles and escorted vehicles, drivers of Owner-approved Contractor escort vehicles must be approved for, issued, and display an Owner-issued security badge. Further, Owner-approved Contractor escort vehicle drivers must be familiar with Airport security and safety procedures.

C. AOA Security Gate Control: A Contractor's gate guard must monitor and coordinate all Contractor traffic at the AOA security gate. The gate guard must be responsible for checking badges and inspecting vehicles of anyone entering and exiting through the gate at which the guard is posted.

1. The Contractor must provide a gate guard at all AOA security gates used for Contractor access. The Contractor must provide a guard shack to be utilized by the Contractor's gate guard at all AOA security gates used for Contractor access. The guard shack must, at minimum:

   a. Have minimum dimensions of 4 feet by 6 feet.

   b. Be weather-proof.

   c. Be temperature-controlled and internally lighted for nighttime operations.

   d. Provide 360-degree visibility and access to all vehicles approaching and exiting the AOA security gate.

   e. Include locking devices to secure the guard shack when not in use.

   f. Secured against overturn by winds up to 100 mph.

   g. Include a fire extinguisher.

   h. Comply with all applicable building and safety codes.

   It is the Contractor's responsibility to prepare the site for installation of the guard shack. Any modifications to the site made by the Contractor must be removed at the end of the project and the site must be restored to its original condition or better.

   It is also the Contractor's responsibility to coordinate, secure, and pay for all utility service connections necessary for the operation of the guard shack.

2. Furnish to the gate guard a list of authorized delivery vehicles to enter the AOA security gate and record the vehicle license plate, time in, and time out for each vehicle using the gate. The Contractor must not permit any unauthorized construction personnel or traffic on the site. The Contractor must prohibit "piggybacking" of multiple vehicles behind an authorized vehicle.

3. Gate guards must be present at all AOA security gates used for Contractor access when the Contractor is onsite. If the gate guard must temporarily leave his post for any reason, a substitute gate guard, pre-approved by the Owner and / or Transportation Security Administration, must assume the responsibilities of the gate guard during that period.

4. AOA security gates to the site must be locked and secured at all times when not attended by the Contractor. If the Contractor chooses to leave any AOA security gate open, it must be attended by Contractor personnel who are knowledgeable of the safety and security requirements of the project. If an AOA security gate is found open or unlocked and unattended, airport security police and / or Transportation Security Administration may issue the Contractor a citation. The Contractor is responsible for all court costs and imposed fines. In addition,

monetary fines may be levied by the Owner and / or Transportation Security Administration for each violation so documented. Payment of all fines assessed to the Owner, due to violations by the Contractor of FAA / Transportation Security Administration security or safety requirements, is the sole responsibility of the Contractor and will be deducted from monies due the Contractor.

5. Pedestrian walkthroughs are not allowed through any AOA security gate.

D. Access to the Site of Construction: The Contractor's access to the site is as shown in the plans. No other access points will be allowed unless approved by the Owner. All Contractor traffic authorized to enter the site must have completed the appropriate AOA driver training and be thoroughly familiar with the access procedures and route for travel or must be guided by an Owner-approved Contractor escort vehicle from the point of AOA entry to the construction site. The Contractor is responsible for traffic control to and from the various construction areas on the site, and for the operation and security of the AOA security gate to the site. Directional signing from the AOA security gate along the delivery route to the temporary construction staging / stockpile / storage areas, plant site, or work site must be provided. In addition, the following requirements are applicable:

1. The Contractor must install work site identification signs at the authorized access point(s). If, in the opinion of the RPR, additional directional signs are needed for clarity, they must be installed along the route authorized for access to each construction site at no additional cost to the Owner.

2. The Contractor is responsible for the immediate cleanup of any debris deposited along the access route because of his construction traffic. In addition to the inspection and cleanup required at the end of each shift, the Contractor is responsible for the immediate cleanup of any debris generated along the construction site access route(s) as a result of construction related traffic or operations whether or not created by Contractor personnel.

3. All Contractor traffic authorized to travel on the airport must be operated in a manner that does not compromise the safety of either landside or airside airport operations. If, in the opinion of the RPR, any vehicle is operated in a manner not fully consistent with this requirement, the RPR has the right to restrict operation of the vehicle or prohibit its use on the Airport.

E. Material Suppliers, Subcontractors, and Visitors: All material suppliers, subcontractors, and visitors to the work site are obligated to follow the same safety and security operating procedures as the Contractor. All material suppliers must make their deliveries using the same access points and routes as the Contractor and must be advised of the appropriate delivery procedures at the time the materials order is placed. The Contractor must not use the Airport address for any delivery but must use the street address appropriate to the location of the entrance to the work site. If it is not practical to conform to vehicle identification requirements, the Contractor must be prepared to escort all suppliers, subcontractors, and visitors while they are on the airport.

F. Do not exceed 15 mph within the AOA.

201-2.5 GENERAL SAFETY REQUIREMENTS.

A. All Contractor vehicles that are authorized to operate on the airport outside of the designated construction area limits or haul routes as defined herein must be vigilant for conflict with any aircraft and give way to any operating aircraft at all times.

All Contractor vehicles that are required to operate outside of the construction area limits as defined herein and cross active taxiways or aprons must do so under the direct control of a flagman who is monitoring the Airport ground control radio frequency. Flagmen must be furnished by the Contractor. All aircraft traffic on taxiways and aprons have priority over

Contractor's traffic. Any movement of the Contractor's vehicles and equipment on or across landing areas must only be under escort by the Owner or when the runway is closed.

Construction vehicles and equipment not in use for extended periods must be parked away from active pavements in the Contractor’s temporary construction staging / stockpile / storage areas.

B. In order to protect all aircraft traffic, aviation related businesses, terminal apron areas, etc. from potential damage caused by foreign object debris (FOD) generated by construction activities, the Contractor must provide an adequate number of sweepers and vacuum trucks as specified in Item G-205, Temporary Construction Items. Protecting the aircraft, airport tenants, users, public, etc., against FOD is a critical safety issue.

C. The Contractor must conduct a weekly safety briefing for all Contractor personnel. These meetings must be open to the Owner, RPR, and any other governing authority that would like to attend. There will also be a mandatory weekly construction meeting, the date and time of which will be established prior to the start of construction, with the Owner that must be attended by the Contractor's senior field staff, including but not limited to superintendents and team leaders.

D. Contractor vehicles and equipment brought into the AOA should be serviced and maintained prior to entering the AOA to prevent fuel, hydraulic fluid, or other chemical fluid leaks and excessive exhaust that may cause environmental issues. Vehicles and equipment that may cause environmentally detrimental conditions will be prohibited from entering the AOA. However, Contractor personnel operating construction vehicles and equipment on the Airport must notify the RPR immediately and expeditiously contain and clean-up spills resulting from fuel, hydraulic fluid, or other chemical fluid leaks within one (1) hour of the spill occurring.

Transport and handling of other hazardous materials on an airport also requires special procedures. To that end, develop and implement spill prevention and response procedures for vehicle operations.

Incorporate these procedures into the SPCD. This includes maintenance of appropriate MSDS data and appropriate prevention and response equipment on-site

E. Contractor vehicles and equipment may not be parked any closer than ten feet (10’) from any security fence or AOA security gate.

F. Contractor supervisory personnel, Contractor gate guards, and Contractor flagmen must be provided an aviation-band radio by the Contractor. All Contractor personnel monitoring

radios must attend “Airport Radio Training” with Airport Operations. Radios must be used to monitor air traffic control frequencies; Contractor personnel may not communicate on the aviation-band radios.

Contractor radios and / or mobile phones must only be used for the Contractor’s internal communications, to communicate clearance for movement of equipment, personnel, etc., on or across active AOA areas. Use of radios must not interfere with frequencies used by the ATCT or the airport. Use of mobile phones is restricted to work-related calls within the AOA; no personal calls will be allowed. The Contractor must maintain an up-to-date contact list with the airport for the duration of all phases of work.

G. Construction will occur adjacent to active airfield pavements. Construction traffic must yield to aircraft at all times. Confine Contractor personnel, equipment, operations and travel to the area within the defined work limits shown in the plans. Do not allow Contractor personnel to enter or remain in part of the AOA which would be hazardous to persons or to aircraft operations. Inform Contractor personnel of the routes, speeds, and procedures for transporting equipment and materials to the construction site and restrictions to movement of equipment or Contractor personnel within the AOA.

H. The Owner reserves the right to suspend construction operations for short periods of time (i.e. while an aircraft passes), daily, or between construction phases, and / or change the order of construction phasing during the project if it is determined as in the best interest of the Owner or safety. The Contractor may be directed to move Contractor personnel, equipment, and materials to a safe location and / or evacuate the site in order to enable aircraft operations. Necessary extensions in contract time will be granted or a stop work order will be issued due to these delays. However, there will be no adjustments in contract price due to these delays, unless otherwise noted in the contract documents.

I. Furnish and install barricades and / or temporary security fencing at the locations shown in the plans. Provide 24 hours per day on-call Contractor personnel for emergency maintenance of airport hazard lighting, barricades, and / or temporary security fencing. Integrate barricades and / or temporary security fencing as a part of the SPCD.

J. Provide an adequate number of sweepers and vacuum trucks to keep haul routes, airfield pavements within the limits of work, and other pavement areas within 250 feet of construction areas traversed by vehicles and equipment clean and free of mud, dirt, debris, waste, loose material, and other FOD capable of causing damage to aircraft landing gears or propellers and / or being ingested in jet engines. Provide enough equipment and operators to ensure an immediate response to properly keep all active airfield pavements affected by construction operations are kept free of FOD.

K. Wear high-visibility warning garments and identifiable hard hats in accordance with applicable OSHA, ANSI, ISEA, local, state, and / or Federal regulations when onsite.

L. Prevent spillage of debris from construction vehicles and equipment outside the immediate work area.

M. Use, manage, handle, and dispose of all “hazardous materials” in strict accordance with all applicable environmental laws. For the purposes of this project, the term “hazardous materials” is defined in the broadest sense to encompass substances, materials, wastes,

pollutants, or oils referred to in any environmental law as toxic, radioactive, dangerous, or similar term. Environmental laws are defined to mean all applicable federal, state, and local statutes, ordinances, regulations, rules, policies, codes, and guidelines in effect during the term of the project.

N. Construction equipment must have a maximum height as approved by *FAA Form 7460-1*. Should the use of construction equipment with heights greater than those approved by *FAA Form 7460-1* be required, including cranes, submit *FAA Form 7460-1* to the FAA for approval. The FAA must provide approval prior to use of the requested equipment – FAA response time may take 60-90 days.

O. It is the sole responsibility of the Contractor to see that all sheeting, shoring and bracing is done in accordance with current OSHA regulations and requirements.

P. Institute dust control measures to mitigate current or potential dust issues. Special attention to dust control is required when earthwork or hauling operations are in progress or when wind and weather conditions cause excessive blowing of dust. Regularly apply water to keep dust down. Provide 24 hours per day on call Contractor personnel for emergency dust control operations. Respond within 20 minutes during times when the Contractor is on site and within two (2) hours when no work is being performed.

Interior dust control measures must be in place to protect all public areas. Building filters must be replaced monthly during interior construction activities.

Q. At the completion of each work period, clean the project work area and remove equipment, materials, and Contractor personnel from the project work area. Sweep and / or vacuum pavements prior to vacating the work area. Ensure that active airfield surfaces affected by construction operations are kept free of FOD deposited by either construction traffic, construction operations, windblown debris, or debris deposited as the result of other sources.

Interior construction areas must be kept free of accumulated trash and construction materials. Public areas adjacent to construction are to be cleaned daily.

R. Blasting will not be permitted.

S. Open-flame welding and torch cutting will not be permitted.

201-2.6 CONSTRUCTION CONTROL. A primary and alternate responsible Contractor's representative must be designated by the Contractor. The Contractor's representatives must be available locally on a 24-hour basis. Names of the primary and alternate, including phone number, must be made available to the RPR by the Contractor. The Contractor must ensure that the names and phone numbers are kept current and made available to the RPR.

201-2.7 CONSTRUCTION TECHNIQUES. Construction must be planned and conducted throughout this project in such a manner as to maintain safe airport operations. Every effort must be made to reduce the impact of construction activity on overall airport operations. To this end, the Contractor's activities must be conducted in such a manner to preclude, except where absolutely required, open excavations, trenches, ditches, and above ground obstacles such as booms on cranes. The primary responsibility for assuring that safe construction techniques are followed rests with the CSSO.

PART 3 - METHOD OF MEASUREMENT

201-3.1 Measurement of the item Safety and Security, as specified herein, will be on a lump sum basis.

BASIS OF PAYMENT

201-4.1 The work and incidental costs covered under the item “Safety and Security” will be paid for at the Contract lump sum price. The RPR will make the final determination of the allowable percentage of completion for the payment of the item Safety and Security and will approve the percentage paid based on the percent of contract amount actually earned which will be based upon actual work completed.

Partial payments will be allowed as follows:

A. With first pay request, 25%.

B. When 25% or more of the original contract is earned, an additional 25%.

C. When 50% or more of the original contract is earned, an additional 45%.

D. After Final Inspection, staging area clean-up and delivery of all project closeout materials, the final 5%.

* The Percent of Contract Amount Earned equals the work completed to date (including the total of all previous mobilization) plus or minus work completed associated with executed change orders, if any, divided by the Total Original Contract Amount plus or minus the Total Executed Change Order Amounts, if any.

Payment will be made under:

Item G-201-4.1 Safety and Security – per lump sum

END OF ITEM G-201

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# SECTION 024119 - SELECTIVE DEMOLITION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of interior finishes

### 1.2 DEFINITIONS

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

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

### 1.3 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.

### 1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project Site

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

1.5 INFORMATIONAL SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

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 013233 "Photographic Documentation." Submit before Work begins.

C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

D. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 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.

1. Before selective demolition, Owner will remove the following items:

a. Documents, personal items, wall hung pictures, art, etc.

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. 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.

## 1.9 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

## 1.10 COORDINATION

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

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

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

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

# PART 3 - EXECUTION

## 3.1 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. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

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

D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

E. 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.

## 3.2 PREPARATION

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

## 3.3 PROTECTION

Revise "Temporary Protection" Paragraph below to suit Project. Delete if adequately covered in Section 015000 "Temporary Facilities and Controls."

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

B. Remove temporary barricades and protections where hazards no longer exist.

## 3.4 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 adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

## 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

## 3.6 DISPOSAL OF DEMOLISHED MATERIALS

Insert other specific disposal, cleanup, or removal requirements to suit Project.

A. Remove demolition waste materials from Project site[and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

## 3.7 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 024119

# SECTION 099123 - INTERIOR PAINTING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

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

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Samples: For each type of topcoat product.

C. Samples for Initial Selection: For each type of topcoat product.

D. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches (200 mm) 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.

E. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

### 1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than **1 gal. (3.8 L)** of each material and color applied.

1.5 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. Architect will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
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.

1.6 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).

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

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 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. Benjamin Moore & Co.
2. PPG Paints.

B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As indicated on Floor Plans and Finish Legend

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.
6. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

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.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: 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.

E. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
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.

F. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

## 3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. 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.

## 3.4 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.

## 3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099123

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# SECTION 095123 - ACOUSTICAL TILE CEILINGS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Acoustical tiles for interior ceilings.
2. Fully concealed, direct-hung, suspension systems.

B. Related Requirements:
1. Section 265119 "LED Interior lighting"

C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

### 1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.

    a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical tile.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:

    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.

d. Speakers.
e. Sprinklers.
f. Access panels.
g. Perimeter moldings.

7. Show operation of hinged and sliding components adjacent to acoustical tiles.
8. Minimum Drawing Scale: 1/4 inch = 1 foot (1:48)

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical tile ceiling, for tests performed by a qualified testing agency.

D. Evaluation Reports: For each acoustical tile ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

## 1.5 CLOSEOUT SUBMITTALS

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

## 1.6 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. Acoustical Ceiling Units: Full-size tiles equal to 10 percent of quantity installed.
2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 10 percent of quantity installed.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site 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.

## 1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, 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

### 2.1 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.

### 2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E1264.

### 2.3 ACOUSTICAL TILES

A. Basis of design: Armstrong Ultima 1912 or equal product per Architect approval

B. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E1264 classifications as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Color: White

D. Size: 24" x 24"

E. Light Reflectance (LR): Not less than .88

F. Ceiling Attenuation Class (CAC): Not less than 35

G. Noise Reduction Coefficient (NRC): Not less than .75

H. Articulation Class (AC): Not less than 170

### 2.4 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, fully concealed, metal suspension system and accessories of type, structural classification, and finish indicated that complies with applicable requirements in ASTM C635/C635M.

B. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated

1. Structural Classification: Intermediate duty system.

## 2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Stainless-Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- (2.69-mm-) diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

## 2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.

1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
2. Finish: Painted white

B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.

1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

## 3.1 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.

## 3.2 PREPARATION

Retain "Testing Substrates" Paragraph below for adhesive-bonded tile.

A. Testing Substrates: Before adhesively bonding tiles to wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.

B. 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 unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

C. Layout openings for penetrations centered on the penetrating items.

## 3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. Install suspended acoustical tile ceilings according to ASTM C636/C636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
3. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
4. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger

involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Arrange directionally patterned acoustical tiles as follows:

1. As indicated on reflected ceiling plans.

G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges of tiles so tile-to-tile joints are interlocked.

1. Fit adjoining tiles to form flush, tight joints. Scribe and cut tiles for accurate fit at borders and around penetrations through ceiling.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tiles and moldings, spaced 12 inches (305 mm) o.c.

## 3.4 ADJUSTING

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.

B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095123

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# SECTION 096513 - RESILIENT BASE AND ACCESSORIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Thermoplastic-rubber base.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For resilient base and accessory products RB-1

### 1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Furnish not less than 10 linear feet (3 linear m)f or every[500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

### 1.5 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 (10 deg C) or more than 90 deg F (32 deg C).

### 1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive resilient products during the following 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 tha**n 55 deg F (13 deg C) or more than 95 deg F (35 deg C)**

C. Install resilient products after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

### 2.2 THERMOPLASTIC-RUBBER BASE RB-1

A. BASIS OF DESIGN: Tarkett Duracove Rubber Base Burnt Umber 63

B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style and Location:

a. Style A, Straight: Provide in areas with carpet
b. Style B, Cove: Provide in areas with resilient floor coverings

C. Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (102 mm)

E. Coils in manufacturer's standard length

F. Outside Corners: Job formed or preformed

G. Inside Corners: Job formed or preformed

H. Colors: Burnt Umber 63

### 2.3 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

3.1 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.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.

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 manufacturer. Do not use solvents.

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 resilient products until materials are the same temperature as 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.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 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. Preformed Corners: Install preformed corners before installing straight pieces.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) 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 3 inches (76 mm)in length.

    a. Miter corners to minimize open joints.

## 3.4 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 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 096513

# SECTION 096519 - RESILIENT TILE FLOORING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Vinyl composition floor tile.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Full-size units of each color, texture, and pattern of floor tile required.

C. Product Schedule: For floor tile LVT-1

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

### 1.5 CLOSEOUT SUBMITTALS

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

### 1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra material 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. Floor Tile 10% of total installed flooring, of each type, color, and pattern of floor tile installed.

### 1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.8 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 (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C or more than 95 deg F (35 deg C)in spaces to receive floor tile during the following 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 (13 deg C) or more than 95 deg F (35 deg C)

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

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

2.2 SOLID VINYL FLOOR TILE LVT-1

A. BASIS OF DESIGN: Interface Citerion Classic Woodgrains

B. Thickness: 0.120 inch (3.0 mm)

C. Size: 12.5 X 100 CM

D. Colors and Patterns: C00108 Mushroom Color. Ashlar Pattern

2.3 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.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 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.

3.2 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 F710.

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.

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 materials are the same temperature as 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.

## 3.3 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 square with room axis

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

## 3.4 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 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 096519

# SECTION 096813 - TILE CARPETING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Carpet tile
2. Refer to finish legend

B. Related Requirements:

1. Section 024119 "Selective Demolition" for removing existing floor coverings.
2. Section 096513 "Resilient Base and Accessories"
3. Section 096519 "Resilient Tile Flooring"

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

### 1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

B. Qualification Statements: For Installer.

C. Sample Warranties: For carpet tile.

### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 10 percent of amount installed for each type indicated, but no fewer than 10 full-size units.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended in writing by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
b. Loss of tuft-bind strength.
c. Excess static discharge.
d. Delamination.

e. Dimensional instability.

3. Warranty Period: 10

## PART 2 - PRODUCTS

### 2.1 CARPET TILE CPT-1

A. BASIS OF DESIGN PRODUCT: Interface Ceremony

B. Color: 104951 Bento

C. Pattern: Ceremony CE171

### 2.2 CARPET TILE CPT-2

A. BASIS OF DESIGN PRODUCT: Interface Ceremony

B. Color: 104959 Bento

C. Pattern: Ceremony CE172

### 2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended in writing by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive types to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and that are recommended in writing by carpet tile manufacturer for releasable installation.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

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

## 3.2 PREPARATION

A. General: Comply with CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, in accordance with manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

## 3.3 INSTALLATION

A. General: Comply with CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive

C. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended in writing by carpet tile manufacturer.

D. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

F. Install pattern parallel to walls and borders.

## 3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended in writing by carpet tile manufacturer.

2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

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# SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad countertops.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

### 1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator

B. Product Certificates: For the following:

1. Composite wood products.
2. High-pressure decorative laminate.
3. Chemical-resistant, high-pressure decorative laminate.
4. Adhesives.

### 1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.

B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.6 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

2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.

B. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Basis of Design: WilsonArt Magnolia 5012K-19 in Leno Weave
2. Match Architect's sample.

C. Edge Treatment: Same as laminate cladding on horizontal surfaces

D. Core Material: As selected by fabricator to comply with quality standard

E. Core Material at Sinks: Particleboard made with exterior glue

F. Core Thickness: 3/4 inch (19 mm)

2.2 ACCESSORIES

A. Wire-Management Grommets: Circular, molded-plastic grommets and matching plastic caps with slot for wire passage.
1. Outside Diameter: 2 inches (51 mm)
2. Color: Black

2.3 FABRICATION

A. Sand wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch (25 mm) over base cabinets. Ease edges to radius indicated for the following:

PART 3 - EXECUTION

3.1 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.

3.2 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. 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.

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 countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical-treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches (3-mm-in-2400-mm) variation from a straight, level plane.
2. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semiexposed surfaces.

C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches (1220 mm) o.c. Remove protection at Substantial Completion.

END OF SECTION 123623.13

# SECTION 265119 - LED INTERIOR LIGHTING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes the following types of LED luminaires:

1. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

### 1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.

5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.

    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

## 1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: For luminaires, accessories, and 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 the certification is based and their installation requirements.

B. Sample warranty.

## 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

## 1.7 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. Lamps: Five percent of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: Five percent of each type and rating installed. Furnish at least one of each type.

3. Globes and Guards: Five percent of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

B. Store all materials in a closed building, in original packaging, and protect from damage and the elements.

C. Decorative elements of fixtures shall be packed by the manufacturer separately from the housing of the fixture, stored at the job site and installed only after completion of plastering, ceiling tile work, painting and general cleanup in area.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

C. Ambient Temperature: **5 to 104 deg F**.

1. Relative Humidity: Zero to 95 percent.

D. Altitude: Sea level to **1000 feet**.

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI.

C. Recessed luminaires shall comply with NEMA LE 4.

D. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

E. California Title 24 compliant.

F. LED's shall be "Bin No. 1" quality.

G. User-Replaceable Lamps:

1. Bulb shape complying with ANSI C78.79.
2. Lamp base complying with ANSI C81.61.

H. CRI of minimum 80. CCT of 4100 K.

I. L70 lamp life of 50,000 hours.

J. Lamps dimmable from 100 percent to 0 percent of maximum light output.

K. Internal driver.

L. Minimum allowable efficacy of 80 lm/W

M. Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.

N. Luminaires shall have internal thermal protection.

O. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

P. Diffusers and Globes:

1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated

Q. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.

R. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management.

S. Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.

T. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

U. Standards:

1. ENERGY STAR certified.
2. LED's shall be Restriction of Hazardous Substances Directive (RoHS) compliant.
3. UL Listing: Listed for damp location.

## 2.3 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A 36/A 36M for carbon structural steel.
2. ASTM A 568/A 568M for sheet steel.

C. Stainless Steel:

1. 1. Manufacturer's standard grade.
2. 2. Manufacturer's standard type, ASTM A 240/240 M.

D. Galvanized Steel: ASTM A 653/A 653M.

E. Aluminum: ASTM B 209.

2.4 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.5 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

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

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaires:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaires:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaires:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

## 3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

## 3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265119

SECTION 260500 – ELECTRICAL WORK, GENERAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Division 26 of the specifications covers all electrical work for the project. Work shall include labor, including time necessary to investigate existing conditions, material, tools, temporary wiring, accessories, etc. required to accomplish the work as specified and shown on the drawings.

B. The drawings and specifications shall support each other to the extent that materials and labor indicated, called for, or implied by either shall be furnished and installed as if required by both. If the drawings and the specifications contradict each other, then the stricter requirement of the two shall be furnished and installed.

C. Provisions of this section shall apply to all Electrical sections.

D. Related Sections:

1. Division 28, Section 284621 "Fire Alarm System" for fire detection and alarm systems.
2. Division 28, Section 284622 "VESDA" for very early warning smoke detection systems.

1.3 CODES, PERMITS AND INSPECTIONS

A. Installation shall comply with all laws applying to electrical installation in effect; with the regulations of the NEC, National Electrical Safety Code, and other applicable publications of the National Fire Protection Association, all local governing codes and ordinances and with the regulations of the serving utility company.

B. Obtain permits and request inspections from authority having jurisdiction and applicable utility companies.

C. Pay for all required licenses, fees, and inspections.

D. Contact the Utility Companies to determine if fees, charges or costs are required by the Utility Company for temporary power, installations and hook-ups. These fees, charges or costs shall be included in Contractor's bid.

E. Both the Contractor and installing electrician are reminded that since the NEC is by statutory inclusion a part of the laws of the state, they bear a prime responsibility to comply with it even when the plans or specifications denote an apparent violation.

This should be observed carefully and continuously, particularly during estimating for proposal, and any discrepancies should be brought to the attention of the engineer for resolution.

F. Contractor shall coordinate and schedule all required State, County, City, and Engineer inspections in a timely manner so as to not "cover up" work to be inspected and to not "hold up" work to be performed by other trades.

1.4 DEFINITIONS

A. Where the word "provide" is used relating to a system or piece of equipment, it shall be understood to mean the furnishing and installing of the system or equipment.

B. Where the word "furnish" is used relating to a system or piece of equipment, it shall be understood to mean supply to the project only, for installation under other Divisions as part of this contract.

C. Where the word "install" is used relating to a system or piece of equipment, it shall be understood to mean to place and put in service equipment furnished under other Divisions as part of this contract.

D. Where the phrase "as directed" is used, it shall be understood to mean direction given to the Contractor by the Architect, Engineer, or Owner.

E. Where the phrase "as indicated" is used, it shall be understood to mean as shown on drawings by notes, graphics or schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "scheduled" and "specified" have the same meaning as "indicated", and are used to assist the reader in locating particular information.

F. Where the word "Contractor" is used, it shall be understood to mean the contractor responsible for all Division 26 specifications and electrical drawings, unless otherwise noted.

G. Where the term "E.C." is used, it shall be taken as a guide for the scope normally performed by the Electrical SubContractor, whereas when the term "G.C." is used, it shall be taken as a guide for the scope normally performed by the General Contractor.

1.5 SUBMITTALS

A. Comply with requirements of Division 01 Specification Sections.

B. Submittals shall be reviewed and coordinated by the Contractor as well as by the subcontractors responsible for work under Division 26. Vendor submittals containing questions or comments directed to the installer shall be addressed. If a vendor states in a submittal that certain required components are "not included" or "by others", the Contractor or subcontractor shall delete such statements and verify that the required materials are contained elsewhere in the submittals. Failure of the

Contractor and/or subcontractor to properly review and coordinate submittals may result in rejection of the submittal by the Engineer

C. Representation: In submitting item, equipment, product, etc. other than that has been listed on contract drawings, in contract documents or in an addenda, Contractor represents that he:

1. Has investigated substitution item and determined that it is equal or superior to specified product in all aspects.
2. Will coordinate installation of accepted substitution into work, making changes as may be required to complete work in all aspects.
3. Waives all claims for additional costs related to substitution which may subsequently become apparent.
4. Will provide the same warranties for the substitution as for the product specified.
5. Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.
6. Will absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or miss-sized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.

D. Shop Drawings and Product Data:

1. Shop Drawings: Shall be submitted as indicated under each section of this division. Shop drawings shall include sufficient information to indicate complete compliance with specifications.
2. Product Data: Shall be submitted as indicated under each section of this division. Each sheet shall show manufacturer's name or trademark. Edit product data to identify only those items to be provided for this project.
3. Where items are those specified, only a bill of material of such items shall be necessary, except where shop drawings and product data are specifically required.
4. At the time of each submission, any deviations from the Contract Documents shall be called to the attention of the Architect-Engineer in writing, and be plainly marked on the shop drawings and product data.
5. Note that the acceptance of shop drawings or other information submitted in accordance with the requirements specified above, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved, the ability of the material or equipment involved or the Mechanical/Electrical performance of equipment. Acceptance of shop drawings does not invalidate the plans and Specifications if in conflict; unless a letter requesting such change is submitted and accepted on the Engineer's letterhead.
6. Contractor is responsible for delays in job project accruing directly or indirectly from late submissions or resubmissions of shop drawings, or product data.

7. The A/E shall be reimbursed cost to review resubmittals subsequent to the second submittal. Cost will be billed to Contractor at Engineer's standard hourly rate

E. Record Drawings:

1. Provide 1 complete set of contract drawings in clean, undamaged condition, indicating all significant changes from the work as shown. Use multiple pencil colors to aid in the distinction between works of separate electrical systems. In general, record every substantive installation of electrical work which previously is either not shown or field modified.

   a. Show exact locations of underground feeder cable and conduits 2" and larger including manholes and handholes, both interior and exterior, drawn to scale and fully dimensioned from building column lines.
   b. Locate devices requiring maintenance.
   c. Indicate changes in equipment ratings and locations.

2. Refer to General Conditions and Division 1 for additional requirements pertaining to record documents.

F. Submit the following upon completion of the work:

1. Certificate of Final Inspection from local authority.
2. Tabulation of all motors listing respective manufacturer, horsepower, nameplate voltage and current, actual running current after installation and overload heater rating.
3. O&M Manuals.

1.6 QUALITY ASSURANCE

A. Materials shall comply with standards of UL, where standards have been established for the particular product and the various NEMA, ANSI, ASTM, IEEE, AEIC, ICEA or other publications referenced.

B. All electrical materials shall be new and within one year of manufacture, complying with all the latest codes and standards. No used, re-built, re-sold through secondary market (salvage, recycle etc), refurbished and/or re-manufactured electrical materials shall be furnished and installed on this project. Material shall have U.L. listing or be listed with an approved, nationally recognized Electrical Testing Agency if and only if U.L. Listing is not available for material.

1.7 ELECTRIC SERVICE

A. Electrical service shall be as shown on the drawings. The Contractor shall coordinate exact location, routing and other requirements with the utility company.

B. Prior to beginning installation of any primary conduits, manhole or transformer pad, Contractor shall contact and meet with the proper utility company engineers to review the plans and project schedule.

C. Electric energy for the project will be provided by the local utility company using local utility company furnished and installed pad-mounted transformers.

D. Voltage at the secondary side of the local utility company transformer shall be 480Y/277 volts three-phase, four-wire. The Contractor shall provide all elements of the system on the load side of the local utility company transformer as necessary to ensure a properly working system.

E. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.

F. Meter Sockets: Comply with requirements of electrical power utility company.

1.8 MANUFACTURERS' NAMES AND CATALOG NUMBERS

A. In some instances, specific references have been made to one or more manufacturer's names and model or catalog numbers. Use of names and catalog numbers does not indicate that the equipment specified is necessarily an "off the shelf" item. Variances may be due to requirement of a desired finish, material, or other modification.

1.9 PROTECTION OF ELECTRICAL EQUIPMENT

A. Electrical equipment shall be protected from the weather, in particular, dripping or splashing water, at all times during shipment, storage and construction. Manufacturer's recommendations with regard to storage and protection shall be followed. Should any apparatus be subjected to possible injury by water, it shall be thoroughly dried and put through a dielectric test, at the expense of the Contractor, to ascertain the suitability of the apparatus or it shall be replaced without additional cost to the Owner.

B. Damaged or Defective Equipment: Inspect all electrical equipment and materials prior to installation. Damaged equipment and materials shall not be installed or placed in service until the Owner has been notified and written approval to proceed has been given by the Owner. Replace or repair to new condition and test repaired damaged equipment in compliance with industry standards at no additional cost to the Owner. Equipment required for the test shall be provided by the Contractor.

1.10 WORKING CLEARANCES

A. Working clearances around equipment requiring electrical service shall comply with code requirements. Should there be apparent violations of clearances, notify the Architect-Engineer before proceeding with connection or placement of equipment.

B. The Contractor shall verify finish dimensions at the project site in preference to using dimensions noted on Contract Documents

1.11 DISCREPANCIES

A. Should it appear that there is a discrepancy between or within the Division 26 drawings, and/or Division 26 specifications, and/or the local Authority Having Jurisdiction's interpretations, and/or local Utility Companies regulations concerning the nature, quality or extent of materials or work to be furnished and/or installed, and such discrepancy is not brought to the Architect/Engineer's attention during Bidding for a formal written Addendum clarification, this Contractor shall base his/her bid on performing the work in the manner having the higher cost or more stringent option. The Architect/Engineer shall then have the option during construction of selecting either of the manners shown and/or specified at no additional cost to the Owner. In the event the lower cost manner is selected, a credit shall be due the Owner in the amount of the difference between the lower cost and higher cost manner. All discrepancies shall be called to the attention of the Architect before proceeding with work affected thereby.

1.12 COORDINATION

A. For locations where several elements of electrical or combined mechanical and electrical work must be positioned with precision in order to fit into the available space, prepare coordination drawings at accurate scale showing the actual physical dimensions required for the installation to assure proper integration of equipment with building systems.

B. In the case of panelboards, safety switches and other equipment requiring wire and cable terminations, ascertain that lug sizes and wiring gutters or space allowed for proper accommodation and termination of the wire and cables are adequate.

1.12 INVESTIGATION OF SITE

A. Check site and existing conditions thoroughly before bidding. Advise A/E of discrepancies or questions noted

B. Each Bidder shall visit the site and shall thoroughly familiarize himself with existing field conditions and the proposed work as described or implied by the Contract Documents. During the course of his site visit, the electrical bidder shall verify every aspect of the proposed work and the existing field conditions in the areas of construction and demolition which will affect his work. The Contractor will receive no compensation or reimbursement for additional expenses they incur due to a failure in making a thorough investigation of the existing facilities. Submission of a proposal will be construed as evidence that such examination has been made and later claims for labor, equipment or materials required because of difficulties encountered will not be recognized.

C. Existing conditions and utilities indicated are taken from existing construction documents, surveys, and/or field investigations. Unforeseen conditions probably exist and existing conditions shown on drawings may differ from the actual existing installation with the result being that new work may not be field located exactly as shown on the drawings. Contractor shall field verify dimensions of all site utilities, conduit routing, boxes, etc., prior to bidding and include any deviations in the contract. Notify A/E if deviations are found.

D. The Contractor shall locate all existing utilities and protect them from damage. The Contractor shall pay for repair or replacement of utilities or other property damaged by operations in conjunction with the completion of this work

PART 2 - PRODUCTS

2.1 N/A

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. The Contractor shall furnish, perform, or provide all labor including planning, purchasing, transporting, storing, installing, testing, cutting and patching, locating and marking existing utilities prior to excavation, trenching, excavating, backfilling, coordination, field verification, equipment (installation and safety), training for owner personnel, supplies, and materials necessary for the correct installation of complete electrical systems (as described or implied by these specifications and the applicable drawings) in strict accordance with applicable codes, which may not be repeated in these specifications, but are expected to be common knowledge of qualified Bidders

B. Comply with NFPA and OSHA requirements.

C. All work shall be installed in a neat, workmanlike manner in accordance with ANSI/NECA 1.

D. Care shall be used in the erection and installation of all equipment and materials to avoid marring surfaces of the work. Damages shall be repaired at no additional cost to the Owner.

E. The Contractor shall keep the construction site clean of waste materials and rubbish. Upon completion of the work, the Contractor shall remove from the site debris, waste, unused materials, and equipment. Disposal of hazardous materials shall comply with all local, state and federal codes.

F. The contractor shall cooperate in reducing objectionable noise or vibration. If noise or vibration is a result of improper material or installation, these conditions shall be corrected at no cost to the owner

G. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

H. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

I. Working clearance around equipment shall not be less than that specified in the NEC for all voltages specified.

J. The locations of switches, receptacles, lights, motors, etc. outlets shown are approximate. The contractor shall use good judgment in placing the preceding items to eliminate all interference with ducts, piping, etc. The contractor shall check all door swings so that light switches are not located behind doors. Relocate switches as required, with approval from the Design Professional.

K. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity. Normal maintenance shall not require the removal of protective guards from adjacent equipment. Install equipment as close as practical to the locations shown on the Drawings.

1. Where the Owner determines that the Contractor has installed equipment not conveniently accessible for operations and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Owner.
2. "Conveniently Accessible' is defined as being capable of being reached without use of ladders, or without climbing or crawling over or under obstacles such as motors, pumps, belt guards, transformers, racks, piping, ductwork, raceways or similar.

L. Right of Way: Give to piping systems installed at a required slope.

M. Owner furnished equipment: Equipment furnished by the Owner shall be received, stored, uncrated, protected, and installed by the Contractor with all appurtenances required to place the equipment in operation, ready for use. The Contractor shall be responsible for the equipment as if he had purchased the equipment himself.

N. During construction the contractor shall at all times maintain electrical utilities of the building without interruption. Should it be necessary to interrupt any electrical service or utility, the contractor shall secure permission in writing from the Owner for such interruption at least seven days in advance. Any interruption shall be made with minimum amount of inconvenience to the Owner and any shut-down time shall have to be on a premium time basis and such time to be included in the contractor's bid. Arrange to provide and pay for temporary power source if required by project conditions.

O. The drawings do not show off-sets, bends, and special fittings, or junction or pull boxes necessary to meet job conditions. These items shall be provided as required at no additional cost to the Owner.

P. Seismic Mounting: All electrical material and equipment, including floor mounted equipment, suspended raceways and light fixtures, shall be installed with bracing, cabling, or anchoring to comply with the latest edition of the Uniform Building Code.

## 3.2 PLACING EQUIPMENT IN SERVICE

A. Equipment requiring electrical service shall not be energized or placed in service until all interested parties have been duly notified and are present or have waived

their right to be present. Where equipment to be placed in service involves service or connection from another contractor or the Owner, the Contractor shall notify the Owner in writing when the equipment will be ready. The Owner shall be notified as far in advance as possible, of the date the various items of equipment will be complete.

3.3 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer

3.4 CLEANING AND PROTECTION

A. The Contractor shall, at all times, keep the area of his work presentable to the public and clean of rubbish caused by his operations; and at the completion of the work shall remove all rubbish, all of his tools, equipment, temporary work and surplus materials, from and above the premises, and shall leave the work clean and ready for use. If the Contractor does not attend to such cleaning immediately upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the responsible Contractor. Each Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of his rubbish or debris

B. After completion of all work and before final acceptance of the work, each Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of materials, equipment and all associated fabrication. Pay particular attention to finished area surfaces such as lighting fixture lenses, lamps, reflectors, panels, etc.

C. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of substantial completion.

3.5 CONCRETE PADS

A. Furnish and install reinforced concrete housekeeping pads for switchboards, generators, and other free-standing equipment. Unless otherwise noted, pads shall be four (4) inches high and shall exceed dimensions of equipment being set on them, including future sections, by three (3) inches each side, except when equipment is flush against a wall where the side against the wall shall be flush with the equipment. Pads shall be reinforced with W1.4 x 1.4 6 x 6 welded wire mesh. Chamfer top edges 1/2". Trowel all surfaces smooth. Use 3000 psi, 28-day compressive strength concrete.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
2. Install epoxy-coated anchor bolts for anchoring equipment to the concrete base.
3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Bolt equipment to channel-iron sills embedded in concrete bases. Install sills level and grout flush with floor or base.
5. Refinish damaged or scratched surfaces.

B. Contractor to provide/install concrete pad for exterior generators as recommended by generator manufacturer and structural engineer.

3.6 FINAL INSPECTION AND TESTING

A. The work shall be thoroughly tested in the presence of the Owner's representative to demonstrate that the entire system is in proper working order and in accordance with the drawings and specifications. Each motor with its control shall be run as nearly as possible under operating conditions for a sufficient length of time to demonstrate correct alignment, wiring capacity, speed and satisfactory operation. All main switches and circuit breakers shall be operated, but not necessarily at full load. During final inspection, furnish the test instruments and qualified personnel to perform complete testing.

B. Costs of tests, including expenses incident to retest occasioned by defects and failures of the equipment to meet the specifications shall be paid by the Contractor.

3.7 SAFETY - GENERAL

A. The Contractor and not the Engineer is responsible for all job site safety relating to his or her work. The Contractor shall be familiar with all safety requirements, such as OSHA regulations, and comply accordingly. The Contractor shall coordinate providing of all personal protection equipment with their employees.

3.8 WARRANTY

A. The work shall include a one-year warranty. This warranty shall be by the Contractor to the Owner for any defective workmanship, equipment or material for a period of one year from the date of substantial completion of System. When required by the specifications, warranties for specific items shall be for periods longer than one (1) year.

END OF SECTION 260500

# SECTION 260519 – LOW VOLTAGE CONDUCTORS AND CABLES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Metal-clad cable, Type MC, rated 600 V or less.
3. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2 and 3 control cables.

### 1.3 DEFINITIONS

A. VFC: Variable frequency controller.

B. RoHS: Restriction of Hazardous Substances

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of cable and conductor product.

## PART 2 - PRODUCTS

### 2.1 CONDUCTORS AND CABLES

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less

B. Manufacturer: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Alpha Wire.

2. Belden Inc.
3. Encore Wire Corporation.
4. General Cable Technologies Corporation.
5. Okonite Company (The).
6. Southwire Incorporated.
7. WESCO.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:

1. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
2. Type THHN and Type THWN-2: Comply with UL 83.
3. Type XHHW-2: Comply with UL 44.

F. VFC Cable:

1. Type TC-ER: Cable designed for use with VFCs, with oversized crosslinked polyethylene insulation, [spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire] [dual spirally wrapped copper tape shields and three bare symmetrically applied ground wires], and sunlight- and oil-resistant outer PVC jacket..

## 2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturer: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. AFC Cable Systems; a part of Atkore International.
2. Alpha Wire.
3. Belden Inc.
4. Encore Wire Corporation.
5. General Cable Technologies Corporation.
6. Southwire Incorporated.
7. WESCO

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.

H. Armor: Steel or Aluminum, interlocked.

I. Jacket: PVC applied over armor.

## 2.3 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use

B. Manufacturer: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. 3M Electrical Products.
2. AFC Cable Systems, Inc.
3. Gardner Bender
4. Hubbell Power Systems, Inc.
5. Ideal Industries, Inc.
6. ILSCO.
7. O-Z/Gedney; a brand of the EGS Electrical Group.
8. Thomas and Betts Corporation.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

C. VFC Output Circuits Cable: Extra-flexible stranded for all sizes

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.

B. Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Branch Circuits: Type THHN/THWN-2, single conductors in raceway.

D. Metal-clad cable, Type MC.

1. Use only for branch circuit wiring serving 20-amp, 120 volt circuits.
2. Use only from receptacle to receptacle or light fixture to light fixture. MC Cable shall not be used for home runs to panelboards.
3. Use of metal clad cable shall be permitted only for lighting, equipment and receptacle branch circuits indicated on the Construction Drawings. Metal clad cable shall not be permitted in locations designated to be hazardous Class I, II or III.
4. Metal clad cable shall be permitted only for motor circuits where the motor being served is less than ½ HP and rated for 120V, single phase. Metal clad cable is not permitted for HVAC equipment and controls.
5. Metal clad cable shall only be installed concealed within walls and above ceiling interstitial spaces.
6. The cable end shall be cut square to ensure flush seating of the cable into the fitting. Fitting securement screws shall be properly torqued. Cable ends shall be fitted with insulating bushings intended for the type of metal clad cable being installed.

E. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

F. VFC Output Circuits: Type TC-ER cable with braided shield.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

G. Complete cable tray systems installation according to Section 260536 "Cable Trays" prior to installing conductors and cables.

H. Neatly train and lace wiring inside boxes, equipment, and panelboards.

## 3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

D. Splices within outlet, pull and junction boxes:

1. Connectors for splicing of No. 10 AWG and smaller conductors shall be 3-M Scotchlok, spring-type pressure connectors, or approved equal.
2. Splices for No. 8 AWG and larger shall be taped, compression type, or approved equal.

E. Terminations for motors with No. 10 AWG or smaller conductors shall be a spring-type pressure connector. Terminations for motors requiring No. 8 AWG and larger terminations shall be taped, compression type.

## 3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

## 3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

## 3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

## 3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each of the following visual and electrical tests:

    a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    b. Test bolted connections for high resistance using one of the following:

        1) A low-resistance ohmmeter.
        2) Calibrated torque wrench.
        3) Thermographic survey.

    c. Inspect compression-applied connectors for correct cable match and indentation.
    d. Inspect for correct identification.
    e. Inspect cable jacket and condition.
    f. Continuity test on each conductor and cable.
    g. Uniform resistance of parallel conductors

B. Cables will be considered defective if they do not pass tests and inspections.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

# SECTION 260526 - GROUNDING AND BONDING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.
3. Foundation steel electrodes.

### 1.3 ACTION SUBMITTALS

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

### 1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.

B. Field quality-control reports.

### 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:

1) Test wells.
2) Ground rods.
3) Ground rings.
4) Grounding arrangements and connections for separately derived systems

b. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, grounding connections for separately derived systems based on NETA MTS.

1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
2) Include recommended testing intervals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. Fushi Copperweld Inc.
4. Harger Lightning and Grounding.
5. ILSCO.
6. O-Z/Gedney; A Brand of the EGS Electrical Group.
7. Robbins Lightning, Inc.
8. Thomas and Betts Corporation.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section or as otherwise indicated on drawing, provided with standard NEMA bolt hole sizing and spacing for the type of connectors to be used. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V. Provide clear Lexan cover over connections. Cover to read "GROUND PLATE" or as indicated on drawing.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

E. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

F. Conduit Hubs: Mechanical type, terminal with threaded hub.

G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

H. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

I. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

J. Straps: Solid copper, copper lugs. Rated for 600 A.

K. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

L. Water Pipe Clamps:

1. Mechanical type, two pieces with stainless-steel bolts.

a. Material: Die-cast zinc alloy.

2. U-bolt type with malleable-iron clamp and copper ground connector.

## 2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, 3/4 inch by 10 feet.

# PART 3 - EXECUTION

## 3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 4/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation. Bury detectable warning tape approximately 6 inches above grounding conductors.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 24 inches above finished floor unless otherwise indicated.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.
5. Bus-Bar connections: Long-barrel compression type with two-bolt connection to the bus bar except as listed below:

    a. Bus-Bar Connections within electrical equipment: Mechanical type, solderless compression-type wire terminals, and long-barrel, two-bolt connection to the bus bar.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Install grounding electrode(s) at the generator or transformer location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator and transformer.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than

No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

G. Outdoor metallic fences around electrical equipment:

1. Comply with requirements of IEEE C2.
2. Grounding Conductor: Bare copper, not less than No. 6 AWG.
3. Gates and Other Fence Openings: Ground fence on each side of opening.
4. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
5. 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.

H. Cable trays shall be grounded and bonded in accordance with N.E.C. requirements.

3.6 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
3. Install test well at each ground rod where indicated on the drawings. Install grounding well top flush with finished grade.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.

1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

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

F. Grounding and Bonding for Piping:

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

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 70 feet apart.

I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each indicated item, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 3/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building's foundation

J. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

K. 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

L. Exothermic Connections: Welds shall be made in accordance with kit recommendations. Damp materials shall not be used. Puffed up or connections that are not fully formed or where material is missing, shall be replaced.

## 3.7 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. Conductor terminations at exposed bus bars shall be identified.

## 3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each

location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

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

D. Prepare test and inspection reports.

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

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 5 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 3 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 2 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 5 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

# SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E and Section 260575 "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## 2.2 COLOR AND LEGEND REQUIREMENTS

A. Color-Coding for Phase and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

1. Color shall be factory applied. Color for branch circuits may be field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
2. Colors for 208/120-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.

3. Colors for 480/277-V Circuits:

    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.

4. Color for Neutral:
    =
    a. White for 208/120V circuits
    b. Gray for 480/277V circuits.

5. Color for Equipment Grounds: Green.
6. Colors for Isolated Grounds: Green with white stripe.

B. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

C. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 42 INCHES."

D. Equipment Identification Labels:

1. Black letters on a white field.

## 2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Brady Corporation.
b. Champion America.
c. Emedco.
d. Grafoplast Wire Markers.
e. Hellermann Tyton.
f. LEM Products Inc.
g. Marking Services, Inc.
h. Panduit Corp.
i. Seton Identification Products.

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Brady Corporation.
b. Hellermann Tyton.
c. Marking Services, Inc.
d. Panduit Corp.
e. Seton Identification Products

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, vinyl flexible label with acrylic pressure-sensitive adhesive.

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. A'n D Cable Products.
b. Brady Corporation.
c. Brother International Corporation.
d. Emedco.

e. Grafoplast Wire Markers.
f. Ideal Industries, Inc.
g. LEM Products Inc.
h. Marking Services, Inc.
i. Panduit Corp.
j. Seton Identification Products

2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
3. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
4. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. A'n D Cable Products.
b. Brady Corporation.
c. Brother International Corporation.
d. Emedco.
e. Grafoplast Wire Markers.
f. Hellermann Tyton.
g. Ideal Industries, Inc.
h. LEM Products Inc.
i. Marking Services, Inc.
j. Panduit Corp.
k. Seton Identification Products

2. Minimum Nominal Size:

a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
c. As required by authorities having jurisdiction.

## 2.4 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameters and that stay in place by gripping action.

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. A'n D Cable Products.

b. Brady Corporation.
c. Hellermann Tyton..
d. Marking Services, Inc.
e. Panduit Corp.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F (93 deg C). Comply with UL 224.

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Brady Corporation.
b. Panduit Corp.

## 2.5 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Carlton Industries, LP
b. Champion America.
c. Hellermann Tyton.
d. Ideal Industries, Inc.
e. Marking Services, Inc.
f. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. Emedco.
d. Marking Services, Inc.

C. Tape and Stencil: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background and are 12 inches (300 mm) wide. Stop stripes at legends.

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Hellermann Tyton.
b. LEM Products Inc.
c. Marking Services, Inc.
d. Seton Identification Products

D. Underground-Line Warning Tape:

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Brady Corporation.
b. Ideal Industries, Inc.
c. LEM Products Inc.
d. Marking Services, Inc.
e. Reef Industries, Inc.
f. Seton Identification Products

2. Tape:

a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communication utility lines.
b. Printing on tape shall be permanent and shall not be damaged by burial operations.
c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:

a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

4. Tag: Non-Utility:

a. Pigmented polyolefin, bright colored, continuous-printed on one side, compounded for direct-burial service.
b. Width: 3 inches (75 mm).
c. Thickness: 4 mils (0.1 mm).
d. Weight: 18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m).
e. Tensile according to ASTM D 882: 30 lbf (133.4 N) and 2500 psi (17.2 MPa).

5. Tag: Utility:

a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
b. Width: 3 inches (75 mm).
c. Overall Thickness: 5 mils (0.125 mm).
d. Foil Core Thickness: 0.35 mil (0.00889 mm).
e. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
f. Tensile according to ASTM D 882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).

## 2.6 TAGS

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. Emedco.
d. Marking Services, Inc.
e. Seton Identification Products

B. Nonmetallic Preprinted Tags: Polyethylene tags, [0.015 inch (0.38 mm)] [0.023 inch (0.58 mm)] thick, color-coded for phase and voltage level, with factory [screened] [printed] permanent designations; punched for use with self-locking cable tie fastener.

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. Emedco.
d. Grafoplast Wire Markers.
e. LEM Products Inc.
f. Marking Services, Inc.
g. Panduit Corp.
h. Seton Identification Products

C. Write-on Tags:

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Carlton Industries, LP.
b. LEM Products Inc.

c. Seton Identification Products

2. Polyester Tags: 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment.
3. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.7 SIGNS

A. Baked-Enamel Signs:

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Carlton Industries, LP.
b. Champion America.
c. Emedco.
d. Marking Services, Inc.

2. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
3. 1/4-inch (6.4-mm) grommets in corners for mounting.
4. Nominal Size: 7 by 10 inches (180 by 250 mm).

B. Metal-Backed Butyrate Signs:

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Brady Corporation.
b. Champion America.
c. Emedco.
d. Marking Services, Inc

2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch (1-mm) galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
3. 1/4-inch (6.4-mm) grommets in corners for mounting.
4. Nominal Size: 10 by 14 inches (250 by 360 mm).

C. Laminated Acrylic or Melamine Plastic Signs:

1. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. Emedco.
d. Marking Services, Inc

2. Engraved legend.
3. Thickness:

    a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
    b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
    c. Engraved legend with red letters on white face.
    d. Self-adhesive.
    e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.8 CABLE TIES

A. Manufacturer: Subject to compliance with requirements, provide a comparable product by one of the following:

1. Hellermann Tyton.
2. Ideal Industries, Inc.
3. Marking Services, Inc.
4. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.

4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

## 2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product

## 3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters.

K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box.

M. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

O. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

P. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

S. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

T. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

V. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

W. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

X. Metal Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using cable ties.

Y. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using cable ties.

Z. Write-on Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using cable ties.

AA. Baked-Enamel Signs:

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

BB. Metal-Backed Butyrate Signs:

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

CC. Laminated Acrylic or Melamine Plastic Signs:

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

DD. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

## 3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3-inch- high, black letters.

1. Locate identification at changes in direction, at penetrations of walls and floors, and at 30-foot maximum intervals.

D. Accessible Raceways, More Than 600 V: Identify with "DANGER' HIGH VOLTAGE" in black letters at least 2 inches high, with self' adhesive vinyl labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

E. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each Pull Box and Junction Box:

1. Label externally on the box cover with a permanent black marker. neatly print and legible when viewing from the ground or floor:
2. Identify feeder and branch circuit(s) within junction and pull boxes where those boxes are located within accessible or exposed ceiling spaces. Identify by source and circuit designation.
3. Identify control, instrumentation, alarm and communication junction boxes and pull boxes where those boxes are located within accessible or exposed ceiling spaces. Identify by system designation

F. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive vinyl tape to identify the phase, neutral and grounding conductor color. Apply Color-Coding Conductor Tape in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

G. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.

H. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, use self-adhesive labels with the conductor or cable designation, origin, and destination. For conductors and cables in manholes, and handholes, use nonmetallic preprinted tags indicating the conductor or cable designation, origin, and destination

I. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.

J. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

K. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation

L. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway 2 inch trade size and larger.

M. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces

N. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

O. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

1. Apply to exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

a. Transfer switches.
b. Controls with external control power connections.

P. Arc Flash Warning Labeling: Self-adhesive labels.

1. Apply to exterior of door, cover, or other access.
2. Labels: 4" by 6", machine printed, thermal transfer type of high adhesion polyester. Outdoor labels shall be suitable for a high-UV environment. Manually field, marked labels are prohibited.

Q. Operating Instruction Signs: Laminated acrylic or melamine plastic signs. Instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect.

R. Emergency Operating Instruction Signs: Laminated acrylic or melamine plastic signs. Instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer and load shedding.

S. Furnish a typewritten or machine printed label for each receptacle outlet located in unfinished interior spaces, interior physical plant spaces and other non-office related spaces. Offices, Conference Rooms, Copy Rooms, Mail Rooms, Breakrooms, Bathrooms and connecting corridors to those rooms do not require labels at the receptacle outlets. Labels shall indicate circuit number and panelboard. Locate along the bottom of the outlet cover plate. Labels shall be made of clear self-laminating vinyl with approximate 1/8-inch lettering, black color.

T. Wall Mounted Ground Reference Bus Bars: Identify field-installed grounding and bonding conductors at the termination point to the ground bus.

1. Install write-on Polyester tag. Identify conductor size and destination. For example: #4/0 to building steel.

U. Color for Raceway, Junction Box and Pull Box: Apply the following continuous painted identification to the systems listed below:

1. Fire Alarm System: Red.
2. Shunt Trip and Emergency Power Off Systems: Yellow.

V. Provide a separate one-line diagram in each of the electrical rooms depicting that building's electrical distribution system. Mount the diagram on the wall in a metal or wood frame under glass at a location for best convenience of viewing without interference with operation and maintenance of equipment. Diagram shall be 30" x 42". Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate the substrate

W. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations,

terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    c. Labels and Letters:

        1) Panelboards, Motor-Control Centers, Switchboards and Switchgear: Provide three lines of text with 1/2-inch-high letters. Label is to describe the panel designation, voltage and phase, and the power source. For example:

            Panel B
            208/120V, 3Ø, 4W
            Fed From Panel A

        2) All other enclosures/devices: Provide a single line of text with 1/2-inch-high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

    d. Panelboard Circuit Directories: Typed circuit schedules with explicit description and identification of items controlled by each individual breaker
    e. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    f. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

    a. Panelboards, Motor-Control Centers, Switchboards and Switchgear.
    b. Panelboard Circuit Directory: Install in the location provided by the panelboard manufacturer
    c. Enclosures and electrical cabinets.
    d. Access doors and panels for concealed electrical items.
    e. Switchgear Circuit Breakers. Identify by source designation.
    f. Switchboard Circuit Breakers. Identify by source designation.
    g. Transformers.
    h. Enclosed Controllers, Switches and Circuit Breakers.
    i. Variable-speed controllers.
    j. Contactors.
    k. Battery racks.
    l. Power-generating units.
    m. UPS equipment.

END OF SECTION 260519

# SECTION 262726 - WIRING DEVICES

## PART 1 – GENERAL

### 1.1 RELATED DOCUMENTS

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

B. Division 26 "Lighting Control Devices" for wall box dimmers and wall box occupancy sensors.

### 1.2 SUMMARY

A. Provide and install all equipment, labor, material, accessories and mounting hardware for a complete and operating system for the following:

1. Receptacles.
2. Switches.
3. Wall plates and covers.
4. Plugs.
5. Connectors.
6. Special devices, as noted
7. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies

### 1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

### 1.4 DEFINITIONS

A. AFCI: Arc-fault circuit interrupter.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

G. SPD: Surge protective device.

1.5 ACTION SUBMITTALS

A. Submit Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations. Submit product data on all types of wiring devices including plates and engraving

B. Samples: Upon request.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names:

1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
2. Leviton Mfg. Company Inc. (Leviton).
3. Pass & Seymour/Legrand (Pass & Seymour).

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with NEMA WD 1.

D. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

E. Corrosion resistant devices shall be as specified for normal usages, and fabricated of yellow color melamine plastic.

F. Device Color:

1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.
2. TVSS Devices: Blue.
3. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

G. Wall Plate Color: For plastic covers, match device color.

H. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

## 2.3 STRAIGHT-BLADE RECEPTACLES

A. General Description:

1. Duplex Convenience Receptacles. 125 V, 20 A
2. Comply with NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498, and FS W-C-596.
4. Hospital Grade Type: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
5. Isolated Ground Type: Grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts. Two pole, three wire, and self-grounding.
6. Tamper-Resistant Type: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles". Two pole, three wire, and self-grounding with integral shutters that operate only when a plug is inserted in the receptacle. Square face.

## 2.4 USB RECEPTACLES

A. USB Charging Receptacles:

1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
2. USB Receptacles: Dual, USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
3. Standards: Comply with UL 1310 and USB 3.0 devices.

B. Tamper-Resistant Duplex and USB Charging Receptacles:

1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle.
2. Line Voltage Receptacles: Two pole, three wire, and self-grounding; NEMA WD 6, Configuration 5-20R.
3. USB Receptacles: Dual USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
4. Standards: Comply with UL 498, UL 1310, USB 3.0 devices, and FS W-C-596.

5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article
6. Hospital Grade Type: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.

## 2.5 GFCI RECEPTACLES

A. General Description:

1. Duplex GFCI Receptacles, 125 V, 20 A
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
3. Comply with NEMA WD 6, Configuration 5-20R.
4. Type: Non-feed through.
5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
6. Hospital Grade Type: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.

## 2.6 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

A. Wiring Devices for Hazardous (Classified) Locations

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Cooper Crouse-Hinds.
   b. EGS/Appleton Electric.
   c. Killark; Division of Hubbell Inc.

2. Description: Pin and sleeve receptacle with matching connector.
3. Raintight.
4. Voltage and amperage as indicated on plans.
5. Standards: Comply with NEMA FB 11 and UL 1203.

## 2.7 TWIST-LOCKING RECEPTACLES

A. Special purpose receptacles for specific equipment shall conform to the requirements of NEMA Standard WD-1, WD 6 and UL 498 Wiring Devices, Specific Purpose, and shall be of the NEMA style number shown or manufacturer's number indicated. Provide a matching cap for each special purpose outlet supplied, each cap being equipped with a cord grip. Special purpose outlets shall be manufacturer's standard color.

## 2.8 TOGGLE SWITCHES

A. Comply with UL 20, and FS W-S-896.

B. Devices shall be Specification Grade as minimum, 120/277 V, 20 A:

C. Snap switches for general use shall be maintained contact types, and shall be single-pole, double-pole, three-way, or four-way as required for the specific switching arrangements shown on the drawings. They shall be quiet tumbler operation types, having silver alloy contacts, and meeting all NEMA performance standards. Color to match plates unless specifically noted otherwise in specifications and/or on drawings.

D. Switches shall be toggle or key-operated types, as indicated on the drawings. All key-operated switches shall be keyed alike.

## 2.9 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

D. Antimicrobial Cover Plates:

1. Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
2. Tarnish resistant

## 2.10 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular with satin finish.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable.

2.11 POKE-THROUGH ASSEMBLIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Wiremold/Legrand or comparable product.

B. Description:

1. Factory-fabricated and -wired assembly of below-floor junction box with multi-channeled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
2. Comply with UL 514 scrub water exclusion requirements.
3. Service-Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks or as otherwise indicated on the drawings
4. Fire Rating: Unit listed and labeled for fire rating of floor-ceiling assembly.
5. Closure Plug: Arranged to close unused cored openings and reestablish fire rating of floor.
6. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair Category 5e cables.

2.12 SHUNT TRIP STATION:

A. Provide complete station with hammer, backbox and face plate. Operator shall be beneath a glass disc. When the glass disc is broken with the hammer, the button becomes accessible to depress. Operator shall be provided with (1) NO and (1) NC contact unless otherwise indicated.

B. Unit shall be mounted as indicated on the drawings with the appropriate type of backbox, flush mount station in NEMA 1 box unless otherwise indicated.

C. Engrave faceplate as follows unless otherwise indicated on the drawings: "ELECTRIC DISCONNECT, BREAK GLASS, PUSH BUTTON."

D. Unit shall be Pilla Electrical Products or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
10. Devices and cover plates shall be securely installed, with cover plates in true vertical or horizontal alignment, as applicable. Plates shall properly contact surfaces to which attached.
11. Install products in accordance with manufacturer's instructions.
12. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
13. Electrical boxes shall be cleaned and completely free of any debris, dust, etc. prior to the installation of wiring devices.

14. To minimize sound transmission through walls, back to back receptacles shall be installed at an offset of at least 6 inches. Back-to-back outlets are prohibited.
15. All receptacles and switches shall be grounded by means of a ground wire from device ground screw to outlet box screw and branch circuit ground conductor. Strap alone will not constitute an acceptable ground.
16. All devices shall be installed so that only one wire is connected to each terminal. At each receptacle "in" and "out" phase and neutral conductors shall have an additional conductor for connection to device. The practice of "looping" conductors through receptacle boxes shall not be acceptable.
17. Install local room area wall switches at door locations on the lock side of the door, approximately four inches from the jamb. Where locations shown on the drawings are in question, provide written request for information to A/E prior to rough-in.
18. GFCI receptacles shall be provided in, Toilet Rooms, Kitchen, near sinks, outdoors and wet/damp areas and as required by local codes.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

A. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical. Group adjacent switches under single, multigang wall plates.

B. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings.

## 3.3 IDENTIFICATION

A. Comply with Section 260553 "Electrical Identification."

## 3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight-blade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 262726

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# SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Shunt trip switches.
4. Molded-case circuit breakers (MCCBs).
5. Molded-case switches.
6. Enclosures.

### 1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

## 1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and 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 the certification is based and their installation requirements.

## 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01782 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

## 1.7 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. Fuses: No fewer than three of each size and type.
2. Fuse Pullers: One for each size and type.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

## 2.2 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with NFPA 70.

## 2.3 FUSIBLE SWITCHES

A. Manufacturers: The manufacturer of fusible switches shall be the same as that of the panelboards utilized on the project.

B. Type HD, Heavy Duty, Single Throw, 250 VAC or 600 VAC as required by the circuit to which it is connected, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit (where indicated): Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.
5. See drawings for other accessories required.

## 2.4 NONFUSIBLE SWITCHES

A. Manufacturers: The manufacturer of nonfusible switches shall be the same as that of the panelboards utilized on the project.

B. Type HD, Heavy Duty, Single Throw, 250 VAC or 600 VAC as required by the circuit to which it is connected, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit (where indicated): Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Mechanical type, suitable for number, size, and conductor material.
4. See drawings for other accessories required.

## 2.5 MOLDED-CASE CIRCUIT BREAKERS

A. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

B. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

C. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated**.**

D. MCCBs shall be equipped with a device for locking in the isolated position.

E. Lugs shall be suitable for 167 deg F (75 deg C) rated wire.

F. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

G. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

H. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

I. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I-squared t response.

J. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

K. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

L. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

M. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

N. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. See drawings for other accessories required.

O. Circuit breakers feeding transformers and panelboard main circuit breakers being fed by a transformer shall be equipped with adjustable instantaneous trip time for frame sizes 100 A and larger

## 2.6 MOLDED-CASE SWITCHES

A. Manufacturers: The manufacturer of molded case switches with enclosures shall be the same as that of the panelboards utilized on the project.

B. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

C. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

D. Features and Accessories:

1. Standard frame sizes and number of poles.
2. Lugs:
    a. Mechanical type, suitable for number, size, trip ratings, and conductor material.
    b. Lugs shall be suitable for 167 deg F (75 deg C) rated wire.
3. See drawings for other accessories required

2.7 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be:

1. NEMA 250 Type 1: Gray baked enamel paint, electrodeposited on cleaned, phosphatized steel.
2. NEMA 250 Type 3R and 12: Gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel.
3. NEMA 250 Type 4-4X stainless steel: Brush finish on Type 304 stainless steel.
4. NEMA 250 Types 7 and 9: Copper-free cast aluminum alloy.

C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.

D. Operating Mechanism: The circuit-breaker operating handle shall be:

1. NEMA 250 Type 1: Directly operable through the front cover of the enclosure
2. NEMA 250 Type 3R: Directly operable through the dead front trim of the enclosure.
3. NEMA 250 Types 7, 9: Externally operable with the operating mechanism being an integral part of the cover.

The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

## 3.2 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

## 3.3 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses in fusible devices.

F. Comply with NFPA 70 and NECA 1.

G. Switches shall be mounted in accessible locations chosen where the passageway to the switch is not likely to become obstructed. Where a switch serves as the disconnecting means for a load, the switch shall be located as close as practical to the load with the switch handle within sight of the load.

H. Disconnect switches shall not be mounted on equipment, unless specifically noted or required and meet all applicable codes, etc. If switches are noted or required to be mounted on equipment they shall have vibrator clips on fuses and be connected to conduit system with liquid tight flexible conduit.

I. Exterior switches shall be mounted on supports to prevent trapping of moisture.

3.4 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

END OF SECTION 262816

# SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. UTP cabling.
2. GAMECHANGER UTP cabling
3. Cable connecting hardware, patch panels, and cross-connects.
4. Telecommunications outlet/connectors.
5. Identification products.

B. Related Requirements:

1. Section 27 05 28 “Pathways for Communications Systems.”

### 1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. CATV: Community antenna television (or cable television).

C. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

D. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

E. EMI: Electromagnetic interference.

F. IDC: Insulation displacement connector.

G. LAN: Local area network.

H. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.

I. NRTL: Nationally Recognized Testing Laboratory.

J. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

K. RCDD: Registered Communications Distribution Designer.

L. TDMM: Telecommunications Distribution Methods Manual.

M. UTP: Unshielded twisted pair.

## 1.4 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.

## 1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

## 1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector. Comply with Section 01 40 00 "Quality Requirements."

B. Source quality-control reports.

C. Field quality-control reports.

## 1.7 CLOSEOUT SUBMITTALS

A. General: Submit project closeout submittals within 30 days of Substantial Completion.

B. Maintenance Data: For splices and connectors to include in maintenance manuals.

## 1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.

B. Testing Agency Qualifications:

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing. Comply with Section 01 40 00 "Quality Requirements."

## 1.9 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site in accordance with BICSI ITSIM.

1. Test each pair of UTP cable for open and short circuits.

# PART 2 - PRODUCTS

## 2.1 SYSTEM COMPONENTS

A. Comply with Section 01 60 00 "Product Requirements."

## 2.2 HORIZONTAL CABLING DESCRIPTION

A. General: 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. Work Area: A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. Distance Limitations: The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

D. Station Cabling: Station cabling between communications rooms and outlets shall be 4-pair, plenum rated and conform to ANSI/TIA-568.2-D Category 6 requirements. For each data drop terminated, provide one (1) 6-feet and one (1) 15-feet long Category 6 connector cables. Outer jackets shall be:

1. Audiovisual - Pink
2. BMS/Control - White
3. Data - Blue
4. Fire Alarm - Red
5. Security - Gray
6. Voice/PA - Black
7. WIFI - Yellow
8. UPS – Orange

## 2.3 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. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. 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.

D. Grounding: Comply with ANSI/TIA-607-E.

## 2.4 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by the following (or approved equal):

1. ADC.
2. Belden Inc.
3. Berk-Tek; a Nexans company.
4. CommScope, Inc.
5. Draka Cableteq USA.
6. Panduit.
7. Siemon.
8. Superior Essex Inc.

B. Description: 100-ohm, four-pair UTP, Category 6, covered with a blue thermoplastic jacket for data and voice.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with ANSI/TIA-568.1-E for performance specifications.
3. Comply with ANSI/TIA-568.2-D for Category 6.
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.

## 2.5 GAMECHANGER UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by the following (or approved equal) where specifically indicated on Drawings:

1. Paige Datacom Solutions.

B. Description: four-pair UTP, indoor/outdoor plenum-rated Category 6, covered with a blue thermoplastic jacket for video.

1. Cable shall deliver 2.5Gbps and 100W PoE at up to 656 feet (200m) or 10Mbps and 100W PoE at up to 850 feet (259m).
2. Comply with ANSI/TIA-568.2-D for Category 6.
3. Cables shall have 22 AWG solid bare copper conductors. Follow manufacturer's guidelines for terminating cable, provide all jacks or patch panels required for Cat6 connectivity. If using a RJ45 connector, refer to manufacturer's termination guide.

## 2.6 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by the following (or approved equal):

1. ADC.
2. American Technology Systems Industries, Inc.
3. Belden Inc.
4. Dynacom Inc.
5. Hubbell Premise Wiring.
6. Leviton Commercial Networks Division.
7. Molex Premise Networks; a division of Molex, Inc.
8. Panduit Corp.
9. Siemon Co. (The).

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. Connecting Blocks: 110-style IDC for Category 6. 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.

1. Number of Terminals per Field: One for each conductor in assigned 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.

1. Number of Jacks per Field: One for each four-pair UTP cable indicated.

F. Jacks and Jack Assemblies: Modular, color-coded (blue for data and voice), eight-position modular receptacle units with integral IDC-type terminals with ANSI/TIA-T568B wiring.

G. Patch Cords: Provide one (1) factory-made, 4-pair cable in 48-inch (1200-mm) or 144-inch (3650-mm) lengths as necessary; terminated with eight-position modular plug at each end, for each termination in the communications rooms.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

## 2.7 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector comply with ANSI/TIA-568.2-D.

B. Workstation Outlets: Quantity of port-connector assemblies mounted in single or multigang faceplate as shown on the Drawings.

1. Plastic Faceplate: High-impact plastic. Coordinate color with Section 26 27 26 "Wiring Devices."
2. For use with snap-in jacks accommodating any combination of UTP, and work area cords.

a. Flush mounting jacks.

3. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

## 2.8 GROUNDING

A. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with ANSI/TIA-607-E.

## 2.9 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by the following (or approved equal):

1. Brady Worldwide, Inc.
2. HellermannTyton North America.
3. Kroy LLC.
4. Panduit Corp.

B. Comply with ANSI/TIA-606-D and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## 2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP cables according to ANSI/TIA-568.2-D.

C. Cable will be considered defective if it does not pass tests and inspections. Comply with Section 01 40 00 "Quality Requirements" for retesting and re-inspecting requirements.

D. Prepare test and inspection reports and submit for approval.

# PART 3 - EXECUTION

## 3.1 ENTRANCE FACILITIES

A. Coordinate cabling with the protectors and demarcation point provided by communications service provider.

## 3.2 WIRING METHODS

A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters. Conceal pathways and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements in Section 27 05 28 "Pathways for Communications Systems."

B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. 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.

## 3.3 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, Ch. 6, "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 (15 m) 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 (760 mm) and not more than 6 inches (150 mm) 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 de-reeling. Heat lamps shall not be used for heating.
11. In the communications equipment room, install a 10-foot (3-m) long service loop on each end of horizontal cable.
12. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "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 (12 mm) 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 (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. 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 (127 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).

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 (64 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

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 (76 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

## 3.4 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI/TIA-607-E.

C. Locate grounding busbar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding busbar. Connect grounding busbar with a minimum No. 4 AWG grounding electrode conductor from grounding busbar to suitable electrical building ground.

D. Bond metallic equipment to the grounding busbar, using not smaller than No. 6 AWG equipment grounding conductor.

## 3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with ANSI/TIA-606-D.

1. Administration Class: 3.
2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Paint and label colors for equipment identification shall comply with ANSI/TIA-606-D for Class 3 level of administration.

C. 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.

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. Follow convention of ANSI/TIA-606-D. Furnish electronic record of all drawings, in software and format selected by Owner.

E. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) 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. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
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 shall be identified 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 as identified herein.

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-D.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

## 3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. Visually inspect UTP 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 6 marking of outlets, cover plates, 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. 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-568.2-D. 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.

5. UTP Performance Tests: Test for each outlet. Perform the following tests according to ANSI/TIA-568.1-E and ANSI/TIA-568.2-D:

    a. Wire map.
    b. Length (physical vs. electrical, and length requirements).
    c. Insertion loss.
    d. Near-end crosstalk (NEXT) loss.
    e. Power sum near-end crosstalk (PSNEXT) loss.
    f. Equal-level far-end crosstalk (ELFEXT).
    g. Power sum equal-level far-end crosstalk (PSELFEXT).
    h. Alien crosstalk.
    i. Return loss.
    j. Propagation delay.
    k. Delay skew.

6. Final Verification Tests: Perform verification tests for UTP and coaxial cable systems after the complete communications cabling and workstation outlet/connectors are installed.

a. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections. Refer to Section 01 40 00 "Quality Requirements" for retesting and re-inspecting requirements.

F. Prepare test and inspection reports and submit for approval.

END OF SECTION 271500

# SECTION 270010 – SUPPLEMENTAL REQUIREMENTS FOR COMMUNICATIONS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This section includes common work results for the following systems:

1. Structured cabling for data
2. Grounding and bonding
3. Cable pathways
4. Cable management
5. Outfitting of communication equipment rooms.

### 1.2 RELATED WORK SPECIFIED UNDER OTHER DIVISIONS

A. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting.
B. Flashing of conduits into roofing and outside walls.
C. Electrical service to equipment rooms.
D. Cutting and patching for low voltage systems work, except for errors and omissions under this division.

### 1.3 RELATED WORK - OWNER FURNISHED EQUIPMENT AND SYSTEMS

A. Data network electronics.
B. Computer workstations, and other peripherals.

### 1.4 DEFINITIONS AND TERMS

A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this section:

1. ANSI American National Standards Institute
2. ASTM American Society For Testing Materials
3. BICSI Building Industry Consulting Service International
4. Designer Firm acquired by the owner to design the Division 27 communications systems (synonymous with consultant and design engineer).
5. FCC Federal Communications Commission
6. FM Factory Mutual
7. NEC National Electrical Code
8. NECA National Electrical Contractors Association
9. NEMA National Electric Manufacturers Association
10. NESC National Electrical Safety Code
11. NFPA National Fire Protection Association
12. OSHA Occupational Safety And Health Administration
13. RCDD Registered Communications Distribution Designer
14. TDMM Telecommunications Distribution Methods Manual
15. TIA Telecommunications Industries Association

16. TR Telecommunications Room
17. UL Underwriters Laboratories
18. UTP Unshielded Twisted Pair

1.5 QUALITY ASSURANCE

A. Contractor experience: the contractor or approved sub-contractor shall be a certified cable installer, with the capability of providing a manufacturer's certification of not less than fifteen (15) years for the horizontal and backbone cabling and associated termination equipment. The contractor shall offer proof of certification by submitting a copy of the certification with the bid.

B. The contractor shall have at least one (1) registered communications distribution designer (RCDD) on staff. The contractor shall offer proof of RCDD certification by submitting a copy of the certification with the bid. The contractors RCDD shall be part of the contractors team throughout the project to assist with shop drawings and other related technical issues.

C. All personnel performing the work of this section shall be thoroughly familiar with the cabling methods outlined in the latest release of the BICSI TDMM (building industry consulting services international telecommunications distribution methods manuals).

D. The contractor's RCDD shall review all required work before commencing. The contractor's RCDD shall oversee the installation and will have the end responsibility for the quality of the installation work performed. All submitted designs and or changes to the design shall be approved and signed off by the contractor's RCDD.

E. Installation and testing crews shall have completed all appropriate training in copper and fiber cabling installation as required by the manufacturer.

F. The contractor shall provide all new UTP cable, optical fiber cable, innerduct, racks, cabinets, patch panels, cover plates, outlet boxes, related hardware, distribution, termination equipment, and any other appurtenances and equipment associated with this project.

G. The contractor shall be responsible for the proper placement of all cabling, racks, cabinets, patch panels, cover plates, outlet boxes, and related hardware, as well as all distribution, and termination equipment.

H. The contractor shall obtain the approval of the design consultant for the final layout of telecommunications rooms (trs) and tenant wiring closets prior to the installation of any materials or equipment. Shop drawings showing proposed room layouts shall be submitted for approval before beginning installation.

I. The contractor shall be responsible to the owner for the acts and omissions of its employees, subcontractors and their agents and employees, and other persons performing any of the work under a contract with the contractor.

J. The contractor shall have an experienced project manager on-site at all times when work is in progress on any project. The individual who represents the contractor shall be the single point of contact between the contractor and the owner, and shall be responsible for the entire project. This representative shall be able to communicate with the owner or designated representative whenever requested throughout the life of the project.

K. The installed cabling systems shall not generate nor be susceptible to any harmful electromagnetic emission, radiation, or induction that degrades cabling systems.

L. Expansion capability: unless otherwise indicated, provide spare positions in-wall fields, cross-connects, and terminal strips, and space in cable pathways to accommodate fifty (50) percent future growth in campus distribution and riser.

M. Backward compatibility: the provided solution shall be backward compatible with lower category ratings such that if higher category components are used with lower category

components, the permanent link and channel measures shall meet or exceed the lower channel's specified parameters.

N. Component compliance: the provided solution's components shall each meet the minimum transmission specifications listed herein such that no individual component will be less than specifications for permanent and channel, regardless of the fact that tests for permanent and channel ultimately meet required specifications.

O. Pre-installation inspection: visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport.

P. Test optical fiber cable while on reels. Use an optical time-domain reflectometer (otdr) to verify the cable length and locate cable defects, splices, and connectors, including the loss value of each.

Q. Test each pair of UTP cable for open and short circuits. Test results to be submitted to the owner.

R. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the owner.

1.6 STANDARDS

A. The contractor's performance of the work shall comply with applicable federal, state, and local laws, rules, and regulations. The contractor shall give required notices, shall procure necessary governmental licenses, permits, and inspections and shall pay without burden to the owner, all fees and charges in connection therewith unless specifically provided otherwise. In the event of a violation, the contractor shall pay all fines and penalties, including attorney's fees and other defense costs and expenses in connection therewith.

B. Federal communications commission

1. Equipment requiring FCC registration or approval shall have received such approval and shall be appropriately identified.

C. CODES, STANDARDS, AND ORDINANCES

1. Design, manufacture, test, and install telecommunications cabling networks per manufacturer's requirements and in accordance with state codes, local codes, requirements of authorities having jurisdiction, and particularly the following standards:

a. NECA 1 – Standard For Good Workmanship In Electrical Construction, 2015

b. ANSI/TIA Standards:

1) ANSI/TIA-568.0-E – Generic Telecommunications Cabling for Customer Premises, 2020
2) ANSI/TIA-568.1-E – Commercial Building Telecommunications Infrastructure Standard, 2020
3) ANSI/TIA-568.2-D – Balanced Twisted Pair Telecommunications Cabling And Components Standard, 2018
4) ANSI/TIA-568.3-E – Optical Fiber Cabling and Components Standard, 2022
5) ANSI/TIA-568.4-E - Broadband Coaxial Cabling and Components Standard, 2022

6) ANSI/TIA-569-E – Telecommunications Pathways and Spaces, 2019
7) ANSI/TIA-606-D – Administration Standard for Telecommunications Infrastructure, 2017
8) ANSI/TIA-607-E – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, 2015
9) ANSI C80.1 Rigid Steel Conduit, Zinc-Coated
10) ANSI C80-3 Electrical Metallic Tubing, Zinc-Coated

c. NFPA-70 – National Electrical Code
d. Install cabling in accordance with the most recent edition of BICSi® publications:

1) BICSI – Telecommunications Distribution Methods Manual, 14th EDITION
2) BICSI – Information Technology Systems Installation Methods Manual, 7th Edition

e. NEMA 250 Enclosures for Electrical Equipment (1000 V Maximum)
f. NEMA-VE-1 – Metal Cable Tray Systems, 2009
g. NEMA-VE-2 – Metal Cable Tray Installation Guidelines, 2006
h. FCC 47 Part 68 Code of Federal Regulations, Title 47, Telecommunications
i. IEEE National Electrical Safety Code (NESC); 2007
j. ISO/IEC 11801 Information Technology - Generic Cabling for Customer Premises
k. UL 1459 Underwriters Laboratories Standard for Safety – Telephone Equipment
l. UL 1863 Underwriters Laboratories Standard for Safety – Communications Circuit Accessories
m. ASTM E. 814 – Standard Test Method For Fire Tests Of Penetration Firestop Systems
n. American Society For Testing And Materials (ASTM): ASTM E. 814 – Standard Test Method For Fire Tests Of Penetration Firestop Systems
o. Underwriters Laboratories, Inc. (UL): UL 1479 – Tests Of Through-Penetration Firestop Systems
p. Americans With Disabilities Accessibility Guidelines, 2010.
q. Code of Federal Regulations, Title 29, Chapter XVII, Part 1910 (OSHA).
r. International Building Code (IBC).
s. Applicable codes and directives of authorities having jurisdiction.

1) References to codes and standards called for in the specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these specifications.

D. Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully part of the specifications as if herein repeated or hereto attached. If the contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the owner's representative in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.

1.7 PRE-INSTALLATION CONFERENCE

A. Arrange and schedule a pre-installation conference prior to beginning any work of this section.
B. Agenda: clarify questions in writing related to work to be performed, scheduling, coordination, etc. With the consultant and/or project manager/owner representative.
C. All individuals, who will be in an on-site supervisory capacity, shall be required to attend the pre-installation conference. This includes project managers, site supervisors and lead installers. Individuals who do not attend the conference will not be permitted to supervise the personnel that install, terminate, or test communications cables on the project. The contractor's RCDD that will oversee the installation is required to attend the pre-installation conference.
D. The manufacturer that will be providing the extended warranty is required to have a representative attend the pre-installation conference.

1.8 SEQUENCE AND SCHEDULING

A. The contractor shall comply with all scheduling requests established by the owner, both prior to commencing work, and during construction. The contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and if accepted will be used to track work status.
B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
C. The successful contractor for all or any portion of the work will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.
D. Submit schedule for installation of equipment and cabling. Indicate delivery, installation, and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for bid award, installation start date, completion of station cabling, completion of riser cabling, completion of testing and labeling, cutover, completion of the final punch list, the start of demolition, owner acceptance, and demolition completion.

1.9 SUBMITTALS

A. Comply with provisions of Division 01.
B. Before any work commences, submit the following items for approval by the designer and owner:

1. Detailed bill-of-materials listing all manufacturers, part numbers, and quantities that the contractor proposes to use in this project
2. Letter of approval or other certification from the manufacturer indicating the contractor is a manufacturer certified installer of the proposed cabling system(s) (submit with a list of materials).
3. Manufacturer datasheets for proposed products to be used on this project.
4. Manufacturer instructions for storage, handling, protection, examination, preparation, operation, and installation of all products. Include any application conditions or limitations of use stipulated by any product testing agency.
5. All applicable material safety data sheets.
6. All factory test information of cables prior to installation of the product.
7. All proposed labeling materials and nomenclature for approval.

8. Shop drawings for other Division 27 sections.
9. Shop drawings:

    a. Indicate locations where space is limited for installation and access.
    b. Submit floor plans, elevations, and details indicating major equipment and end device locations of equipment to be provided by this contractor to interface to new and existing systems.

1.10 ALTERNATES, SUBSTITUTIONS AND CHANGE ORDERS

A. If a proposed alternate material is equal to or exceeds specified requirements, the contractor shall provide the manufacturer's specifications in writing for written approval prior to the purchase and installation of proposed materials. The proposed material substitution shall not void or change the manufacturer's warranty.
B. Under no circumstances shall the owner be required to prove that an item proposed for substitution is not equal to the specified item. It shall be mandatory that the contractor submits to designer all evidence to support the contention that the item proposed for substitution is equal to the specified item. The owner's decision as to the equality of substitution shall be final and without further recourse.
C. In the event that the design consultant is required to provide additional design services as a result of a substitution of equivalent materials or equipment by the contractor, or changes by the contractor in dimension, weight, power requirements, etc., of the equipment and accessories, furnished, or if the design consultant is required to examine and evaluate any changes proposed by the contractor for the convenience of the contractor, then the design consultant's expenses in connection with such additional services shall be paid by the contractor and may be deducted from any moneys owed to the contractor.
D. The contractor shall provide complete cabling infrastructure according to these written specifications and drawings. If the owner changes the scope of work to be performed by the contractor, it shall be in writing. The contractor shall respond to these changes with a complete material list, labor, and taxes in writing presented to the owner for approval. The contractor shall not proceed with additional scope of work without a signed approval by the owner.
E. Additional work performed by the contractor will not be paid by owner without signed approval of these changes prior to implementing changes. Submit a copy of signed change order upon billing.

1.11 USE OF THE SITE

A. Use of the site shall be at the owner's direction in matters in which the owner deems it necessary to place restrictions.
B. Access to building wherein the work is performed shall be as directed by the owner.
C. The owner will occupy the premises during the entire period of construction for conducting his or her normal business operations. Cooperate with the owner to minimize conflict and to facilitate the owner's operations.
D. Schedule necessary shutdowns of plant services with the owner and obtain written permission from the owner. Refer to article - continuity of services herein.
E. Proceed with the work without interfering with ordinary use of streets, aisles, passages, exits, and operations of the owner.
F. All contractor personnel must check in with the facilities engineering department and/or the general contractor upon arrival and upon departure.

G. The contractor shall furnish an adequate supply of technicians and materials at all times, and shall perform the work in the most appropriate, expeditious, and economical manner consistent with the interests of the owner.
H. The contractor shall not unreasonably encumber the site with any material or equipment. Operations shall be confined to areas permitted by law, permits, and contract documents.
I. While working at the facility, the contractor shall not block any entrances, egresses, or other passageways that are necessary for normal, safe operation. It should be noted that the contractor is responsible to provide any lifts, hand trucks, etc. That it will need to transport its materials and equipment throughout the site.
J. The contractor shall protect all buildings, walls, floors, and property from damage resulting from the installation. Any and all damage to property shall be repaired by the contractor at its expense. If the contractor enters an area that has damage (not caused by the contractor), the contractor shall immediately bring this to the attention of the owner's representative so the area can be appropriately noted.
K. Following each day's work, the contractor shall clean up the areas in which it has been working and dump all trash in the appropriate designated areas.

1.12 DELIVERY AND STORAGE

A. Insofar as possible, deliver items in manufacturers' original unopened packaging. Where this is not practical, cover items with protective materials, to keep them from being damaged. Use care in loading, transporting, unloading, and storage to keep items from being damaged.
B. Store items in a clean dry place and protect from damage.
C. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the owner.
D. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
E. Provide protective covering during construction to prevent damage or entrance of foreign matter.
F. Contractor is responsible for on-site security of tools, test equipment and materials.
G. Replace at no expense to owner, product damaged during storage, handling or the course of construction.

1.13 CONTRACTOR CLOSE OUT SUBMITTALS

A. Submit closeout documentation in accordance with Division 1 of the project manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 1 of the project manual, or a minimum of five (5) sets. Submit closeout documentation within 30 days after substantial completion.

1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
2. Test reports on all copper and optical fiber cables (electronic file format and hard copy).
3. As-built cable schedules with recorded cable routing and lengths of each designated run.
4. As built documentation of all cabling systems.
5. As built documentation of TR modifications and associated cabinet elevations.

B. Warranty and maintenance:

1. Test report binder(s).
2. Record drawings.

1.14 RECORD DRAWINGS

A. Keep a hard copy set of project drawings at the job site exclusively for recording deviations from the construction drawings.
B. Project record documents required include:

1. Marked-up copies of contract drawings.

a. Record locations and depths of buried and concealed conduits from fixed, easily identifiable objects, such as building walls. Where conduits are concealed in walls, indicate distances off of building corners or other building features not likely to be disturbed by future alterations.
b. Mark deviations in a different color so that work of various systems can be easily identified.

2. Newly prepared drawings.
3. Marked-up copies of specifications, addenda and change orders.
4. Marked-up project data submittals.
5. Record samples.
6. Field records for variable and concealed conditions.
7. Record information on work that is recorded only schematically.
8. As-built drawings.

C. Post changes and modifications to the documents as they occur. Drawings will be updated electronically and submitted to the owner in accordance with the schedule provided for this by the owner. Do not wait until the end of the project. Design consultant will periodically review project record documents to assure compliance with this requirement.
D. At completion of as-built drawings, submit project record documents to design consultant for the owner’s records.

1. Upon completion of the as built drawings, the design consultant will review the as built work with the contractor.
2. If the as built work is not complete, the contractor will be so advised and shall complete the work as required.

E. Submit a complete test plan (and subsequent test data) per ANSI/TIA-568 for all cabling.

1. Submit (1) hardbound copies of all cable test results and one electronic compact disc.
2. Submit calibration reports for all test equipment, the calibration shall be performed by a manufacturer certified calibration facility and be dated no more than sixty (60) days prior to the start of testing.

1.15 WARRANTY

A. Materials shall meet or exceed industry standards and be fully guaranteed for a minimum of fifteen (15) years from final acceptance. Cable integrity and associated terminations shall be thoroughly inspected, fully tested and guaranteed as free from defects, transpositions, opens, shorts, tight kinks, damaged jacket insulation, etc.

1. All labor must be thoroughly competent and skilled, and all work shall be executed in strict accordance with the best practice of the trades.
2. The contractor shall be responsible for and make good, without expense to the owner, any and all defects arising during this warranty period that are due to imperfect materials, appliances, improper installation or poor workmanship.

B. The contractor shall submit a copy of all manufacturer warranty information.

C. The structured cabling system manufacturer of the cable products to be submitted shall provide a minimum fifteen (15) year extended product warranty and application assurance (system performance warranty). The warranty shall provide the following:

1. Ensure against all product defects.
2. Ensure that all copper and fiber approved cabling and components meet or exceed the specifications of ANSI/TIA-568 and ISO/IEC is 11801.
3. Ensure that the installation of copper and fiber components will meet or exceed the loss and bandwidth requirements of ANSI/TIA-568 and ISO/IEC is 11801 for a fifteen-year period.
4. Cover the repair or replacement of defective products, and the labor for repair or replacement of such defective products.
5. Application assurance that shall cover the failure of the cabling system to support the application which it was designed to support, as well as additional applications introduced in the future by recognized standards or user forums that use the ANSI/TIA-568 or ISO/IEC is 11801 component and link/channel specifications.

D. Contractor shall guarantee their laborfor a minimum of one (1) year after final acceptance by the owner.

## PART 2 - PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

A. All materials and equipment used in carrying out these specifications are to be new, using latest technology, and have a ul or fm listing, or a listing by other recognized testing laboratory when such listings are available.

1. This listing requirement applies to the entire assembly.
2. Application and installation of all equipment and materials shall be in accordance with such labeling and listing. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.

B. Equipment shall meet all applicable FCC regulations.

C. Model numbers and manufacturers included in this specification are listed to establish as standard of product quality.

D. The listing of a manufacturer as “acceptable” does not indicate acceptance of a standard or catalogued item of equipment. All equipment and systems must conform to the specifications.

E. Other qualified manufacturers may be substituted only with the owner’s written consent. To request a substitution, the contractor shall submit complete technical data, samples, and if requested, results of independent testing laboratory tests of proposed equipment.

1. If proposed system includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review.
2. Material not specifically identified within this document, but which is required for the successful implementation of the intended system(s), shall be of the same class and quality as the specified material and equipment.
3. Include a list of previously installed projects using proposed equipment that are similar in nature to specified system.

F. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for the final assembled unit.

1. All components of an assembled unit need not be products of the same manufacturer.
2. Constituent parts, which are alike, shall be from a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for intended service.
4. The contractor shall guarantee for a minimum of fifteen (15) years, the performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

G. Components of equipment shall bear the manufacturer's name or trademark, model number and serial number on a nameplate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

H. Major items of equipment that serve the same function must be the same make and model.

I. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that a complete and fully operational system will result.

J. Maximum standardization of components shall be provided to reduce spare part requirements.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. System installation and construction methods shall conform to the owner’s requirements, requirements of the state of texas and all applicable building codes.

B. Before construction work commences, the contractor shall visit the site and identify the exact routing for all horizontal and backbone pathways.

C. The maximum allowable category 6 UTP cable distance (as measured by electronic UTP test equipment) between the wall outlet and the serving port on the ethernet switch in the serving TR is 90 meters. Planned horizontal cable conduit runs that will result in a cable run that exceeds 90 meters shall be pointed out to designer before they are installed for appropriate redesign or waiver.

D. All work shall be concealed above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, designer shall be notified before starting that part of the work. In areas with no ceilings, install only after design consultant reviews and comments on arrangement and appearance.

E. Provide easy, safe, and code mandated clearances at equipment racks and enclosures, and other equipment requiring maintenance and operation. All TR cabinets and racks shall

be mounted a minimum of 36-inches from the wall, any wall mounted equipment, other cabinets, equipment, or power panels (or per nec for voltages exceeding 120VAC).

F. Where required, the contractor shall be responsible for cutting, patching, coring, and associated work for the complete cabling system at no additional cost to the owner. Cut and drill from both sides of walls to eliminate splaying. Patch adjacent existing work disturbed by installation of new work. Cut openings in prefabricated construction units in accordance with manufacturer's instructions.

G. All conduit and sleeve openings used by the contractor shall be waterproofed or fireproofed in compliance with state and local building and fire codes.

H. The contractor shall patch all openings remaining around and inside all conduit, sleeves, and cable penetrations to maintain the integrity of any fire rated wall, ceiling, floor, etc. The firestop system shall consist of a dielectric, water resistant, non-hardening, permanently pliable/re- enterable putty along with the appropriate damming materials (where required). The sealant must be capable of being removed and reinstalled, must adhere to all penetrants and common construction materials, and shall be capable of allowing normal wire/cable movement without being displaced.

I. All building conduits and sleeves installed and/or used under these specifications shall be firestopped, or re-firestopped, upon cable placement through such passageways.

J. The contractor shall seal all foundation penetrating conduits and all service entrance conduits and sleeves to eliminate the intrusion of moisture and gases into the building. This requirement also includes spare conduits designated for telecommunications use.

1. Spare conduits shall be plugged with expandable plugs.
2. All service entrance conduits through building shall be sealed or resealed upon cable placement.

## 3.2 INSPECTION

A. The contractor shall perform a detailed inspection of the site prior to submitting any technical data for approval.

B. The contractor shall verify that the proposed equipment and methods of installation are compatible with the existing conditions and prepare a corresponding written report of their findings.

C. The owner shall be notified in writing if modifications of the existing building are required in order to accommodate the new equipment. These modifications shall be made only upon receiving written approval from the owner.

D. Submit installation drawings for review and approval.

## 3.3 COORDINATION

A. Insofar as it is possible to determine in advance, advise the general contractor to leave proper chases and openings. Place all outlets, anchors, sleeves, and supports prior to pouring concrete or installation of masonry work. Should the contractor neglect doing this, any cutting and/or patching required is to be done at this contractor’s expense. Visit the site and be informed of conditions under which work must be performed. No subsequent allowance will be made because of error or failure to obtain the necessary information to completely estimate and perform the work involved.

B. Carefully coordinate with other divisions to ensure proper power requirements, grounding, fireproofing, and interlocking controls between the fire alarm system, security system, and other owner-furnished systems. Coordinate with all the telecommunications, mechanical, and electrical drawings. Verify with the design consultant the exact location and mounting

height of all equipment in finished areas, such as equipment racks and telecommunications devices.

C. Where more than one trade is involved in an area, space, or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. There will be no priority schedule for trades. If, after installation of any equipment, piping, ducts, conduit, and boxes, it is determined that ample maintenance and passage space has not been provided, rearrange work, and/or furnish other equipment as required for ample maintenance space. Any changes in the size or location of the material or equipment supplied or proposed that may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of the designer and approval received before such alterations are made.

D. Notify other tradesmen of any deviations or special conditions necessary for the installation of work. Interferences between works of various contractors to be resolved prior to installation. Work installed not in compliance with specifications and drawings and without properly checking and coordinating as specified above shall, if necessary, be removed and properly reinstalled without additional cost to the owner.

E. The owner or the owner’s representative shall be the mediating authority in all deviation and disputes arising on the project.

F. Coordinate with local telephone and cable service providers to assure that proper points of service, demarcation location and grounding requirements are in accordance with contract drawings. Duct bank is to be provided by Division 26 and/or civil. This contractor shall be involved regarding discussions about services to the building.

1. Coordinate with other trades to provide wall and ceiling access panels wherever required for access to communication equipment.

G. Intent:

1. These sections of specifications and drawings form a complete set of documents for communications systems for this project. Neither is complete without the other. Any item mentioned in one shall be as binding as though mentioned in both.
2. The intent of these specifications and drawings is to form a guide for a complete systems installation. Where an item is reasonably necessary for a complete system but not specifically mentioned, such as pull boxes, fittings, expansion fittings, support hangers, etc. Provide same without additional cost to owner.
3. Communication equipment room layouts indicated on drawings are diagrammatical only. Exact location of outlets and equipment to be coordinated and governed by project conditions. The designer reserves the right to make any reasonable changes (approximately 6 feet) in location of junction boxes, or equipment prior to roughing in of such without additional cost to owner.

H. DEVIATIONS:

1. No deviations from specifications and drawings to be made without full knowledge and consent of designer.
2. Should the contractor find during progress of work that existing conditions make desirable a modification of the requirements of any particular item, report such item promptly to designer for their decision and instructions.

I. MAIN HORIZONTAL PATHWAY/RACEWAY

1. Unless otherwise noted on the drawings, all communications/low voltage systems cabling shall be routed above accessible corridor ceilings parallel to room walls and corridors via cable tray or j-hook supports. Cabling shall be segregated by function as follows:

    a. Voice/data cabling.
    b. All other systems.

3.4 CONTINUITY OF SERVICES

A. The contractor shall not take any action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the owner's representative. Arrange the work to minimize shutdown time.
B. Owner's personnel will perform shutdown of operating systems. The contractor shall give minimum seven (7) days' advance notice for systems shutdown.
C. Should services be inadvertently interrupted, immediately furnish labor, including overtime, material, and equipment, necessary for prompt restoration of interrupted service.

3.5 FIRESTOPPING

A. Refer to section 078413 "penetration firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.
B. Select appropriate type or types of through penetration firestop devices or systems appropriate for each type of communications penetration and base each selection on criteria specified herein.
C. Selected systems shall not be less than the hourly time delay ratings indicated in the contract documents for each respective fire-rated floor, wall, or other partition of building construction. Firestop for each type of communications penetration shall conform to requirements of an independent testing laboratory design drawing or manufacturer's approved modification when used in conjunction with details shown on the drawings.
D. Perform all necessary coordination with trades constructing floors, walls, or other partitions of building construction with respect to size and shape of each opening to be constructed and device or system approved for use in each instance.
E. Coordinate each firestop selection with adjacent work for dimensional or other interference and for feasibility. In areas accessible to public, and other finished areas, firestop systems work shall be selected, installed, and finished to the quality of adjacent surfaces of building construction being penetrated.
F. Use materials that have no irritating or objectionable odors when firestopping is required in existing buildings and areas that are occupied.
G. Provide damming materials, plates, wires, restricting collars, and devices necessary for proper installation of firestopping. Remove combustible installation aids after firestopping material has cured.
H. All firestops shall be installed in accordance with the manufacturer's instructions in order to maintain the specific rating assigned by the independent testing laboratory.
I. Existing raceways, cable trays, and cabling that penetrate existing building construction shall be firestopped to the extent necessary to fill cavities that may exist between existing building construction and existing communications penetrations or existing conduit sleeve, and between existing conduits and existing conduit sleeve.
J. If required by inspecting authorities:

1. Expose and remove firestopping to the extent directed by inspecting authority to permit his or her inspection.
2. Reinstall new firestopping and restore work where removed for inspection.

3.6 TESTS

A. On completion of work, installation shall be entirely free of damaged conductors, software errors, incomplete jack termination including labeling and faceplates and dust. Perform a thorough operation test in the presence of the owner or their representative. Provide documentation of all test results as outlined in each system's specifications. Include labor, materials, and instruments for above tests.
B. Furnish to owner, as a part of closing documents, a copy of such tests including identification of each cable. Provide the dedicated communication service ground test as required by each system's individual manufacturer, indicating compliance with their requirements.
C. Prior to final observation and acceptance, test and leave in satisfactory operating condition, all systems and equipment including but not limited to the following:

1. Grounding.
2. Firestopping of all sleeves and conduits.
3. Telephone and LAN systems.
4. Turn in test results on cabling.

3.7 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, dust, and construction debris and repair damaged finish, including chips, scratches, and abrasions. This includes touching up paint removed for grounding.
B. Contractor shall provide a clean work environment, free from trash/rubbish accumulated during and after cabling installation.
C. Maintain construction materials and refuse within the area of work. Clean the work area at the end of each day.
D. Contractor shall keep all liquids (drinks, sodas, etc.) Off finished floors, carpets, tiles, racks, and equipment. If any liquid damage to above finishes or equipment occurs, contractor shall provide professional services to clean or repair scratched/soiled finishes or damaged equipment at own expense.

3.8 INSPECTION FEES AND PERMITS

A. Obtain and pay for all necessary permits and inspection fees required for communication systems installation. Work shall not start until all permit applications are approved.

3.9 OBSERVATIONS

A. When field observation services are a part of the project scope, the designer's office will provide periodic observation of the progress of work specified herein. The purpose of the observation service is to ensure compliance of contractor's work with specifications and drawings. The designer's office may also observe tests required of this contractor as called for in other sections of the specifications.
B. Specifications and drawings represent work to be done in view of total project requirements. To eliminate possible conflict with other trades, final location of conduits,

jacks, outlets, components, etc., is the responsibility of this contractor. Contractor to provide all supervision required for his personnel to ensure that installation is made in accordance with specifications and drawings and all safety rules and regulations are observed. In event of conflicts of work on project with other trades, contractor is to make every reasonable effort to resolve conflict through meetings and discussions with other parties involved, by preparation of drawings, or other appropriate action. Only after this has been done shall the designer's assistance be requested through the rfi process.

C. When the designer is requested to visit the project to aid in resolution of conflicts, or for witnessing tests, they shall be given a minimum of fourteen (14 days' notice prior to time their presence is requested at job site.

3.10 WARRANTY-GUARANTEE

A. The designer reserves the right to accept or reject any part of the installation which does not successfully meet requirements as set out in these specifications.

B. Contractor shall, and hereby does, guarantee all work installed under this division shall be free from defects in workmanship and materials for a period of one year from date of final acceptance. This contractor further agrees to repair or replace any defective material or workmanship which is or becomes defective within the terms of this warranty-guarantee.

C. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from the date of replacement.

END OF SECTION 270010

# SECTION 270526 – GROUNDING AND BONDING FOR COMMUNICATIONS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 01 specification sections, apply to this section.

### 1.2 SUMMARY

A. SECTION INCLUDES:

1. Grounding Conductors.
2. Grounding Connectors.
3. Grounding Busbars.
4. Grounding Labeling.

### 1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. ITS: Information Technology System.

C. MGB: Main Grounding Busbar.

D. NRTL: Nationally Recognized Testing Laboratory.

E. PBB: Primary Bonding Busbar.

F. RBB: Rack Bonding Busbar (Ground Bus In A Rack Or Cabinet Tied To The SBB or PBB).

G. SBB: Secondary Bonding Busbar.

H. TBB: Telecommunication Bonding Backbone (Connects PBB to SBB).

I. TBC: Telecommunication Bonding Conductor (Connects PBB to MGB).

J. TEBC: telecommunication equipment bonding conductor (connects RBB to SBB or PBB).

### 1.4 ACTION SUBMITTALS

A. Product data: for each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. As-built data: plans showing as-built locations of grounding and bonding infrastructure, including the following (where applicable):

1. Ground Rods.
2. Ground And Roof Rings.
3. TBC, PBB, SBBS, and routing of their bonding conductors.

B. Qualification data: for installation supervisor and field inspector.

C. Qualification data: for testing agency and testing agency's field supervisor.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. GENERAL: Submit project closeout submittals within 30 days of substantial completion.

B. Operation and maintenance data: for grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in section 01 78 00 "Operation and Maintenance Data," include the following:

a. Result of the ground-resistance test, measured at the point of TBC connection.
b. Result of the bonding-resistance test at each TGB and its nearest grounding electrode.

1.7 QUALITY ASSURANCE

A. Installer qualifications: cabling installer must have personnel certified by BICSI on staff.

1. Installation supervision: Installation shall be under the direct supervision of its Installer 2, who shall be present at all times when work of this section is performed at project site.
2. Field inspector: Currently registered by BICSI as its installer to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS

A. Comply with section 01 60 00 "Product Requirements."

B. Comply with ANSI/TIA-607-E.

2.2 CONDUCTORS

A. Manufacturers: subject to compliance with requirements, provide products by the following (or approved equal):

1. Harger Lightning and Grounding.
2. Panduit Corp.
3. TE Connectivity Ltd.

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: minimum no. 8 AWG.

D. CABLE TRAY GROUNDING JUMPER:

1. Not smaller than no. 6 AWG and no longer than 12 inches (300 mm). 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 cable: 28 KCMILS (14.2 SQ. MM), 14 strands of NO. 17 AWG conductor, and 1/4 INCH (6.3 MM) in diameter.
5. Bonding conductor: NO. 4 OR NO. 6 AWG, stranded conductor.
6. Bonding jumper: tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 INCHES (41 MM) wide and 1/16 inch (1.6 MM) thick.

2.3 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 the following (or approved equal):

1. Burndy; Part of Hubbell Electrical Systems.
2. Chatsworth Products, Inc.
3. Harger Lightning and Grounding.
4. Panduit Corp.
5. Tyco Electronics Corp.

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 (15.8- or 25.4-mm) 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.

## 2.4 GROUNDING BUSBARS

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY THE FOLLOWING (OR APPROVED EQUAL):

1. Chatsworth Products, Inc.
2. Harger Lightning And Grounding.
3. Panduit Corp.

B. SBB: Predrilled rectangular bars of hard-drawn solid copper, 1/4 by 2 inches (6.3 by 50 mm) in cross section, length as indicated on drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with ANSI/TIA-607-E.

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 (50-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
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. 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-E. Predrilling shall be with holes for use with lugs specified in this section.

1. RBB: terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.
2. Horizontal RBB: designed for mounting in 19- or 23-inch (483- or 584-mm) 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. Vertical RBB: 72 or 36 inches (1827 or 914 mm) long, with stainless-steel or copper-plated hardware for attachment to the rack.

2.5 LABELING

A. Manufacturers: Subject to compliance with requirements, provide products by the following (or approved equal):

1. Brother International Corporation.
2. Hellermann Tyton.
3. Panduit Corp.

B. Comply with ANSI/TIA-606-D 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 (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

PART 3 - EXECUTION

3.1 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 TBC connection.

C. Prepare written report, endorsed by installer, listing conditions detrimental to performance of the work.

D. Proceed with connection of the TBC only after unsatisfactory conditions have been corrected.

3.2 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-E.

3.3 APPLICATION

A. Conductors: install solid conductor for no. 8 AWG and smaller and stranded conductors for no. 6 AWG and larger unless otherwise indicated.

1. The bonding conductors between the SBB and structural steel of steel-frame buildings shall not be smaller than no. 6 AWG.
2. The bonding conductors between the PBB and structural steel of steel-frame buildings shall not be smaller than no. 6 AWG.

B. Conductor terminations and connections:

1. Pipe and equipment grounding conductor terminations: bolted connectors.
2. Underground connections: welded connectors except at test wells and as otherwise indicated.
3. Connections to ground rods at test wells: bolted connectors.
4. Connections to structural steel: welded connectors.

C. Conductor support:

1. Secure grounding and bonding conductors at intervals of not less than 36 inches (900 mm).

D. 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 (900-mm) intervals.
4. Install grounding and bonding conductors in 3/4-inch (21-mm) pvc conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.

    a. 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 27 05 28 "Pathways for Communications Systems," and bond both ends of the conduit to a tgb.

## 3.4 GROUNDING BUSBARS

A. Indicate locations of grounding busbars on drawings. Install busbars horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 12 inches (300 mm) above finished floor unless otherwise indicated.

B. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

## 3.5 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. Pre-twist the conductor.
3. Apply an antioxidant compound to all compression connections.

D. Interconnections: interconnect all SBBs with the PBB using the TBB. If more than one pb is installed, interconnect PBBs using the grounding equalizer conductor. The TBC and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot (1 sq. Mm/linear meter) of conductor length, up to a maximum size of no. 3/0 AWG unless otherwise indicated.

E. Telecommunications enclosures and equipment racks: bond metallic components of enclosures to the RBB. Install RBB unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the SBB no. 2 AWG TEBC.

F. 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.

G. 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.

H. Shielded cable: bond the shield of shielded cable to the SBB in communications rooms and spaces in accordance with ANSI/TIA-607-E. Comply with ANSI/TIA-568.2-D when grounding screened, balanced, twisted-pair cables.

I. Rack- and cabinet-mounted equipment: bond powered equipment chassis to the RBB. Power connection shall comply with nfpa 70; the TEBC in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this section.

J. Towers and antennas (where applicable):

1. Coaxial cable:
2. Connections to structural steel: welded connectors.

K. Conductor support:

1. Secure grounding and bonding conductors at intervals of not less than 36 inches (900 mm).

L. 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 (900-mm) intervals.
4. Install grounding and bonding conductors in 3/4-inch (21-mm) pvc conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.

a. 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 27 05 28 "Pathways for Communications Systems," and bond both ends of the conduit to a tgb.

## 3.6 GROUNDING BUSBARS

A. Indicate locations of grounding busbars on drawings. Install busbars horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 12 inches (300 mm) above finished floor unless otherwise indicated.

B. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

## 3.7 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. Pre-twist the conductor.
3. Apply an antioxidant compound to all compression connections.

D. Interconnections: interconnect all SBBs with the PBB using the TBB. If more than one pb is installed, interconnect PBBs using the grounding equalizer conductor. The TBC and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot (1 sq. Mm/linear meter) of conductor length, up to a maximum size of no. 3/0 AWG unless otherwise indicated.

E. Telecommunications enclosures and equipment racks: bond metallic components of enclosures to the RBB. Install RBB unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the SBB no. 2 AWG TEBC.

F. 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.

G. 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.

H. Shielded cable: bond the shield of shielded cable to the SBB in communications rooms and spaces in accordance with ANSI/TIA-607-E. Comply with ANSI/TIA-568.2-D when grounding screened, balanced, twisted-pair cables.

I. Rack- and cabinet-mounted equipment: bond powered equipment chassis to the RBB. Power connection shall comply with nfpa 70; the TEBC in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this section.

J. Towers and antennas (where applicable):

1. 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 using bonding conductor size recommended by surge-arrester manufacturer.

## 3.8 IDENTIFICATION

A. Labels shall be preprinted or computer-printed type.

1. Label SBB(s) with "FS-SBB," where "FS" is the telecommunications space identifier for the space containing the SBB.
2. Label the TBC and each TBB at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

## 3.9 FIELD QUALITY CONTROL

A. Comply with section 01 40 00 “Quality Requirements."

B. Testing agency: engage a qualified testing agency to perform tests and inspections.

C. 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 in each SBB. Maximum acceptable ac current level is 1-AMP.

D. Reports: prepare test and inspection reports and submit for approval.

E. Excessive ground resistance: if resistance to ground at the TBC exceeds 5-Ohms, notify the owner promptly and include recommendations to reduce ground resistance.

F. Retest: grounding system will be considered defective if it does not pass tests and inspections. Contractor to submit corrective action for approval.

END OF SECTION 270526

# SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 01 specification sections, apply to this section.

### 1.2 SUMMARY

A. SECTION INCLUDES:

1. Metal Conduits and Fittings.
2. Metal Wireways and Auxiliary Gutters.
3. Surface Pathways.
4. Hooks
5. Boxes, Enclosures, and Cabinets.

B. RELATED REQUIREMENTS:

1. Section 26 05 26 "Grounding and Bonding for Electrical Systems.”
2. Section 26 05 33 "Raceway and Boxes for Electrical Systems.”
3. Section 28 05 28 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

### 1.3 DEFINITIONS

A. ARC: Aluminum Rigid Conduit.

B. EMT: Electrical Metallic Tubing.

C. GRC: Galvanized Rigid Steel Conduit.

D. IMC: Intermediate Metal Conduit.

E. PVC: Polyvinyl Chloride.

### 1.4 ACTION SUBMITTALS

A. Product data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

### 1.5 INFORMATIONAL SUBMITTALS

A. Comply with section 01 40 00 “Quality Requirements.”

B. 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.

C. Source quality-control reports.

## PART 2 - PRODUCTS

### 2.1 SYSTEM COMPONENTS

A. Comply with section 01 60 00 "Product Requirements."

### 2.2 METAL CONDUITS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following (or approved equal):

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit.
3. Alpha Wire Company.
4. Anamet Electrical, Inc.
5. Electri-Flex Company.
6. O-Z/Gedney.
7. Picoma Industries.
8. Republic Conduit.
9. Robroy Industries.
10. Southwire Company.
11. Thomas & Betts Corporation.
12. Western Tube and Conduit Corporation.
13. Wheatland Tube Company.

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
3. Section 26 05 33 "Raceway And Boxes For Electrical Systems."

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. PVC-Coated Steel Conduit: PVC-Coated rigid steel conduit or IMC.

1. Comply with NEMA RN 1.
2. Coating thickness: 0.040 INCH (1 MM), minimum.

G. EMT: Comply with ANSI C80.3 and UL 797.

H. 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. Fittings for EMT:

a. Material: Steel or die cast.
b. Type: Setscrew or compression.

3. 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.
4. Coating for fittings for PVC-coated conduit: minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

I. 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.

## 2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following (or approved equal):

1. Cooper B-Line, Inc.
2. Hoffman.
3. Mono-Systems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be 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. Fittings and accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway covers: Hinged type, screw-cover type and flanged-and-gasketed type as shown, unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

## 2.4 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 cover complying with UL 5. Manufacturer's standard enamel finish in color selected by the owner.

1. Manufacturers: Subject to compliance with requirements, provide products by the following (or approved equal):

a. Mono-Systems, Inc.
b. Niedax-Kleinhuis Usa, Inc.
c. Panduit Corp.
d. Wiremold / Legrand.

C. Surface nonmetallic pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by the owner 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 the following (or approved equal):

a. Lamson & Sessions; Carlon Electrical Products.
b. Mono-Systems, Inc.
c. Panduit Corp.
d. Quazite:Hubbell Power Systems, Inc.
e. Wiremold / Legrand.

D. TELE-POWER POLES:

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. Mono-Systems, Inc.
b. Panduit Corp.
c. Wiremold / Legrand.

2. Material: Galvanized steel with ivory baked-enamel finish.
3. Fittings and accessories: dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

## 2.5 HOOKS

A. Description: Prefabricated sheet metal cable supports for telecommunications cable.

1. Manufacturers: Subject to compliance with requirements, provide products by the following (or approved equal):

a. Mono-Systems, Inc.
b. Niedax-Kleinhuis Usa, Inc.
c. Panduit Corp.
d. Wiremold / Legrand.

2. Listed and labeled as defined in NFPA 70, by an nrtl, and marked for intended location and application.

3. Comply with ANSI/TIA-569-E.
4. Galvanized steel.

B. J shape.

## 2.6 BOXES, ENCLOSURES AND CABINETS

A. Manufacturers: subject to compliance with requirements, provide products by the following (or approved equal):

1. Adalet.
2. Cooper Technologies Company; Cooper Crouse-Hinds.
3. Egs/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. Hoffman.
6. Lamson & Sessions; Carlon Electrical Products.
7. Milbank Manufacturing Co.
8. Molex; Woodhead Brand.
9. Mono-Systems, Inc.
10. O-Z/Gedney.
11. Quazite:Hubbell Power Systems, Inc.
12. Raco; Hubbell.
13. Robroy Industries.
14. Spring City Electrical Manufacturing Company.
15. Stahlin Non-Metallic Enclosures.
16. Thomas & Betts Corporation.
17. Wiremold / Legrand.

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, ferrous alloy or aluminum (type FD for extra depth as needed), with gasketed cover.

E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

F. Metal floor boxes:

1. Material: Cast metal or sheet metal.
2. Type: fully adjustable.
3. Shape: Rectangular.
4. Listing and labeling: metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Small sheet metal pull and junction boxes: NEMA OS 1.

H. Cast-metal access, pull and junction boxes: comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

I. Device box dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep) or 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep) as required.

J. Gangable boxes are allowed.

K. Nonmetallic outlet and device boxes: comply with NEMA OS 2 and UL 514C.

L. Hinged-cover enclosures: Comply with UL 50 and NEMA 250, of type dictated by environmental conditions (such as type 1, type 3R or type 12) with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic enclosures:

    a. Material: Plastic or fiberglass.
    b. Finished inside with radio-frequency-resistant paint.

3. Interior panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:

1. Nema 250, galvanized-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.

## PART 3 - EXECUTION

### 3.1 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed conduit: GRC.
2. Concealed conduit, aboveground: GRC.
3. Boxes and enclosures, aboveground: NEMA 250, type 4X.

B. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, not subject to physical damage: EMT or rnc.
2. Exposed, not subject to severe physical damage: EMT or RNC identified for such use.
3. Concealed in ceilings and interior walls and partitions: EMT.
4. Damp or wet locations: GRC.
5. Pathways for optical-fiber or communications cable in spaces used for environmental air: plenum-type, optical-fiber-cable pathway.
6. Pathways for optical-fiber or communications-cable risers in vertical shafts: riser-type.

7. Pathways for concealed general-purpose distribution of optical-fiber or communications cable: EMT.
8. Boxes and enclosures: nema 250 type 1, except use NEMA 250 type 4 stainless steel in institutional and commercial kitchens and NEMA 250 type 3R in damp or wet locations.

C. Minimum pathway size: 3/4-inch (21-mm) trade size.

D. 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 sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120-degrees F (49-degrees C).

## 3.2 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 (150 mm) 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. No section of conduit shall be longer than 100 feet between pull points. Pull boxes shall be placed in conduit runs of over 100 feet. No section of conduit shall have more than the equivalent of three 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction.

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 (300 mm) of enclosures to which conduit is attached.

H. Pathways embedded in slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.

3. Arrange pathways to keep a minimum of 1 inch (25 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved for each specific location.
5. Change from ent to rnc, type epc-40-PVC, GRC or imc before rising above floor.

I. 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.

J. Threaded conduit joints, exposed to wet, damp, corrosive, or outdoor conditions: apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

L. 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.

M. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. 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.

O. Cut conduit perpendicular to the length. For conduits of 2-inch (53-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

P. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

Q. 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 (50-mm) radius control at bend points.
3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) 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.

R. Pathways for communications cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

1. 3/4-inch (21-mm) trade size and smaller: install pathways in maximum lengths of 50 feet (15 m).
2. 1-inch (27-mm) trade size and larger: install pathways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of three 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.

S. 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.

T. 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.

U. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

V. Expansion-joint fittings:

1. Install in each run of aboveground rnc that is located where environmental temperature change may exceed 30-degrees F (17-degrees C), and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground rmc and EMT conduit that is located where environmental temperature change may exceed 100-degrees f (55-degrees c) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor locations not exposed to direct sunlight: 125-degrees f (70-degrees c) temperature change.
    b. Outdoor locations exposed to direct sunlight: 155-degrees f (86-degrees c) temperature change.
    c. Indoor spaces connected with outdoors without physical separation: 125-degrees f (70-degrees c) temperature change.
    d. Attics: 135-degrees F (75-degrees C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree f (0.06 mm per meter of length of straight run per degree c) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per degree F (0.0115 mm per meter of length of straight run per degree C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

W. Hooks:

1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.

2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
3. Hook spacing shall allow no more than 6 inches (150 mm) of slack. The lowest point of the cables shall be no less than 6 inches (150 mm) adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
4. Space hooks no more than 5 feet (1.5 m) O.C.
5. Provide a hook at each change in direction.

X. Mount boxes at heights indicated on drawings. If mounting heights of boxes are not individually indicated, give priority to ada requirements. Install boxes with height measured to center of box unless otherwise indicated.

Y. 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.

Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

AA. 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.

BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

CC. Set metal floor boxes level and flush with finished floor surface.

DD. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

## 3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in section 27 05 44 "Sleeves And Sleeve Seals for Communications Pathways and Cabling."

## 3.4 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 270528

# SECTION 270544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Sleeves for pathway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 07 84 13 “Penetration Firestopping.”

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

## PART 2 - PRODUCTS

### 2.1 SYSTEM COMPONENTS

A. Comply with Section 01 60 00 "Product Requirements."

B. For small penetrations, firestop system shall be UL-listed for the condition on which it is installed, including wall/slab type (drywall, masonry, etc.), hour rating, and accessibility type. Putties, caulks, cementitious materials, or firestop grommets are acceptable for small penetrations.

2.2 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40 (if allowed by authority having jurisdiction).

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms (if allowed by authority having jurisdiction).

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized-steel sheet.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.3 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device used for conduit penetrations in slabs-on-grade and below grade in exterior walls, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by the following (or approved equal):

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

2. Sealing Elements: EPDM (or Nitrile [Buna N] if hydrocarbons are present in the soil) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

## 2.4 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or exterior wall. Unit shall have plastic or rubber waterstop collar with center opening to match penetrating piping OD.

1. Manufacturers: Subject to compliance with requirements, provide products by Presealed Systems, or the equivalent product of another manufacturer.

## 2.5 GROUT

A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

## 2.6 SILICONE SEALANTS

A. General: Where use of silicone sealants and silicone foams is permitted as an alternative to grout in sealing of conduit or cable penetrations in gypsum wallboard walls, conform to the following.

B. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Sealant shall have VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 92 00 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing sleeve-seal system.

## 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at pathway entries into building (if any).

B. Install type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

## 3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed. Using grout, seal the space around outside of sleeve-seal fittings.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall. Secure nailing flanges to concrete forms.

END OF SECTION 270544

# SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Signs.
2. Bands and tubes.
3. Cable ties.
4. Miscellaneous identification products.
5. Labels.

### 1.3 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 communications identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule:

1. Outlets: Scaled drawings indicating location and proposed designation.
2. Racks: Scaled drawings indicating location and proposed designation.

3. Patch Panels: Enlarged scaled drawings showing rack row, number, and proposed designations.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 70 and ANSI/TIA 606-D.

B. Comply with ANSI Z535.4 for safety signs and labels.

C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

### 2.2 COLOR AND LEGEND REQUIREMENTS

A. Equipment Identification Labels:

1. Black letters on a white field.

### 2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
c. As required by authorities having jurisdiction.

## 2.4 BANDS AND TUBES

A. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameters of raceway or cable they identify, that stay in place by gripping action.

## 2.5 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, and ANSI Z535.4.
2. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL-FIBER CABLE".

C. Tag, Nonconducting Polyolefin: Type I:

1. Pigmented polyolefin, bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Width: 3 inches (75 mm).
3. Thickness: 4 mils (0.1 mm).
4. Weight: 18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m).
5. Tensile according to ASTM D882: 30 lbf (133.4 N) and 2500 psi (17.2 MPa).

D. Tag, Nonconducting Multilayer Laminate: Type II:

1. Multilayer laminate, consisting of high-density polyethylene scrim coated with pigmented polyolefin; bright colored, continuous-printed on one side with the inscription of the utility, ]compounded for direct-burial service.
2. Width: 3 inches (75 mm).
3. Thickness: 12 mils (0.3 mm).
4. Weight: 36.1 lb/1000 sq. ft. (17.6 kg/100 sq. m).
5. Tensile according to ASTM D882: 400 lbf (1780 N) and 11,500 psi (79.2 MPa).

E. Tag, Detectable: Type ID:

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Width: 3 inches (75 mm).
3. Overall Thickness: 5 mils (0.125 mm).
4. Foil Core Thickness: 0.35 mil (0.00889 mm).
5. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
6. Tensile according to ASTM D882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).

F. Tag, Detectable, Reinforced: Type IID:

1. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Width: 3 inches (75 mm).
3. Overall Thickness: 8 mils (0.2 mm).
4. Foil Core Thickness: 0.35 mil (0.00889 mm).
5. Weight: 34 lb/1000 sq. ft. (16.6 kg/100 sq. m).
6. Tensile according to ASTM D882: 300 lbf (1334 N) and 12,500 psi (86.1 MPa).

## 2.6 SIGNS

A. Laminated-Acrylic or Melamine-Plastic Signs:

1. Engraved legend.

2. Thickness:

a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.

## 2.7 CABLE TIES

A. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C) according to ASTM D638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

## 2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Section 09 91 23 “Interior Painting” for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying communications identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

## 3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.

G. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

H. Snap-Around Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Provide label 6 inches (150 mm) from cable end.

I. Self-Adhesive Wraparound Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Provide label 6 inches (150 mm) from cable end.

J. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

K. Snap-Around, Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

L. Cable Ties: General purpose, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

## 3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.

C. Accessible Fittings for Raceways and Cables within Buildings: Identify covers of each junction and pull box with self-adhesive labels containing wiring system legend.

1. System legends shall be as follows:

a. Telecommunications.

D. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation, numbered clockwise when entering room from primary egress, composed of the following, in the order listed:

1. Wiring closet designation.
2. Colon.
3. Faceplate number.

E. Equipment Room Labeling:

1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels containing equipment designation.

2. Patch Panels: Label individual rows in each rack, starting at top and working down, with self-adhesive labels. Label individual rows and outlets, starting at to left and working down, with self-adhesive labels.
3. Data Outlets: Label each outlet with a self-adhesive label indicating the following, in the order listed:

    a. Room number being served.
    b. Colon.
    c. Faceplate number.

F. Horizontal Cables: Label each cable with a vinyl-wraparound label indicating the following, in the order listed:

1. Room number.
2. Colon.
3. Faceplate number.

G. Instructional Signs: Self-adhesive labels.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures: Self-adhesive labels.

1. Apply to exterior of door, cover, or other access.

I. Equipment Identification Labels:

1. Indoor Equipment: Laminated-acrylic or melamine-plastic sign.
2. Outdoor Equipment: Laminated-acrylic or melamine-plastic sign Stenciled legend 4 inches (100 mm) high.
3. Equipment to Be Labeled:

    a. Communications cabinets.
    b. Uninterruptible power supplies.
    c. Computer room air conditioners.
    d. Fire-alarm and suppression equipment.
    e. Egress points.
    f. Power distribution components.

END OF SECTION 270553

# SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### **1.2** SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment cabinets.
4. Power strips.
5. Network.
6. Network switch.
7. AV Equipment
8. Surge Protection.
9. Uninterruptible Power Supply.
10. Wall-mounted Video Displays.
11. Grounding.
12. Labeling.

B. Related Requirements:

1. Section 27 00 10 “Supplemental Requirements for Communications.”
2. Section 27 15 00 "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

### **1.3** DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. EMI: Electromagnetic interference.

C. LAN: Local area network.

D. LCD: Liquid-crystal display.

E. LED: Light-emitting diode.

F. TDMM: Telecommunications Distribution Methods Manual.

**1.4** ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for 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.
4. UPS:

a. Detail equipment assemblies and indicate dimensions, weights, components, and location and identification of each field connection.
b. Show access, workspace, and clearance requirements; details of control panels; and battery arrangement.
c. Include wiring diagrams for power, signal, and control wiring.
d. Provide documentation of correct UPS size selection in the form of spreadsheet analysis listing all equipment loads (including in-rush currents) on each UPS unit according to manufacturers' data sheets for each device. Load calculations shall clearly demonstrate that the proposed UPS sizes will be adequate to support all critical devices at full load plus 50% spare capacity.
e. Provide recharge time for each set of batteries.

**1.5** INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector. Refer to Section 01 40 00 "Quality Requirements."

**1.6** CLOSEOUT SUBMITTALS

A. General: Submit project closeout submittals within 30 days of Substantial Completion.

B. Operation and Maintenance Data: For UPS units to include in emergency, operation, and maintenance manuals.

**1.7** QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
2. Field Inspector: Currently registered by BICSI as Commercial Installer, Level 2 to perform the on-site inspection.

## PART 2 - PRODUCTS

### 2.1 SYSTEM COMPONENTS

A. Comply with Section 01 60 00 "Product Requirements."

### 2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, all imperfections and voids shall be filled, sealed and sanded prior to being painted with two coats of white fire-retardant paint, ¾-inch thick by 48-inch high and shall cover walls as shown on the drawings. Fire retardant coating shall be tested to UL 723. Install horizontally 18 inches above floor with smooth side facing outward using hardware and anchors with a combined pullout force of at least 500 lbs. Butt adjacent sheets tightly, and form smooth gap-free corners and joints. Backboards shall be clearly labeled with the name of the Backboard Manufacturer, UL Classification of the Fire Retardant Coating, NFPA 255 Coating Flame Spread Index Class and the APA grade of plywood. Comply with requirements in Section 27 00 10 “Supplemental Requirements For Communications" for plywood backing panels.

### 2.3 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by the following (or approved equal):

1. APC.
2. Belken.
3. Black Box.
4. Chatsworth.
5. Eaton.
6. Great Lakes.
7. Hewlett Packard Enterprise.
8. Kendall Howard
9. Leviton Commercial Networks Division.
10. Liebert.
11. Middle Atlantic Products, Inc.
12. Ortronics, Inc. (by Legrand)
13. Panduit Corp.

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 ECIA-310-E standard, 19-inch (480-mm) panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.
4. Grounding: All equipment frames shall be properly grounded.

C. Floor-Mounted Racks: Modular-type, steel or aluminum construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
2. Baked-polyester powder coat finish.

D. Modular Freestanding Cabinets:

1. Removable side panels.
2. Hinged and lockable front and rear doors.
3. Adjustable feet for leveling.
4. Screened ventilation openings in the roof, front and rear door.
5. Cable access provisions in the roof and base.
6. Grounding bus bar.
7. Roof-mounted, 550-cfm (260-L/s) fan with filter.
8. Power strip.
9. Baked-polyester powder coat finish.
10. All cabinets keyed as determined by the Owner.

E. Modular Wall Cabinets:

1. Wall mounting.
2. Steel or aluminum construction.
3. Treated to resist corrosion.
4. Lockable front and rear doors.
5. Louvered side panels.
6. Cable access provisions top and bottom.
7. Grounding lug.
8. Roof-mounted, 250-cfm (118-L/s) fan.
9. Power strip.
10. All cabinets keyed as determined by the Owner.

F. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

**2.4** POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. All-metal construction with detachable mounting flanges for rackmount in one rack space (1U) in standard 19 inch rack
3. Twelve NEMA5-20R output receptacles (6 front/6 rear)
4. 15-ft. (4.57 m) AC cord NEMA5-20P plug connection.
5. Illuminated power switch confirms power on/off status with Snap-in switch guard to prevent accidental turn off
6. 120V AC, 50/60Hz - 20 amp electrical capacity with circuit breaker

**2.5** NETWORK SWITCH

A. Network Switch: The Contractor shall furnish and configure all network switches for the project. Contractor shall coordinate installation of switches and connection to the existing firewall with the Owner's IT representative. Contractor shall closely coordinate all work and system configuration requirements with the Owner's IT Representatives for a fully functional system.

1. Wi-Fi Network Switch: The Airport Wi-Fi network switch shall be a 24 or 48 port PoE managed ethernet switch (as indicated on the drawings) supporting 24 or 48-port PoE, 10/100/1000 Base-TX communications infrastructure of Ethernet data (refer to Drawings for quantity and location). PoE+ power shall be available across all ports.

B. Manufacturers: Subject to compliance with requirements, provide products by the following (or approved equal):

1. Ubiquiti Inc.

C. Switches shall have the following minimum characteristics:

1. Compatible with any IEEE 802.3 device.
2. Minimum of (2) 10G SFP+ ports
3. (20/40) ports IEEE 802.3af/at compliant for power source equipment (PSE) with up to 30W of PoE power available per port.
4. (4/8) ports IEEE 802.3af/at/bt compliant for power source equipment (PSE) with up to 60W of PoE power available per port.
5. Total PoE power available 300W for 24 port, 600W for 48 port.
6. (1) USP RPS DC input for power redundancy.
7. 88 Gbps total non-blocking throughput.
8. 176 Gbps switching capacity.
9. Standard 19-inch rack-mountable.
10. Extended five (5) year warranty.

D. Rack-mounted redundant power supply shall have the following minimum characteristics:

1. 950W total DC power supply.
2. (6) USP DC ports.

3. (1) GbE RJ45 port.
4. 1.3" LCM color touchscreen.

**2.6** WIRELESS FIDELITY

E. General: The Contractor shall furnish and provide new stand-alone wireless network including new gateway, switches, and access points complete including all licenses and software as required for a complete and working system. Contractor shall install headend and wireless access points models as indicated below or an approved equivalent product of another manufacturer. Contractor shall provide the latest generation of the models indicated. Configuration of all access points, gateways and switches shall be completed by the Contractor as coordinated with the Owner's IT representative. Installation of all equipment shall be by the Contractor.

F. Manufacturers: Subject to compliance with requirements, provide products by the following to match existing:

1. Ubiquiti Networks.

G. Gateway: Ubiquiti Dream Machine Pro (UDM Pro), 10G Cloud Gateway with 100+ UniFi device / 1,000+ client support and 3.5 Gbps IPS routing.

1. Eight (8) GbE RJ45 ports.
2. One (1) 10G SFP+ ports
3. 3.5 Gbps throughput.
4. Standard 19-inch rack-mountable.
5. Extended five (5) year warranty.

H. Interior Ceiling/Wall Mounted Access Point: Ubiquiti model U6 Pro, 802.11ac Access Point. Powered by PoE IEEE 802.3at+. Provide mounting hardware meeting requirements as shown on the Drawings including enclosure mounting bracket.

**2.7** AV EQUIPMENT

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Extron
2. approved equal.

B. General: Provide high-resolution audio-visual video conferencing system complete with distribution amplifier, receivers, displays, cameras, dedicated network switches, wireless access points, wireless microphones, twisted pair outputs for the digital transmission of video, audio, and control signals up to 330 feet (100 meters) over shielded CAT6 cable as indicated on the Contract Drawings.
1. System installer shall be certified by the system manufacturer.

C. Control Panel: Ethernet controller shall provide common AV functions such as power, input/output switching, volume control, and Ethernet control of AV devices. Control buttons shall be customizable and configurable. The unit shall support power over ethernet (PoE) via a single

Ethernet cable and will mount to a two-gang junction box. Face plate color (black or white) shall be approved by the Owner.

1. Provide wall mounted control panel where indicated on the drawings.
2. Provide desktop control panel where indicated on the drawings.

D. Network Switches: The AV Contractor shall furnish and configure all network switches for AV system. AV Contractor shall provide dedicated switches for the AV system as shown on the Contract Documents fully configured as required for a fully functional system.

**2.8** SURGE PROTECTION

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor's entry connection to components.

1. Rack Mounted: Surge protectors with interchangeable modules (DTK-NETMS or DTK EXTMS), meeting UL497B to protect power, video, and data circuits that use PoE connections.
2. Equipment: Installed at the end device or ahead of midspan devices, Model DTK-MRJPOE, as manufactured by Ditek (or approved equal), meeting UL497B to protect power, video, and data circuits that use PoE connections.

**2.9** UNINTERRUPTIBLE POWER SUPPLY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Power Conversion (Schneider Electric).

2. Tripp Lite (Eaton).

B. Uninterruptible Power Supply (UPS): Smart-UPS following features:

1. Power conditioning.
2. Automatic self-test.
3. Rectifier-charger.
4. Inverter.
5. Bypass mode.
6. Battery and battery disconnect.
7. Remote UPS monitoring via Network Card.

C. Automatic Operation:

1. Normal Conditions: Load is supplied with power flowing from the normal power input terminals, through the rectifier-charger and inverter, with the battery connected in parallel with the rectifier-charger output.
2. Abnormal Supply Conditions: If normal supply deviates from specified and adjustable voltage, voltage waveform, or frequency limits, the battery supplies energy to maintain constant, regulated inverter power output to the load without switching or disturbance.

3. If normal power fails, energy supplied by the battery through the inverter continues supply-regulated power to the load without switching or disturbance.
4. When power is restored at the normal supply terminals of the system, controls automatically synchronize the inverter with the external source before transferring the load. The rectifier-charger then supplies power to the load through the inverter and simultaneously recharges the battery.
5. If the battery becomes discharged and normal supply is available, the rectifier-charger charges the battery. On reaching full charge, the rectifier-charger automatically shifts to float-charge mode.
6. If any element of the UPS system fails and power is available at the normal supply terminals of the system, the static bypass transfer switch switches the load to the normal ac supply circuit without disturbance or interruption.
7. If a fault occurs in the system supplied by the UPS, and current flows in excess of the overload rating of the UPS system, the static bypass transfer switch operates to bypass the fault current to the normal ac supply circuit for fault clearing.
8. When the fault has cleared, the static bypass transfer switch returns the load to the UPS system.
9. If the battery is disconnected, the UPS continues to supply power to the load with no degradation of its regulation of voltage and frequency of the output bus.

D. Environmental Conditions: The UPS shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability, except battery performance.

1. Ambient Temperature for Electronic Components: 32 to 104 deg F (0 to 40 deg C).
2. Ambient Temperature for Battery: 41 to 95 deg F (5 to 35 deg C).
3. Relative Humidity: 0 to 95 percent, noncondensing.
4. Altitude: Sea level to 10000 feet (3048 m).

E. Performance Requirements: The UPS shall perform as specified in this article while supplying rated full-load current, composed of any combination of linear and nonlinear load, up to 100 percent nonlinear load with a load crest factor of 3.0, under the following conditions or combinations of the following conditions:

1. Inverter is switched to battery source.
2. Steady-state ac input voltage deviates up to plus or minus 10 percent from nominal voltage.
3. Steady-state input frequency deviates up to plus or minus 5 percent from nominal frequency.
4. THD of input voltage is 15 percent or more with a minimum crest factor of 3.0, and the largest single harmonic component is a minimum of 5 percent of the fundamental value.
5. Load is 30 percent unbalanced continuously.

F. Minimum Duration of Supply: If battery is sole energy source supplying rated full UPS load current at 80 percent power factor, duration of supply is 20 minutes.

G. Input Voltage Tolerance: System steady-state and transient output performance remains within specified tolerances when steady-state ac input voltage varies plus 10, minus 20 percent from nominal voltage.

H. Overall UPS Efficiency: Equal to or greater than 94 percent at 100 percent load, 93 percent at 75 percent load, and 92 percent at 50 percent load.

I. EMI Emissions: Comply with FCC Rules and Regulations and with 47 CFR 15 for Class A equipment.

J. Battery: Lithium-Ion (Li-Ion) battery units; factory assembled in a separate matching rack mount cabinet, complete with battery disconnect switch.

K. Controls and Indications: Group displays, indications, and basic system controls on a common control panel on front of UPS enclosure with plain-language messages on a digital LCD or LED. Alarms include audible signals and visual displays.

1. Indications shall include the following:
   a. Online.
   b. On battery
   c. Load Graph
   d. Battery charge graph
   e. Audible Alarm
   f. Input & output voltage.
   g. Load (watts, VA, and percentage).
   h. Estimated battery runtime.

L. Remote Monitoring: Connectors and network interface units for data transmission via SmartSlot or other communications link for the remote indication of the following conditions:

1. UPS on battery.
2. UPS on-line.
3. UPS load-on bypass.
4. UPS in alarm condition.
5. UPS off (maintenance bypass closed).

M. Emergency Power Off Switch: Capable of local operation and operation by means of activation by external dry contacts

**2.10** WALL-MOUNTED VIDEO DISPLAYS

A. The following wall-mounted video display types planned for this project shall be provisioned with LED Flat Screen units:

1. Wall-mounted commercial video displays in Conference Rooms.

B. Wall-mounted televisions in Conference Rooms shall be 85 inch displays, LED backlit LCD video screens meeting the following minimum specifications:

1. Viewable image size: 85 inches.
2. Native Resolution: 3840 x 2160.
3. Brightness: 350 nit
4. Contrast Ratio: ≥4000:1.
5. Aspect Ratio: 16:9.
6. Operation hours: 16/7.
7. Three (3) HDMI 2.0 Inputs.
8. Two (2) USB 2.0 Inputs.

9. One (1) Ethernet Port.
10. Warranty: 3-years

F. The Contractor shall coordinate with millwork, power, and communication trades to assure proper fit and functionality of the display equipment, which includes, but is not limited to:

1. Proper structural mounting of video display.
2. Proper power interface.
3. Proper communication interface.

G. Video displays shall be provided with the following accessories:

1. VESA compliant flat screen display tilt mounting brackets, Single screen mount attachments as indicated in the Project Drawings.
2. Wall-mount and structural support as indicated on the drawings.
3. Coax and CAT 6 Patch cables.
4. Power cords.

**2.11** MOUNTS AND ACCESSORIES

1. Provide adjustable VESA 200 x 400mm pattern compliant mounts for all displays that meet the following criteria:
   a. Orientation: Portrait.
   b. Extension: Up to 10.7”.
   c. Stud Pattern: 16”.
   d. Max Weight: 150 LBS.
   e. Plumb Adjustment: to 2.5 Deg.
   f. Design Selection: Chief Manufacturing LSMVPU, or approved equal.

**2.12** GROUNDING

A. Comply with requirements in Section 27 05 26 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with ANSI/TIA-607-E.

**2.13** LABELING

A. Comply with ANSI/TIA-606-D and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

**3.1** ENTRANCE FACILITIES

A. Contact telecommunications service provider(s) and arrange for installation of demarcation point, protected entrance terminals, and housing when so directed by service provider.

B. Comply with requirements in Section 27 05 28 "Pathways for Communications Systems" for materials and installation requirements for underground, buried or aerial pathways.

**3.2** INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout and installation of communications equipment 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 communications room.
5. All racks shall be installed and leveled and plumbed. Four post racks and two post racks shall be anchored to the floor and shall be installed with isolation pads. Equipment cabinets shall be leveled using the leveling feet unless design drawings specifically indicate to leave them on casters.
6. A minimum of 3 ft. of clearance in front of racks shall be provided but a 4 ft. clearance is preferred. A minimum of 2 ft. of rear clearance shall be provided but a clearance of 3 ft. is preferred.
7. Racks and cabinets should preferably be no taller than 7ft. for easier access to the equipment or connecting hardware installed at the top. Where floor is limited, taller racks and cabinets may be used if allowed by Authority having jurisdiction.

E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

**3.3** SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

**3.4** GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI/TIA-607-E.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

**3.5** IDENTIFICATION

A. Identify system components, wiring, and cabling complying with ANSI/TIA-606-D.

B. Comply with requirements in Section 09 91 23 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Labels shall be preprinted or computer-printed type.

**3.6** FIELD QUALITY CONTROL FOR UPS

A. Tests and Inspections:

1. Comply with manufacturer's written instructions.
2. Inspect interiors of enclosures, including the following:

a. Integrity of mechanical and electrical connections.
b. Component type and labeling verification.
c. Ratings of installed components.

3. Test manual and automatic operational features and system protective and alarm functions.
4. Test communication of status and alarms to remote monitoring equipment.
5. The UPS system will be considered defective if it does not pass tests and inspections. See Section 01 40 00 "Quality Requirements" for retesting and re-inspecting requirements and Section 01 73 00 "Execution" for directions for correcting the Work.

B. Record of Tests and Inspections: Maintain and submit documentation of tests and inspections, including references to manufacturers' written instructions and other test and inspection criteria. Include results of tests, inspections, and retests.

C. Reports: Prepare test and inspection reports and submit for approval.

END OF SECTION 271100