

January 6, 2023

PROJECT MANUAL VOLUME 1

# **Security Upgrades City of Wheeling Fire Stations**

City of Wheeling  
1500 Chapline Street  
Wheeling, WV 26003

Division	Section Title
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**DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS**

000100	COVER PAGE
000101	TABLE OF CONTENTS

***VOLUME 1***

**DIVISION 01 - GENERAL REQUIREMENTS**

011000	SUMMARY OF WORK
012600	CONTRACT MODIFICATION PROCEDURES
012900	PAYMENT PROCEDURES
013100	PROJECT MANAGEMENT AND COORDINATION
013200	CONSTRUCTION PROGRESS DOCUMENTATION
013233	PHOTOGRAPHIC DOCUMENTATION
013300	SUBMITTAL PROCEDURES
014000	QUALITY REQUIREMENTS
014200	REFERENCES
016000	PRODUCT REQUIREMENTS
017300	EXECUTION
017700	CLOSEOUT PROCEDURES
017823	OPERATION AND MAINTENANCE DATA
017839	PROJECT RECORD DOCUMENTS
017900	DEMONSTRATION AND TRAINING

**DIVISION 8 - DOORS HARDWARE**

087100	DOOR HARDWARE
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**DIVISION 26 - ELECTRICAL**

260000	GENERAL REQUIREMENTS FOR ELECTRICAL
260519	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
260544	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING
260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS
262416	PANELBOARDS
262726	WIRING DEVICES

**DIVISION 27 - COMMUNICATIONS**

270000	GENERAL TECHNOLOGY REQUIREMENTS
270500	COMMUNICATIONS GENERAL REQUIREMENTS
270523	PATHWAYS FOR TECHNOLOGY SYSTEMS
270526	GROUNDING AND BONDING FOR TECHNOLOGY SYSTEMS
271100	COMMUNICATIONS EQUIPMENT ROOMS
271300	COMMUNICATIONS BACKBONE CABLING
271500	COMMUNICATIONS HORIZONTAL CABLING
271600	COMMUNICATIONS CONNECTING CORDS
271800	COMMUNICATIONS LABELING AND IDENTIFICATION
272100	NETWORK ELECTRONICS AND UPS SYSTEMS
276000	PHYSICAL SECURITY GENERAL REQUIREMENTS
276200	ELECTRONIC ACCESS CONTROL SYSTEM
276600	VIDEO SURVEILLANCE SYSTEM

**DIVISION 28 - ELECTRONIC SAFETY AND SECURITY**

281300	Access Control Software and Database Management
282300	Video Management System

END OF TABLE OF CONTENTS

**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. Project information.
- 2. Work covered by Contract Documents.
- 3. Work by Owner.
- 4. Work under separate contracts.
- 5. Future work.
- 6. Purchase contracts.
- 7. Owner-furnished products.
- 8. Contractor-furnished, Owner-installed products.
- 9. Access to site.
- 10. Work restrictions.
- 11. Specification and drawing conventions.
- 12. Use of Architect's Digital Files

- B. Related Section:

- 1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
- 2. Division 01 Section "General Commissioning Requirements" for coordination with Owner's Commissioning Agent.

**1.3 PROJECT INFORMATION**

- A. Project Identification: City of Wheeling – Fire Station Security Upgrades

- B. Owner: City of Wheeling

- 1. Owner's Representative: Michael A. Lloyd, Director of Information Technology.

**1.4 WORK COVERED BY CONTRACT DOCUMENTS**

- A. The Work of the Project is defined by the Contract Documents and consists of the following:

- 1. Unified Security Platform (SECURITY SYSTEMS) including IP-CCTV and Access Control to six fire stations and a new FD Headquarters Building

**1.5 FURNISHINGS**

- A. These specifications and accompanying drawings are intended to cover the furnishing of all labor, material, and equipment and superintendence of the Security Systems.

- B. It is the intent and purpose of these specifications and accompanying drawings to cover and include each item, all materials, machinery, apparatus, and labor necessary to properly install,

equipment, adjust, and put into perfect operation the respective portions of the installations specified and to so interconnect the various items or sections of the work as to form a complete and properly operating whole.

C. Any equipment, apparatus, conduit, cabling material and small items not mentioned in detail, and labor not hereinafter specifically mentioned, which may be found necessary to complete or perfect any portion of installation in a substantial manner, and in compliance with the requirements stated, implied or intended in these specifications shall be furnished without extra cost. This shall include all materials, devices or methods peculiar to the machinery, equipment, apparatus, or systems furnished and installed as part of the SECURITY SYSTEMS work.

D. Type of Contract

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

#### 1.6 PHASED CONSTRUCTION

A. The Work shall be conducted in phases as coordinated by the Owner.

B. Before commencing Work of each phase, submit an updated copy of the Contractor's construction schedule showing the sequence, commencement and completion dates, and move-in dates of Owner's personnel for all phases of the Work.

#### 1.7 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

#### 1.8 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

#### 1.9 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.

B. Owner-Furnished Products:

1. The City of Wheeling will provide the network uplink from each of the fire stations to the new HQ building.

#### 1.10 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

C. Condition of Existing Building: Repair damage caused by construction operations.

1.11 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
  - 1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours, Monday through Friday, except as otherwise directed by the Owner.
- C. Nonsmoking Building:
  - 1. Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor air intakes.
- D. Controlled Substances: Use of tobacco products and other controlled substances on the Project site is not permitted.

1.12 SPECIFICATION AND DRAWING CONVENTIONS

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

1.13 USE OF ARCHITECTS DIGITAL FILES

- A. It is understood and agreed that the drawings, specifications or other documents prepared by The Architect and Engineers, whether in hard copy or electronic format are instruments of service prepared solely for use in connection with the Project for which the documents were prepared. The Architect shall retain all statutory, common law, and other reserved rights, including copyright. Notwithstanding the Architect's agreement to release Electronic Documents to Recipients authorized by the Owner, this agreement to transfer Electronic Documents shall in no way alter the parties' rights as set forth in their respective Agreements for the Project, including the specific provisions pertaining to the Architect's Instruments of Service.
- B. Except as expressly referenced otherwise herein, the Electronic Documents (including printed copies of the Electronic Documents) shall not be added to, modified or altered in any way by the Owner or the Recipient; and, the Owner and the Recipient shall not allow other persons to add

to, modify or in any way alter the Electronic Documents or printed copies of the Electronic Documents.

- C. After transmission of Electronic Documents by the Architect, the Architect shall not be liable for any revisions, modifications or changes of any kind made to any Electronic Documents by the Recipient or the Recipient's employees, agents, consultants or other third party that receives the Electronic Documents from the Recipient.
- D. The Electronic Documents are not a product, nor should the Electronic Documents be construed to be a product. By requesting the Electronic Documents from the Owner and receiving Electronic Documents from the Architect, the Recipient acknowledges that there are no warranties of any kind, express or implied, concerning the Electronic Documents or the media in which the Electronic Documents is contained.
- E. The Architect shall transfer Electronic Documents to the Recipient only upon the Owner's request. If the Owner requests the Architect to transfer Electronic Documents directly to the Recipient, the Architect must receive a written Request and Authorization form, with an acknowledgement that the Owner and the Recipient have read, understand and will adhere to the requirements of this "Terms and Release for Use of Electronic Documents". The Request and Authorization form shall be signed by and submitted jointly by the Owner and the Recipient to the Architect.
- F. Transfer of Electronic Documents is not intended to create third-party beneficiary status, or any other cause of action, in favor of the Recipient or its sub-contractors, material, men, suppliers, vendors and/or any other third-party against the Architect, including the Architect's employees and consultants.
  - 1. **To the fullest extent permitted by law, the Each Prime Contractor or subcontractor, vendor or consultant hereby indemnifies and holds harmless City of Wheeling and its officers, directors, employees and consultants from and against all claims, damages, losses and expenses, including, but not limited to, attorney's fees arising out of, relating to and resulting from use of any information provided by City of Wheeling.**
  - 2. The Each Prime Contractor or subcontractor, vendor or consultant agrees to keep confidential information confidential and not to disclose to anyone except the Each Prime Contractor or subcontractor, vendor or consultant' employees, subcontractor, vendor or consultants that need to know in order to perform services or construction for the project.
  - 3. The Recipient of the Electronic Documents assumes all risk and responsibility for its use of the Electronic Documents. Recipient agrees to indemnify and hold harmless City of Wheeling and its sub-consultants, and each of their officers, directors, shareholders, partners, and employees, from and against all claims, liabilities, judgments, damages, costs and expenses, including attorney fees, that arise as a result of (a) the Recipient's non-compliance with the requirements and procedures governing the transfer of Electronic Documents; or (b) errors, omissions, or other defects in the Electronic Documents that were not present in the Contract Documents; or (c) where the use of the Contract Documents rather than the Electronic Documents would have prevented the claims, liabilities, judgments, damages, costs and expenses; this paragraph applies whether the claims, liabilities, judgments, damages, costs and expenses are based on breach of contract, breach of warranty, misrepresentation, negligence or other tort.
- G. In accepting and using Digital Data, provided by City of Wheeling, the Prime Contractor or subcontractor, vendor or consultant recognizes and accepts the following:
  - 1. The Electronic Documents provided to Recipients authorized by the Owner are being provided as a convenience to the Recipient. The Electronic Documents transferred are not, and shall not be construed to be, part of the Contract Documents. The Electronic Documents are not intended to replace or supplement the Contract Documents.

- Electronic Documents provided to the Recipient shall not be information that can be relied upon by the Recipient.
2. The Each Prime Contractor or subcontractor, vendor or consultant is fully and solely responsible to verify the accuracy of the drawings and the actual built conditions produce from the digital files, as it may affect the Each Prime Contractor or subcontractor, vendor or consultant's work.
    - a. The Recipient is responsible for comparing the Electronic Documents with the Contract Documents, new and existing field conditions. Prior to utilizing the Electronic Documents in connection with the Project, the Recipient shall, in all instances, compare the Electronic Documents to the paper copies of the Contract Documents to ensure that the Electronic Documents are consistent with the paper copies of the Contract Documents. If there are conflicts between the Electronic Documents and the paper copies of the Contract Documents, the paper copies of the Contract Documents shall be presumed to be correct and take precedence over the Electronic Documents.
  3. The drawings are an instrument of service of City of Wheeling who shall be deemed the author of the drawings and shall retain all common law, statutory and other reserved rights, including the copyright.
  4. The Recipient may use the Electronic Documents to prepare documents that it is obligated to prepare for the Project provided that the Recipient removes the Architect's and/or the Architect's Consultants' title block (and any other identifying information) from the Electronic Documents. The Recipient, including the Recipient's sub-contractors, material, men, suppliers and vendors, shall not use the Electronic Documents as a shop drawing or other submittal. The only exception to this restriction shall be that the Recipient may use the Electronic Documents as the background for which to prepare its shop drawings or other submittal.
    - a. The Recipient shall not utilize or allow to be utilized the Electronic Documents transferred pursuant to this section for any purpose other than for this Project. If the Recipient utilizes, or allows to be utilized, the Electronic Documents transferred pursuant to this section for any purpose other than this Project, the Recipient agrees to indemnify, defend and hold harmless the Owner, and the Architect, including the Architect's consultants, for any and all claims, losses, damages or expenses, including reasonable attorney fees, arising out of or resulting from the unauthorized use of the Electronic Documents. Moreover, the Recipient hereby further agrees to pay the Owner's, Architect's and the Architect's (including the Architect's consultants') expenses, including reasonable attorney fees, in connection with any effort, including legal actions and cases in equity, by the Owner, Architect or the Architect (including the Architect's consultants') to prevent the unauthorized use of Electronic Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
  - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.( and documented in this section

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on Modification description form & box checked appropriately to be issued by Architect.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    - e. Change Order Request Form: Use Change Order form in the contractor's standard format.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
  - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

**1.4 CHANGE ORDER PROCEDURES**

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on form included in Project Manual.

**1.5 CONSTRUCTION CHANGE DIRECTIVE**

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Construction Change Directive must be signed by the owner's representative to authorize the contractor to proceed with indicated work.
- C. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.
  2. Notify Owner's On Site Representative prior to proceeding with work for verification purposes.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

**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 necessary to prepare and process Applications for Payment.
- B. Related Requirements:
  - 1. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
  - 2. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  - 3. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

**1.3 DEFINITIONS**

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

**1.4 SCHEDULE OF VALUES**

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.
  - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with continuation sheets.
    - b. Submittal schedule.
  - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
  - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
  - 4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
  - 5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment

requests, provide subschedules showing values coordinated with the scope of each design services contract as described in Section 011000 "Summary."

- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the schedule of values:
    - a. Project name and location.
    - b. Contractor's name and address.
    - c. Date of submittal.
  2. Arrange schedule of values consistent with format of AIA Document G703.
  3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
    - a. Related Specification Section or Division.
    - b. Description of the Work.
    - c. Name of subcontractor.
    - d. Name of manufacturer or fabricator.
    - e. Name of supplier.
    - f. Change Orders (numbers) that affect value.
    - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
      - 1) Labor.
      - 2) Materials.
      - 3) Equipment.
  4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
  5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
  6. 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. If required, include evidence of insurance.
  7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
  8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
  9. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit 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 Contractor's option.
10. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

## 1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
  1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
  1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
  1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
  3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
  4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
  1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
  2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
  3. Provide summary documentation for stored materials indicating the following:
    - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.

- b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
  - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit one signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
- 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
- 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  - 2. When an application shows completion of an item, submit conditional final or full waivers.
  - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  - 4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
- 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  - 2. When an application shows completion of an item, submit conditional final or full waivers.
  - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  - 4. Submit final Application for Payment with or preceded by conditional 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 executed waivers of lien on forms, acceptable to Owner.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
- 1. List of subcontractors.
  - 2. Schedule of values.
  - 3. Contractor's construction schedule (preliminary if not final).
  - 4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
  - 5. Products list (preliminary if not final).
  - 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 authorities having jurisdiction for performance of the Work.
  12. Initial progress report.
  13. Report of preconstruction conference.
  14. Certificates of insurance and insurance policies.
  15. Performance and payment bonds.
  16. Data needed to acquire Owner's insurance.
- J. Interim Application for Payment: Administrative actions and submittals that are scheduled at regular intervals to coincide with Application submission.
1. Updated Schedule of Values.
- K. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- L. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement, accounting for final changes to the Contract Sum.
  4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
  5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
  6. AIA Document G707, "Consent of Surety to Final Payment."
  7. Evidence that claims have been settled.
  8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
  9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900



**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Administrative and supervisory personnel.
  - 3. Coordination drawings.
  - 4. Requests for Information (RFIs).
  - 5. Project Web site.
  - 6. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
  - 1. Section 011200 "Multiple Contract Summary" for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
  - 2. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
  - 3. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 4. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.
  - 5. Section 018113 "Sustainable Design Requirements" for description of ongoing submittals requiring periodic updates.
  - 6. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

**1.2 DEFINITIONS**

- A. RFI: Request from Owner, Architect, or Contractor seeking information from each other during construction, required by or clarifications of the Contract Documents.
- B. PIM: Project Information Management system that tracks activity on the project and is accessible to project participants on a selective basis.
- C. Static Project Information: project information that is not editable on the project website and must be removed from the website edited and reloaded to be accurate.
- D. Website forms and processes: website provided forms, tracking methods editing tools etcetera, for submitting information to the various parties involved in the management of the project.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, and telephone number of entity performing subcontract or supplying products.

2. Number and title of related Specification Section(s) covered by subcontract.
  3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.

#### 1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

#### 1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    - b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

- c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
  - d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
  - e. Indicate required installation sequences.
  - f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. AutoCAD
  2. Architect will furnish through the owner to the Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
    - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
    - b. Refer to Division 01 Section Summary for requirements for using Architect's digital files.

#### 1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
  2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
  2. Project number.
  3. Date.
  4. Name of Contractor.
  5. RFI number, numbered sequentially.
  6. RFI subject.
  7. Specification Section number and title and related paragraphs, as appropriate.
  8. Drawing number and detail references, as appropriate.
  9. Field dimensions and conditions, as appropriate.
  10. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  11. Contractor's signature.

12. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
  - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
  
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
  1. Architect's [Attachments shall be electronic files in Adobe Acrobat PDF format.
  
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
  1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of Architect's actions on submittals.
    - g. Incomplete RFIs or inaccurately prepared RFIs.
  
  2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
  
  3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
  
- E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
  
- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:
  1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect.
  4. RFI number including RFIs that were dropped and not submitted or returned without action or withdrawn.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Architect's response was received.
  
- G. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
  1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
  2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
  2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  3. Minutes: Architect will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
  2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Lines of communications.
    - f. Procedures for processing field decisions and Change Orders.
    - g. Procedures for RFIs.
    - h. Procedures for testing and inspecting.
    - i. Procedures for processing Applications for Payment.
    - j. Distribution of the Contract Documents.
    - k. Submittal procedures.
    - l. Sustainable design requirements.
    - m. Status of ongoing submittals related to LEED certification
    - n. Preparation of record documents.
    - o. Use of the premises.
    - p. Work restrictions.
    - q. Working hours.
    - r. Owner's occupancy requirements.
    - s. Responsibility for temporary facilities and controls.
    - t. Procedures for moisture and mold control.
    - u. Procedures for disruptions and shutdowns.
    - v. Construction waste management and recycling.
    - w. Parking availability.
    - x. Office, work, and storage areas.
    - y. Equipment deliveries and priorities.
    - z. First aid.
    - aa. Security.
    - bb. Progress cleaning.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, and Owner's Commissioning Authority of scheduled meeting dates.
  2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Review of mockups.
    - i. Possible conflicts.
    - j. Compatibility requirements.
    - k. Time schedules.
    - l. Weather limitations.
    - m. Manufacturer's written instructions.
    - n. Warranty requirements.
    - o. Compatibility of materials.
    - p. Acceptability of substrates.
    - q. Temporary facilities and controls.
    - r. Space and access limitations.
    - s. Regulations of authorities having jurisdiction.
    - t. Testing and inspecting requirements.
    - u. Installation procedures.
    - v. Coordination with other work.
    - w. Required performance results.
    - x. Protection of adjacent work.
    - y. Protection of construction and personnel.
  3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
  5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
  2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors;

suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
  - a. Preparation of record documents.
  - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
  - c. Submittal of written warranties.
  - d. Requirements for completing sustainable design documentation.
  - e. Requirements for preparing operations and maintenance data.
  - f. Requirements for delivery of material samples, attic stock, and spare parts.
  - g. Requirements for demonstration and training.
  - h. Preparation of Contractor's punch list.
  - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
  - j. Submittal procedures.
  - k. Coordination of separate contracts.
  - l. Owner's partial occupancy requirements.
  - m. Installation of Owner's furniture, fixtures, and equipment.
  - n. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

**E. Progress Meetings: Conduct progress meetings at biweekly intervals.**

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
  - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - 1) Review schedule for next period.
  - b. Review present and future needs of each entity present, including the following:
    - 1) Interface requirements.
    - 2) Sequence of operations.
    - 3) Resolution of BIM component conflicts.
    - 4) Status of submittals.
    - 5) Status of sustainable design documentation.
    - 6) Deliveries.
    - 7) Off-site fabrication.

- 8) Access.
  - 9) Site utilization.
  - 10) Temporary facilities and controls.
  - 11) Progress cleaning.
  - 12) Quality and work standards.
  - 13) Status of correction of deficient items.
  - 14) Field observations.
  - 15) Status of RFIs.
  - 16) Status of proposal requests.
  - 17) Pending changes.
  - 18) Status of Change Orders.
  - 19) Pending claims and disputes.
  - 20) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
1. Startup construction schedule.
  2. Contractor's construction schedule.
  3. Construction schedule updating reports.
  4. Daily construction reports.
  5. Material location reports.
  6. Site condition reports.
  7. Special reports.
  8. Draft and final Waste Management Plan
  9. Periodic waste management reports.
  10. Draft and final construction-indoor air quality management plan
  11. Periodic construction-indoor air quality reports.
  12. Building material certification form. (BMcF)
- B. Related Requirements:
1. Section 013100 "Project Management and Coordination" for report and schedule formats and inclusion of project web site in document management.
  2. Section 013300 "Submittal Procedures" for submitting schedules and reports.
  3. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.
  4. Section 017418 "Construction Waste Management and Disposal" for procedures and reporting requirements on the disposal of waste and the calculation of percentages of waste not land filled.

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  2. Predecessor Activity: An activity that precedes another activity in the network.
  3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.

1. Float time belongs to Owner.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

### 1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file.

B. Startup construction schedule.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

E. Construction Schedule Updating Reports: Submit with Applications for Payment.

F. Daily Construction Reports: Submit at weekly intervals.

G. Material Location Reports: Submit at weekly intervals.

H. Site Condition Reports: Submit at time of discovery of differing conditions.

I. Special Reports: Submit at time of unusual event.

J. Qualification Data: For scheduling consultant.

1.4 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
  - 1. Review software limitations and content and format for reports.
  - 2. Verify availability of qualified personnel needed to develop and update schedule.
  - 3. Discuss constraints, including phasing and work stages.
  - 4. Review delivery dates for Owner-furnished products.
  - 5. Review schedule for work of Owner's separate contracts.
  - 6. Review submittal requirements and procedures.
  - 7. Review time required for review of submittals and resubmittals.
  - 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
  - 9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
  - 10. Review and finalize list of construction activities to be included in schedule.
  - 11. Review procedures for updating schedule.

1.5 COORDINATION

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

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice of Proceed to date of final completion.
  - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
  - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
  - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in

schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
  4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
  5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
  6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
  2. Work under More Than One Contract: Include a separate activity for each contract.
  3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
  4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  6. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Uninterruptible services.
    - c. Partial occupancy before Substantial Completion.
    - d. Use of premises restrictions.
    - e. Provisions for future construction.
    - f. Seasonal variations.
    - g. Environmental control.
  7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - a. Subcontract awards.
    - b. Submittals.
    - c. Purchases.
    - d. Mockups.
    - e. Fabrication.
    - f. Sample testing.
    - g. Deliveries.
    - h. Installation.
    - i. Waste management reports
    - j. Tests and inspections.
    - k. Adjusting.
    - l. Curing.
    - m. Startup and placement into final use and operation.

8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

- a. Structural completion.
- b. Temporary enclosure and space conditioning.
- c. Permanent space enclosure.
- d. Completion of mechanical installation.
- e. Completion of electrical installation.
- f. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion, and the following interim milestones:

1. Temporary enclosure and space conditioning.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

## 2.2 STARTUP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction.

## 2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.

- a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
  2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
  3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
  4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- B. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
    - a. Preparation and processing of submittals.
    - b. Mobilization and demobilization.
    - c. Purchase of materials.
    - d. Delivery.
    - e. Fabrication.
    - f. Utility interruptions.
    - g. Installation.
    - h. Work by Owner that may affect or be affected by Contractor's activities.
    - i. Testing and commissioning.
    - j. Punch list and final completion.
    - k. Activities occurring following final completion.
  2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
  3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
  4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
    - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- C. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- D. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
  2. Description of activity.
  3. Main events of activity.
  4. Immediate preceding and succeeding activities.

5. Early and late start dates.
  6. Early and late finish dates.
  7. Activity duration in workdays.
  8. Total float or slack time.
  9. Average size of workforce.
  10. Dollar value of activity (coordinated with the schedule of values).
- E. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
  2. Changes in early and late start dates.
  3. Changes in early and late finish dates.
  4. Changes in activity durations in workdays.
  5. Changes in the critical path.
  6. Changes in total float or slack time.
  7. Changes in the Contract Time.
- F. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
  2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
  3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
  4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
    - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.

## 2.4 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
  2. List of separate contractors at Project site.
  3. Approximate count of personnel at Project site.
  4. Equipment at Project site.
  5. Material deliveries.
  6. High and low temperatures and general weather conditions, including presence of rain or snow.
  7. Accidents.
  8. Meetings and significant decisions.
  9. Unusual events (see special reports).
  10. Stoppages, delays, shortages, and losses.
  11. Meter readings and similar recordings.
  12. Emergency procedures.
  13. Orders and requests of authorities having jurisdiction.
  14. Change Orders received and implemented.
  15. Construction Change Directives received and implemented.
  16. Services connected and disconnected.

17. Equipment or system tests and startups.
  18. Partial completions and occupancies.
  19. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
  2. Material stored prior to previous report and since removed from storage and installed.
  3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

## 2.5 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
- C. Construction Air Quality Reports: Submit a minimum of three periodic reports describing methods taken to maintain the Plan submitted prior to commencement of the Work. Include not less than 6 photographs with each report documenting implementation of Plan.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

- 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 requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
  - 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
  - 2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
  - 3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
  - 6. Division 01 Section "Contractor Waste Management Plan" for administrative and reporting requirements regarding the disposal and treatment of demolition and construction waste
  - 7. Division 01 Section "General Commissioning Requirements" for administrative requirements and coordinated procedures for commissioning the mechanical, electrical and plumbing systems in the building.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.



**1.4 ACTION SUBMITTALS**

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
  2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
  3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule but no later than the second Application for Payment.
    - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
  4. Format: Arrange the following information in a tabular format:
    - a. Scheduled date for first submittal.
    - b. Specification Section number and title.
    - c. Submittal category: Action; informational.
    - d. Name of subcontractor.
    - e. Description of the Work covered.
    - f. Scheduled date for Architect's final release or approval.
    - g. Scheduled date of fabrication.
    - h. Scheduled dates for purchasing.
    - i. Scheduled dates for installation.
    - j. Activity or event number.
  5. Delivery: Submittals shall be delivered to the Architect in digital format (pdf) that is compatible with the Newforma Info Exchange™ system as administered by the Architect.

**1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS**

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
- B. At the request of the Owner, the Architect shall transfer Electronic Documents to Recipients authorized by the Owner. Electronic Documents that may be transferred from the Architect to Recipients authorized by the Owner are for the convenience of the Recipient in connection with the Recipient's preparation of certain documents for the Project.
1. The Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
    - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    - b. Under no circumstances shall the transfer of the drawings, or other instruments of service, for use by the General Contractor or subcontractor, vendor or consultant be deemed to be a sale by Renaissance 3 Architects, P. C., and Renaissance 3

- Architects, P. C. makes no warranties, express or implied, of merchantability or of fitness for a particular purpose; and
- c. Digital Drawing Software Program: The Contract Drawings are available in Adobe Acrobat version 9 AutoCAD version (2010)
  - d. General Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual with the Owner. Architect will comply with Owner instructions.
  - e. Drawing files will only be issued to the General Contractor
    - 1) Subcontractors shall obtain digital file from the General Contractor.
  - f. In accepting and using Digital Data, the General Contractor or subcontractor, vendor or consultant recognizes and accepts the following:
    - 1) The drawings shall not be used in whole or part for any project or purpose, other than, PREPARATION OF SHOP DRAWINGS for the project for which they were prepared.
  - g. The following digital data files will be furnished to the General Contractor. The General Contractor shall be responsible to sort the information contained in each file for each subcontractor, vendor or consultant base upon the issued contract drawings and specifications:
    - 1) Floor plans.
    - 2) Reflected ceiling plans.
    - 3) Building Section
    - 4) Elevations
- C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
  4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 days for review of each resubmittal.
  4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal. The Sequential Review submittals are listed below.
    - a. Division 03 (Concrete)
    - b. Division 05 (Metals- structural steel)
    - c. Division 08 - Section 087100
    - d. Division 21 (Fire protection)
    - e. Division 22 (Plumbing)
    - f. Division 23 (HVAC)
    - g. Division 26 (Electrical)
    - h. Division 27 (Communication)
    - i. Division 28 electronic Safety & Security
    - j. Division 31 – (Earthwork)
    - k. Division 32 – (Exterior improvements)
    - l. Division 33 (Utilities)
  5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  2. Name file with submittal number or other unique identifier, including revision identifier.
    - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
  3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
  4. Include the following information on an inserted cover sheet:
  5. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner, containing the following information:
    - a. Project name.
    - b. Date.
    - c. Name and address of Architect.
    - d. Name of Contractor.
    - e. Name of firm or entity that prepared submittal.
    - f. Names of subcontractor, manufacturer, and supplier.
    - g. Category and type of submittal.
    - h. Submittal purpose and description.

- i. Specification Section number and title.
  - j. Indication of full or partial submittal.
  - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
  - l. Drawing number and detail references, as appropriate.
  - m. Location(s) where product is to be installed, as appropriate.
  - n. Related physical samples submitted directly.
  - o. Indication of full or partial submittal.
  - p. Transmittal number, numbered consecutively.
  - q. Submittal and transmittal distribution record.
  - r. Other necessary identification.
  - s. Remarks.
6. Metadata: Include the following information as keywords in the electronic submittal file metadata:
- a. Project name.
  - b. Number and title of appropriate Specification Section.
  - c. Manufacturer name.
  - d. Product name.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- 1. Note date and content of previous submittal.
  - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

## PART 2 - PRODUCTS

### 2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections. Collect related information for each type of product or equipment and combine

product data, shop drawings, samples, material certificates, and Testing and inspection reports into a single submittal.

1. Post electronic submittals as PDF electronic files directly to Architect's PIM site specifically established for Project.
    - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
  2. Action Submittals: Submit one digital copy of each submittal unless otherwise indicated. Architect will return Insert number copies.
  3. Informational Submittals: Submit one digital copy of each submittal unless otherwise indicated. Architect will not return copies.
  4. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
  5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
    - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
  6. Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams showing factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.
    - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
  6. Submit Product Data in the following format:
    - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).
  3. Submit Shop Drawings in the following format:
    - a. PDF electronic file.
  4. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.
    - a. Refer to Section 013100 "Project Management and Coordination" for requirements for coordination drawings.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of applicable Specification Section.
    - e. Specification paragraph number and generic name of each item.
  3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
  4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

- a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
  - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
- a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
- a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
    - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
    - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
  2. Manufacturer and product name, and model number if applicable.
  3. Number and name of room or space.
  4. Location within room or space.
  5. Submit product schedule in the following format:
    - a. PDF electronic file.
- F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- K. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.
  - 3. Drawing number and detail references, as appropriate, covered by subcontract.
  - 4. Submit subcontract list in the following format:
    - a. PDF digital file.
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

- U. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."
- V. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- X. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- Y. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- Z. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

## 2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

2. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

### PART 3 - EXECUTION

#### 3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

#### 3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action. action, as follows:
  1. NO EXCEPTION TAKEN:
    - a. The product or installation does appear to conform to contract documents.
  2. MAKE CORRECTIONS NOTED:
    - a. The work as submitted does not conform to contract documents, However when the marks and notations are corrected it should allow current submission to conform to the contract documents. No resubmission is required.
  3. REJECTED:
    - a. The product or installation does not conform to contract documents, select appropriate or specified manufacturers, products or installation techniques.
  4. SUBMIT SPECIFIED:
    - a. Approval of the product or installation is contingent on the subsequent submission and approval of additional items as notated on the current submission.
  5. REVISE AND RESUBMIT:
    - a. The work as submitted does not conform to contract documents, the marks and notations must corrected to allow submission conform to the contract documents. Resubmit the products or installation intent to the architect for verification that changes have been made and will still conform to the contract documents.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

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

END OF SECTION 013300

**PART 1 - GENERAL**

**1.1 DEFINITIONS**

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

**1.2 INDUSTRY STANDARDS**

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

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- A. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities typical for the industry relate to the section from which they are referenced. If confusion arises Architect will clarify the abbreviation
- B. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities typical for the industry relate to the section from which they are referenced. If confusion arises Architect will clarify the abbreviation
- C. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulation in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
- D. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

**PART 1 - GENERAL**

**1.1 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. Division 01 Section "Substitution Procedures" for requests and reviews of substitutions.
  - 2. Division 01 Section "General Commissioning Requirements" for additional testing requirements.
  - 3. Division 01 Section "Alternates" for products selected under an alternate.
  - 4. Division 01 Section "References" for applicable industry standards for products specified.
  - 5. Division 01 through 49 for specific product requirements.

**1.2 DEFINITIONS**

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

**1.3 ACTION SUBMITTALS**

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Include any previously submitted Substitution Request Forms whether for "during Bid phase" (form 012500.01) or "after Bid phase" (012500.02) with Architect's approval verification.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Section 013300 "Submittal Procedures."

- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

#### 1.4 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.

#### 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

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

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. 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.

## 1.6 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. Refer to 02 through 49. 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 not in conflict with requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Architect will make selection.
  5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
  6. **Or Equal:** For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. **Product Selection Procedures:**

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  3. Products:
    - a. Restricted List: 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.
    - b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
  4. Manufacturers:
    - a. Restricted List: 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.
    - b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
  5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

**2.2 COMPARABLE PRODUCTS**

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Proposed product has been previously submitted as a substitute to the originally specified product using the forms and procedures as outlined in Section 012500. Proposed product must receive a positive review from the Architect prior to its designation as a comparable product.
  2. As required by the Architect, further evidence may be required to determine whether Evidence that the proposed product does not require revisions to the Contract Documents. If revisions are required, the cost of researching the required revisions and the cost of those revisions shall be incorporated into the proposed product's installed cost. The proposed product shall also be , that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work. Compatibility shall be verified by distribution of proposed product submittal to other trades, as required, for impacts on their portion of the Work. The General Contractor shall manage and coordinate the activities required to determine compatibility of proposed product on the Work and on the Work Schedule.
  3. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  4. Evidence that proposed product provides specified warranty.
  5. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
  6. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

1.1

- A. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work
- B. Certificates of Release: From authorities having jurisdiction.
- C. Certificate of Insurance: For continuing coverage.
- D. Field Report: For pest control inspection.

1.2 MAINTENANCE MATERIAL SUBMITTALS

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

1.3 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  - 2. Advise Owner of pending insurance changeover requirements.
  - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 5. Prepare and submit Project Record Documents. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
  - 6. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 7. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner and Architect. Label with manufacturer's name and model number where applicable.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
  - 8. Submit test/adjust/balance records.
  - 9. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
  2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  3. Complete startup and testing of systems and equipment.
  4. Submit test/adjust/balance records.
  5. Perform preventive maintenance on equipment used prior to Substantial Completion.
  6. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
  7. Advise Owner of changeover in heat and other utilities.
  8. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
  9. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  10. Advise Owner of changeover in heat and other utilities.
  11. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
  12. Complete final cleaning requirements, including touchup painting.
  13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for final completion.

#### 1.4 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
  2. Certified List of Incomplete Items: Submit certified copy of Contractor's Substantial Completion inspection list of incomplete items reviewed and noted by Architect items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report and warranty.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings.

6. Submit copies of record documents from each trade, final maintenance manuals, and damage or settlement surveys.
7. Submit final instructions to Owner on the operation and maintenance of all building equipment.
8. Submit consent of surety.
9. Submit all specific warranties, workmanship bonds, maintenance agreements, certifications and other similar documents.
10. Submit final releases enabling the Owner unrestricted access and use of services and utilities including all certificates of occupancy, operating certificates and similar releases.
11. Submit additional requirements not listed here but acknowledged in your construction contract

B. Inspection: Submit a list and written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction of items that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
  - a. Project name.
  - b. Date.
  - c. Name of Architect.
  - d. Name of Contractor.
  - e. Page number.
4. Submit list of incomplete items in the following format:
  - a. MS Excel electronic file. Architect will return annotated file.
  - b. PDF electronic file. Architect will return annotated file.

#### 1.6 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
  - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive **8-1/2-by-11-inch (215-by-280-mm)** paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
  - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

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

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

- a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
  - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
  - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
  - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
  - e. Remove snow and ice to provide safe access to building.
  - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  - h. Sweep concrete floors broom clean in unoccupied spaces.
  - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
  - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - k. Remove labels that are not permanent.
  - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
    - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
    - 2) Replace filters with MERV 13 or better rated filters as specified in Division 23 "Heating Ventilating And Air Conditioning"
  - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
  - q. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
- E. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

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

END OF SECTION 017700



**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.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
  - 4. Product maintenance manuals.
  - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Section 019113 "General Commissioning Requirements" for verification and compilation of data into 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. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Architect and Commissioning Authority will comment on whether content of operations and maintenance submittals are acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
  - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

- a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
  - b. Enable inserted reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

## PART 2 - PRODUCTS

### 2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
1. List of documents.
  2. List of systems.
  3. List of equipment.
  4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. 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.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

### 2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Name and contact information for Commissioning Authority.
8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
9. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. 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: Enable bookmarking of 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.

## 2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

## 2.4 OPERATION MANUALS

A. 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.

B. 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.

C. 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.

- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.5 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
1. Product name and model number.
  2. Manufacturer's name.
  3. Color, pattern, and texture.
  4. Material and chemical composition.
  5. Reordering information for specially manufactured products.
- D. 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.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. 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.

**2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS**

- A. 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 warranty and bond information, as described below.
- B. 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.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins.
  - 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.
- D. 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.
- E. 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.
- F. 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.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. 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 3 - EXECUTION**

**3.1 MANUAL PREPARATION**

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original project record documents as part of operation and maintenance manuals.
  - 2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."
- G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823



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 017300 "Execution" for final property survey.
  - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
  - 3. 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 copies of record Drawings as follows:
    - a. Initial Submittal:
      - 1) Submit PDF electronic files of scanned record prints
      - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
    - b. Final Submittal:
      - 1) Submit PDF electronic files of scanned record prints.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
  - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
  - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
    - e. Cross-reference record prints to corresponding archive photographic documentation.
  - 2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations below first floor.
    - 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. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
  - 1. Format: Annotated PDF electronic file with comment function enabled.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Format: Annotated PDF electronic file.
2. 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.
3. Identification: As follows:
  - a. Project name.
  - b. Date.
  - c. Designation "PROJECT RECORD DRAWINGS."
  - d. Name of Architect.
  - e. Name of Contractor.

## 2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
  1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file.

## 2.3 RECORD PRODUCT DATA

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

## 2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.
  1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

3.1 RECORDING AND MAINTENANCE

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

END OF SECTION 017839

PART 1 - GENERAL

1.1 SUMMARY

- A. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
  - 2. Electromechanical door hardware, power supplies, back-ups and surge protection.
  
- B. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. ICC/IBC - International Building Code.
  - 3. NFPA 70 - National Electrical Code.
  - 4. NFPA 80 - Fire Doors and Windows.
  - 5. NFPA 101 - Life Safety Code.
  - 6. NFPA 105 - Installation of Smoke Door Assemblies.
  - 7. State Building Codes, Local Amendments.
  
- C. Standards: All hardware specified herein shall comply with the following industry standards:
  - 1. ANSI/BHMA Certified Product Standards - A156 Series
  - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
  
- B. Door Hardware Schedule: The finish hardware supplier shall, prior to ordering and/or delivering, prepare and submit to Architect within ten days after award of contract an electronic PDF detailed and engineered, vertical type hardware schedule conforming to DHI publication, "Sequence and Format of the Hardware Schedule" engineering and detailing door hardware specified ensuring all components work together, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware. Hardware schedules submitted without the AHC's signature will be rejected without review.
  - 1. Engineering Responsibility: Hardware supplier is responsible to properly coordinate mechanical hardware and electronic hardware specified for each door and ensures that the specified hardware will all work together without any mounting or electrical conflicts. If any conflicts are encountered, they must be addressed at time of hardware submittal for Architect to review. Supplier is responsible to provide suggested resolutions for every issue of conflict they request information on.
    - a. Any material that is ordered, and will not fit on doors and frames and is required for the intended use, such material shall be removed and replaced at no additional cost to the owner.
  
  - 2. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

3. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  4. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
- C. Where hardware is specified to be supplied by section 087100 for installation in Section 084113, coordinate hardware requirements prior to submitting schedule for approval. Clearly indicate on submittals any deviations from hardware specified and why the additional or deviated hardware is required. Any material that is ordered, and will not fit on Aluminum-Framed Entrances and Storefront doors and frames and is required for the intended use, such material shall be removed and replaced at no additional cost to the owner.
- D. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
    - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    - b. Complete (risers, point-to-point) access control system block wiring diagrams.
  2. Electrical Coordination: Coordinate with related Division 26 Electrical Sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- E. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.
- 1.3 INFORMATIONAL SUBMITTALS
- A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.
  - B. Warranties and Maintenance: Special warranties and maintenance agreements specified in this

Section.

- C. The Architect will check the Hardware Schedule submitted for quality and types only, but Hardware Supplier shall be solely responsible for quantities, errors, omissions and full conformance with the specifications and the drawings including all addenda and bulletins.

#### 1.4 QUALITY ASSURANCE

- A. Where items of hardware are not definitely or correctly specified and is required for the intended operation, such omission, error or other discrepancy should be directed to the Architect prior to the bid date for clarification by addendum. Otherwise, furnish such items in the type, quality and quantity established by this specification for the appropriate service intended. Should any material be ordered without proper coordination, it shall be replaced at no additional cost to the owner.
- B. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- C. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Installation shall be in compliance with Federal ADA Guidelines, Installation of all hardware (except that noted by storefront supplier) is to be by General Contractor.
- E. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
  - 1. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- F. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.
  - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
  - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- G. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:
  - 1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 2. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG),"

ANSI A117.1 as follows:

- a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
  - b. Door Closers: Comply with the following maximum opening-force requirements indicated:
    - 1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
    - 2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
  - c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
3. NFPA 101: Comply with the following for means of egress doors:
- a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
  - b. Thresholds: Not more than 1/2 inch high.
4. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 (neutral pressure at 40" above sill) or UL-10C.
- a. Test Pressure: Positive pressure labeling.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
1. Prior to installation of door hardware, arrange for hardware supplier and manufacturers' representatives to hold a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
  2. Electrical Operation: Verify function of all openings requiring electrified hardware. In addition to Owner, Contractor, Architect; conference participants shall also include Hardware Supplier's Architectural Hardware Consultant, Electrical contractor, Low Voltage contractor, Access Control System provider, automatic door operator supplier and related subs. Meeting shall result in all parties understanding of the functionality of others systems, interfacing between products and systems, requirements for wiring, power requirements, etc. Operation narratives have been provided in the hardware groups for reference and as an understanding of the desired function at each door. All involved parties shall provide preliminary Riser Diagrams of their respective systems and review if and how these systems interface. Results of any deviations from hardware specified shall clearly be indicate on submittals and why the additional or deviated hardware is required.
    - a. Any material that is ordered, and will not fit on doors and frames, will not function as desired based on the required operation of each opening and is required for the intended use, such material shall be removed and replaced at no additional cost to the owner



3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

- I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".
- D. Compare delivered hardware to Approved Hardware Schedule. Report any shortages or damaged materials to Architect and Supplier within 24 hours of delivery. Shortages not reported will be the Contractor's responsibility.

#### 1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.
- D. Coordinate delivery with other work to avoid delay. All work shall be coordinated with other sections.
- E. Keying Conference: A preliminary planning meeting shall be set three months before the building is occupied to determine keying system requirements. Meeting shall include the architect, a representative of the building occupant(s), representative from the Facilities Management Locksmithing Shop, and a representative the Hardware Supplier Certified Key System Specialist. Keying conference to incorporate the following criteria into the final keying schedule document:
  1. Function of building, purpose of each area and degree of security required.
  2. Plans for existing and future key system expansion.
  3. Requirements for key control storage and software.
  4. Installation of permanent keys, cylinder cores and software.

5. Address and requirements for delivery of keys.

- F. Electrical System Roughing-in: Based on Approved hardware submittals a coordination meeting shall be held on project site. In addition to Owner, Contractor, Architect; conference participants shall also include Hardware Supplier's Architectural Hardware Consultant, Electrical contractor, Low Voltage contractor, Access Control System provider, installers, related trades and related subs. All involved parties shall review the coordination, layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system, and building control system.
1. As a result of the Pre-Submittal meeting, Electrical Contractor shall provide one set of complete accurate elevation drawings with the understanding of the functionality of others systems, interfacing between products and systems, showing requirements for wiring, power requirements, etc. Operation narratives for each door shall be submitted along with point-to-point hook-up drawings. Any discrepancies, alterations, deviations and additions from products and/or systems specified shall be submitted to architect for review and acceptance.

#### 1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
1. Structural failures including excessive deflection, cracking, or breakage.
  2. Faulty operation of the hardware.
  3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
1. Ten years for mortise locks and latches.
  2. Seven years for heavy duty cylindrical (bored) locks and latches.
  3. Five years for exit hardware.
  4. Twenty five years for manual door closers.
  5. Two years for electromechanical door hardware.

#### 1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and

installation of original products.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
  - 1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
    - a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

### 2.2 SCREWS AND FASTENERS

- A. Fasteners: Use only manufacturer supplied fasteners required for the intended use. Any fasteners used that are not provided by the manufacturer, such material shall be removed and replaced and any substrate damaged shall be replaced at no additional cost to the owner.

### 2.3 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
  - 1. Acceptable Manufacturers:
    - a. ABH – (AB) – PT200/PT1000
    - a. Securitron (SU) - EL-CEPT Series.
    - b. Stanley (ST) – EPT-12C
    - c. Von Duprin (VD) - EPT-10 x CON Series.
- B. Wiring Harnesses: Provide electric transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Acceptable Manufacturers:
  - a. ACSI – LC x (# Wires).
  - b. Ives (IV) – CON x (# Wires).
  - c. McKinney Products (MK) – QC-C Series.
  - d. Stanley (ST) –WH Series.

Provide one each of the following similar tools of the manufacturer of electrified hardware as part of the base bid contract:

- e. McKinney Products (MK) - Electrical Connecting Kit: QC-R001.
- f. McKinney Products (MK) - Connector Hand Tool: QC-R003.

**2.4 DOOR OPERATING TRIM**

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified automatic flush bolts designed for use in metal doors and mortised into door edge for all doors. Coordinate with Wood Door Manufacturers. Provide top and bottom Flushbolts for inactive leaf of door pair, unless otherwise specified. Whenever top and bottom bolts are utilized, provide dustproof strike as required for sill conditions. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

1. Acceptable Manufacturers:

	<u>DCI</u>	<u>Hager</u>	<u>Ives</u>	<u>Rockwood</u>	<u>Trimco</u>
Auto- Metal Door- LBB	840	295M	FB31T	2840	3810T
Dust Proof Strike	82	280X	DP2	570	3911

- A. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Coordinators fabricated from steel with nylon-coated strike plates and built-in adjustable safety release. Provide coordinators complete with necessary closer brackets.

- B. Provide proper size coordinators for size of door, plus filler piece to complete total length of frame stop.

- C. Acceptable Manufacturers and Products:

	<u>DCI</u>	<u>Hager</u>	<u>Ives</u>	<u>Rockwood</u>	<u>Trimco</u>
Bar Type	600	297D	COR7G	2600	3094
Coordinator Series					

- D. Door Push Plates and Pulls: ANS/BHMA A156.6 certified door pushes and pulls of type and design specified below or in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Acceptable Manufacturers and Products:
  - a. Burns, Hager, Hiawatha, Rockwood and Trimco

- E. Vandal Resistant Pulls: Provide stainless steel anti-ligature design minimizing the opportunity for tampering with a black soft touch coating. Provide with through bolts at non-integrated mounting. Provide with mounting points that mate with exit device or mortise lock. Similar to Rockwood VRT24

1. Acceptable Manufacturers and Products:
  - a. Burns, Hager, Hiawatha, Rockwood and Trimco

- F. Locking Pull System: Post-mount style door pulls with integrated deadbolt locking system in type and design as specified in the Hardware Sets. Pulls available in multiple head, floor, or combination locking options, with outside keyed rim cylinder operation and inside turn piece activation. Mounting applications for aluminum, glass, steel and wood doors, with customized

sizing and configuration options. Pull finishes include brass, bronze, and stainless steel. Provide pulls standard with dustproof strike and auxiliary door stop as specified.

1. Acceptable Manufacturers:
  - a. Rockwood Manufacturing (RO) – LP Series.
  - b. C.R. Laurence DB-110 Series

## 2.5 CYLINDERS AND KEYING

- A. Provide temporary keyed construction cores and keys for all doors during the construction period. Construction control and operating keys and cores shall not be part of the Owner's permanent keying system or furnished on the same keyway (or key section) as the Owner's permanent keying system.
- B. Provide locksets, cylinders and cores that are keyed into Owners existing master key system. Key cylinders as directed by the owner. Owner to supply system expansion requirements.

## 2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Provide wrought boxes and curved lip strikes with lip length sufficient to minimally clear trim.
- B. Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified mortise locksets furnished in the functions as specified in the Hardware Sets. Furnish with standard 2 3/4" backset, 3/4" throw anti-friction stainless steel latchbolt, and a full 1" throw stainless steel bolt for deadbolt functions.
  1. Acceptable Manufacturers:
    - a. Sargent Manufacturing (SA) – 10 Line Series.
    - b. Or equal

## 2.7 ACCESS CONTROL SYSTEM

- A. Access Control System and all necessary equipment to properly operate security door hardware.
- B. Interfacing of this equipment with hardware specified in this section shall be the responsibility of the Access Control System Supplier.

## 2.8 ELECTRIC STRIKES

- A. Standard Electric Strikes: Heavy duty, electric strikes conforming to ANSI/BHMA A156.31, Grade 1, UL listed for both Burglary Resistance and for use on fire rated door assemblies. Provide strikes with 12 or 24 VDC capability and supplied standard as fail-secure unless otherwise specified.
  1. Acceptable Manufacturers:
    - a. HES (HS).
    - b. Von Duprin (VD).
    - c. Trine
- B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with combined products having unlimited lifetime warranty.

## 2.9 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
  2. Except on fire rated doors, provide exit devices with keyed cylinder dogging device to hold the pushbar and latch in a retracted position.
  3. Flush End Caps: Provide heavy weight impact resistant flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
  4. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty trim with cold forged escutcheons, beveled edges, and four threaded studs for thru-bolts.
    - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    - b. Where function of exit device requires a cylinder, provide an interchangeable core type keyed cylinder (Rim or Mortise) as specified in Hardware Sets.
  5. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets.
1. Acceptable Manufacturers:
    - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
    - b. Sargent Manufacturing (SA) - 80 Series.
    - c. Stanley-Precision (ST) Apex 2000 Series.
    - d. Von Duprin (VD) - 35A/98/99 XP Series.

## 2.10 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
  2. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
  3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide closers meeting requirements to physically handicapped, provide units complying with ANSI/ICC A117.1 provisions for door opening and closing force.
  4. Provide parallel rigid arm for closers mounted on push side of opening.
  5. Closer Arms: Where closers are mounted on push side and where door strikes fixed object such as sink, cabinet, and similar obstructions, provide a spring stop arm.
  6. Where closers are indicated to be delayed action, provide units designed with an adjustable delay that holds door open before closing cycle begins. Consult with Owner for time of delay.
  7. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
  8. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt.
- B. Door Closers, Surface Mounted (Extra Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Provide at exterior, vestibule, shipping room and storage room locations.

2. Acceptable Manufacturers:
    - a. Corbin Russwin Hardware (RU) – DC8000 Series.
    - b. LCN Closers (LC) – 4040XP Series.
    - c. Norton Door Controls (NO) - 7500 Series.
    - d. Sargent Manufacturing (SA) - 351 Series.
    - e. Stanley (ST) D4550 Series.
  
  - C. Door Closers, Surface Mounted (Medium Duty): ANSI/BHMA 156.4, Grade 1 certified surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.
    1. Acceptable Manufacturers:
      - a. Corbin Russwin Hardware (RU) - DC6000 Series.
      - b. LCN Closers (LC) - 1460FC Series.
      - c. Norton Door Controls (NO) - 8500 Series.
      - d. Sargent Manufacturing (SA) - 1431 Series.
      - e. Stanley (ST) D3550 Series.
  
  - D. Door Closers, Overhead Concealed (Narrow Profile): ANSI/BHMA 156.4 compliant door closers designed for narrow profile frames. Closers to have fully concealed body in the frame head and track assembly in door either offset or center hung applications, with separate and independent valves for closing speed and backcheck adjustments. Narrow profile overhead concealed closers require a maximum 2-inch frame head for mounting. Closer shall be fire rated UL10C for doors tested for overhead concealed products up to 3 hours.
    1. Acceptable Manufacturers:
      - a. Dorma Products (DO) - RTS88 (BFI/BFE) Series. (Single)
      - b. LCN Closers (LC) - 2030 Series. (Single Acting)
      - c. Rixson Door Controls (RF) - 91 Series. (Single Acting)
- 2.11 ELECTRONIC ACCESSORIES
- A. The electrical products contained within this specification represent a complete engineered system. If alternate electrical products are submitted, it is the responsibility of the supplier to bear the cost of providing a complete and working system including re-engineering of electrical diagrams and system layout, as well as power supplies, power transfers and all required electrical components. Coordinate with electrical engineer and electrician to ensure that line voltage and low voltage wiring is coordinated to provide a complete and working system.
  - B. For each item of electrified hardware specified, provide standardized plug connectors to accommodate up to twelve (12) wires. Plug connectors shall plug directly into through-door wiring harnesses and frame wiring harnesses to power supplies.
  - C. Request-to-Exit Motion Sensor: Request-to-Exit Sensors motion detectors specifically designed for detecting exiting through a door from the secure area to a non-secure area. Include built-in timers (up to 60 second adjustable timing), door monitor with sounder alert, internal vertical pointability coverage, 12VDC or 24VDC power and selectable relay trigger with fail safe/fail secure modes.
    1. Acceptable Manufacturers:
      - a. Tyco T.REX-XLBosch DS150i
  - D. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Acceptable Manufacturers:
  - a. GRI 8080-TMC with Channel Magnet
  - b. Sargent Manufacturing (SA) – 3280 Series.
  - c. Security Door Controls (SD) - DPS Series.
  - d. Securitron (SU) - DPS Series.
- E. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
  1. Acceptable Manufacturers:
    - a. LifeSafety Power – Unified Series.
    - b. Sargent Manufacturing (SA) – 3500 Series.
    - c. Schlage-Electronics (SE) – PS Series
    - d. Security Door Controls (SD) - 630 Series.
    - e. Securitron Door Controls (SU) - AQD 12/24 Series.
    - f. Von Duprin (VO) - PS.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

#### 3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

#### 3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
  3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1

- "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- D. Locks: Mount so key enters cylinder with smooth edge down.
- E. Door Closers:
1. Install closers on room side of corridor doors, and stair side of stairways.
  2. Lobby doors: Mount on vestibule side.
  3. Exterior doors: Parallel rigid arm installation.
  4. Install closers using only manufacturer-furnished template machine screws for metal doors and manufacturer -furnished wood screws for wood doors.
    - a. Use of self-drilling or self-tapping fasteners is not allowed.
  5. Coordinate with door supplier to provide proper blocking for surface mounting. Use of through-bolts is not acceptable.
- F. Push plates:
1. Distance from edge of door to edge of push plate on double acting doors and pairs of doors shall be 1/2 inch.
  2. Distance from edge of door to edge of push plate on single acting doors shall be 1 inch.
  3. Bottom of frame to center line of push plate shall be 45 inches.
- G. Push bars and pulls:
1. Bottom of frame to center line of push bar shall be 42 inches.
  2. Top bolt or screws (backset same as for locks) shall be 45 inches.
  3. Where pull-mounting interferes with outside cylinder function, off-set pull horizontally on door to allow for cylinder to function.
- H. Kick plates and armor plates: Bottom within 1/8 inch of door bottom; attach with Phillips head screws.
- I. Door guards: Apply on single acting doors to stop side of hinge edge of door and covering both edges on double acting doors. Place the bottom 1/8 inch from the bottom of the door. Butt kick or armor plates, if any, to the guard.
- J. Door Stops: Coordinate blocking requirement with Section 061000.
1. Position wall stops to catch lever handle or pull.
  2. Wall Stop/ Holder- 6'-6" up from finish concrete floor.
- K. Clothes hooks: 48 inches from finish floor on door centerline.
- L. Lock Cylinders: Install construction cores to secure building and areas during construction period.
1. Furnish permanent cores to Owner for installation.
- M. Keys: After locks have been reinstalled, and just prior to substantial completion and under direction of Owner or his representative, install permanent cores. Seal keys and/or cores in

envelopes. Mark each envelope with door number, change key set or Masterkey set and keyway number. Turnkey control system over to Owner with instructions on its assembly and use. Ship Masterkeys to Owner via registered mail.

- N. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- O. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Section 07-9200 - Joint Sealants.
- P. Install weather strip prior to other surface hardware such as door closers, exit devices etc. to provide full perimeter seal without interruption. Supplier to ensure proper templating of surface hardware allowing for the thickness of the weatherstrip.

### 3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### 3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

Interfacing of Access Control equipment with hardware specified in this section shall be the responsibility of the Access Control System Supplier.

Functions:

- Doors normally closed, latched and outside is secure.
- Daytime Operation: A timed event (programmed from Card Access System software) activates the outside actuator switch and signals the latch retraction for push/pull operation.
  - Pressing either actuator switch signals the automatic operators to power the doors open at a safe speed as indicated in ANSI A117.1. Doors will stand open for a preset time, and then close.

- Rotating key in keyswitch next to door allows manual override of the time lock/unlock at the exterior and vestibule doors. Rotating key to right bi-pass the exterior door. Rotating key to left, bi-passes vestibule door..
- After Hours Operation: A timed event (programmed from Card Access System software) de-activates the outside actuator switch and disrupts circuit to exit devices releasing (extending) the latches securing the doors from outside.
  - Key outside unlocks the turn lever which retracts latchbolts. Key can only be removed in locked position.
  - Presenting a valid credential activates the outside actuator switch and signals the latch retraction for entry by pull for a preset time, and then relocks.
    - When active, pressing the outside actuator switch signals the automatic operators to power the doors open at a safe speed as indicated in ANSI A117.1. Doors will stand open for a preset time, and then close.
  - Depressing touchpad from inside retracts latchbolt at all times allowing free egress and internal request to exit (LM/LS) switch shunts the door position switch, allowing exit without alarm condition at the Access Control System. LM switch used to monitor if doors are latched.
  - Pressing the inside actuator switch signals the electric latch retraction, and then the automatic operators will power the doors open at a safe speed as indicated in ANSI A117.1. Doors will stand open for a preset time, and then close.
- Power Failure or Fire Alarm: In case of loss of power or signal from fire alarm system, the latches are released (extended) and the automatic operator is deactivated. Doors will automatically close and latch.
- Access Control System shall log unsecured violation if doors are not closed within a preset time limit (programmed from Card Access System software).

END OF SECTION 08-7100

SECTION 260000 - GENERAL REQUIREMENTS FOR ELECTRICAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Division 01 Specifications, General and Supplemental Requirements apply to this section with additions and modifications specified herein.
- B. Instructions to Bidders, Bidding Forms, Forms of Agreement between Owner and Contractor, Contract Award Date, Starting and Completion Dates, Conditions of the Contract, Insurance Requirements, and other Owner Requirements will be furnished separately by the Owner, CM. These documents, as well as any addenda issued, shall form a part of these Specifications, and this Contractor shall consult them in detail for instructions pertaining to his work.
- C. Each trade contractor shall receive all drawings and specification sections issued as part of the overall bid package. All contractors are to receive, review, and coordinate all of their work as shown or referenced on the other trade documents. All work shown or referenced on the other trade documents shall be included as part of the overall project scope for that particular discipline and trade.

1.2 SCOPE OF WORK:

- A. These specifications and accompanying drawings are intended to cover the furnishing of all labor, material, and equipment and superintendence of the Electrical System for.
- B. It is the intent and purpose of these specifications and accompanying drawings to cover and include each item, all materials, machinery, apparatus, and labor necessary to properly install, equipment, adjust, and put into perfect operation the respective portions of the installations specified and to so interconnect the various items or sections of the work as to form a complete and properly operating whole.
- C. Any equipment, apparatus, machinery, material and small items not mentioned in detail, and labor not hereinafter specifically mentioned, which may be found necessary to complete or perfect any portion of installation in a substantial manner, and in compliance with the requirements stated, implied or intended in these specifications shall be furnished without extra cost. This shall include all materials, devices or methods peculiar to the machinery, equipment, apparatus, or systems furnished and installed as part of the ELECTRICAL work.
- D. The term "Furnish" shall mean to obtain and supply to the job site. The term "Install" shall generally mean to fix in position and connect for use. Where language indicates that one party or trade is to "install" and another is to "connect", the term "install" shall mean only to fix in position, and "connect" shall mean to make electrical connections to. The term "Provide" shall mean to furnish and install.

1.3 LAWS, REGULATIONS AND CODES:

- A. Perform all work in strict compliance with all laws, regulations, and/or codes applying, including all Federal, State and local codes and any other authority having jurisdiction. Wherever drawings or specifications conflict with such regulations they shall be made to conform, and approval of the Design Professional obtained on such changes as may be involved.
- B. All electrical work shall comply with the requirements of the National Electrical Code, latest revision.

1.4 PERMITS, FEES, AND CERTIFICATES OF APPROVAL:

- A. Unless stated otherwise in General Conditions or Division 1, obtain and pay for all permits, fees, and licenses required, including those of utilities and Agencies. Provide copies to Design Professional in the quantity requested.
  - 1. "Fees" shall include connection charges construction costs, and other such charges by utility companies or service providers. Ascertain such charges during bidding period and include bid price.
- B. As a prerequisite to final acceptance, supply to the Design Professional a Certificate of Inspection from an Electrical Inspection Agency acceptable to the Owner and approved by the local municipality and the utility company serving the project. Certificate shall cover rough wiring, fixtures, and equipment.

1.5 RECORD DRAWINGS:

- A. During construction keep an accurate record of all deviations of the work as shown on the drawings and that which is actually installed.
- B. Secure from the Design Professional, a complete set of prints of the Electrical drawings and note changes thereon. Make a complete record in a neat and accurate manner, of all changes and revisions to original design which exist in completed work and submit CAD file format.
- C. The cost of furnishing above CAD files and preparing these record drawings shall be borne by the Contractor. When all revisions showing the work as finally installed are made, the prints and CAD files shall be submitted for review and approval by the Design Professional.
- D. Record drawings shall be delivered to Owner within 30 days after acceptance of completed project by Owner.

1.6 OPERATING INSTRUCTIONS:

- A. Provide to the Owner three bound copies of complete written instruction on the operation, care and maintenance of each piece of equipment and the installation as a whole. Include frequency of inspection, cleaning and adjusting and other attention as may be required in accordance with manufacturer's instructions. Material shall be manufacturer's brochures, catalog cuts, parts lists, wiring diagrams, etc. Also supply Owner with three complete sets of approved shop drawings.

- B. Furnish qualified personnel to instruct the Owner's personnel in the maintenance and operation of all equipment and systems. Instructing personnel shall remain on the job continuously during working hours until such instruction is complete, but not less than 16 hours.
- C. A video recording in digital format (DVD) of the operator training session shall be made during this training period and the DVD submitted to the Owner with the Operation and Maintenance Manuals.

1.7 CORRECTION OF WORK AFTER FINAL PAYMENT AND GUARANTEE:

- A. This article is supplementary to Guarantee Provisions of Division 1 and General Conditions.
- B. Final payment shall not relieve the Contractor of responsibility for faulty equipment, materials and workmanship and unless otherwise specified he shall remedy any defects due thereto and pay for damage to other work resulting therefrom, which shall appear within a period of one (1) year from the date of acceptance.
- C. Include guarantees by the respective equipment manufacturers which shall be subject to the terms and time limits defined under this Article of Specifications.
- D. Guarantees furnished by Sub-Contractor and/or equipment manufacturers shall be counter-signed by the related Prime Contractor for joint and/or individual responsibility for subject item.
- E. Manufacturers' equipment guarantees or warranties extending beyond the guarantee period described herein shall be transferred to the Owner along with the Contractor's guarantees.

1.8 QUALITY ASSURANCE

- A. Comply with the requirements of the adopted editions of the following codes and/or standards:
  - 1. ANSI
  - 2. ASTM
  - 3. UL
  - 4. NEMA
  - 5. NFPA
  - 6. NEC
  - 7. IBC
- B. IMC All packaged equipment shall be independently Third Party labeled as a system for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with the OSHA Federal Regulations 29CFR1910.303 and .399, as well as NFPA Pamphlet #70 and National Electric Code (NEC), Article 90-7.

1.9 WARRANTIES:

- A. Manufacturer's warranties on equipment provided under this contract shall be included in the operating and maintenance manuals.
- B. Warrantee period shall begin when the Owner receives beneficial use of the equipment. The installing contractor shall be responsible for protecting all equipment until the testing and balancing reports are accepted and commissioning reports are submitted.

- C. The period of “Owners Beneficial Use” shall begin when:
  - 1. Permanent or temporary certificate of occupancy is granted; or
  - 2. Final Punchlist items are successfully completed; or
  - 3. Owner acknowledges benefits and risks of using the equipment to expedite completion of construction and grants permission for early use of Electrical systems.
- D. See specification section regarding restrictions on early use of Electrical equipment.

## PART 2 - MATERIALS

### 2.1 MATERIALS AND EQUIPMENT:

- A. All installed materials and equipment shall be new and the best of their kind and shall conform to the grade, quality and standards specified herein.
- B. Unless otherwise specifically stated, all materials and equipment offered under these specifications shall be limited to products regularly produced and recommended by the manufacturer for the service intended. This material and equipment shall have capacities and ratings sufficient to amply meet the requirements of the project. The capacities and ratings shall be in accord with engineering data or other comprehensive literature made available to the public by the manufacturer and in effect at the time of opening of bids.
- C. Equipment shall be installed in accordance with manufacturer's instructions for type and quality of each piece of equipment used. These instructions shall be obtained from the manufacturer and shall be considered part of these specifications. Type, capacity and application of equipment shall be guaranteed suitable to operate satisfactorily. No experimental material or equipment shall be permitted.

### 2.2 WORK DESCRIPTION:

- A. In general, the work shall consist of but not necessarily be limited to the following:
  - 1. Install Owner's prepurchased equipment. Refer to Article: ELECTRICAL EQUIPMENT BY OTHERS.
  - 2. Rough in and make final connections to equipment furnished by Owner or by other Trades. Refer to Article: ELECTRICAL EQUIPMENT BY OTHERS.
  - 3. Provide new lighting fixtures with lamps, switches, and other controls for areas shown on the Drawings.
  - 4. Provide receptacles and other outlets.
  - 5. Provide branch circuit wiring from local lighting and power panels for all general light and power circuits.
  - 6. Provide new lighting fixtures, circuits, controls and distribution equipment as shown on the Drawings.
  - 7. Provide new branch panels including feeders.
  - 8. Provide service switchboards, transformers, substations distribution panels and other service and distribution equipment as shown on the Drawings. Include conduit, cable, site work etc., required by Utility Co.
  - 9. Life safety 90-minute lighting transfers.
  - 10. Provide all site work as shown on the Drawings.
  - 11. Provide lightning protection systems as described in these Specifications.

12. Provide HVAC controls and wiring for same to the extent shown on the Drawings, or described elsewhere in these Specifications.
13. Provide all Special Systems described in Specification Sections 260000 and drawing documentation.
14. Provide temporary service for construction in accordance with Division 01.
15. Fire alarm system.

**2.3 WORK INCLUDED:**

- A. In addition to work described above under WORK DESCRIPTION, the work shall include but not necessarily be limited to the following:
1. Provide removals, relocations, alterations and additions to existing electrical equipment and systems as shown on the Drawings. For removals and demolition refer to Article: REMOVAL OF EXISTING EQUIPMENT AND MATERIALS.
  2. Rigging of equipment and materials related to the Electrical Work.
  3. Panel directories for lighting and distribution panels. See Section: PANELBOARDS
  4. Lamping of all lighting fixtures.
  5. Grounding and bonding of all systems in accordance with National Electrical Code Requirements.
  6. Providing for electrical inspection of all new electrical work.
  7. Testing and energizing as specified below.
  8. Miscellaneous steel and hangers required for support of electrical equipment.
  9. Furnishing and wiring of smoke detectors for air handling systems shutdown.

**2.4 REMOVAL OF EXISTING EQUIPMENT AND MATERIALS:**

- A. Remove all superfluous wiring, fixtures, devices, controls, equipment, etc. Where removals are shown on Drawings, they are a general indication only, and may not necessarily indicate the full extent of the work.
- B. No existing equipment or material shall be reused without specific approval of the Owner's Representative.
- C. All equipment and material to be removed, and not desired by the Owner, shall be removed from the site by the Contractor.
- D. Any removed material which is desired by the Owner shall be moved to an on-site storage location by the Contractor.

**2.5 EXCAVATION AND BACKFILL:**

- A. All excavation and backfill required for electrical work will be done by Others.
- B. Provide to the appropriate trade all information required to properly perform the excavation work in a timely and coordinated manner.

2.6 CHASES AND OPENINGS:

- A. Provide information to the appropriate trades regarding size and location of all openings and chases as required for the installation of this Electrical Work.

2.7 CUTTING AND PATCHING:

- A. Cutting and chasing for installation of electrical work will be a part of the work of this Contract. Patching and repair of finishes will be by the General Contractor.
- B. Provide sleeves for conduits passing through poured concrete decks, footings, walls, etc. Cut all openings for conduits passing through precast concrete or existing concrete or masonry. Such holes shall be cut with core drill or similar equipment. They shall not be cut with hammer and chisel, or with any power tool depending on impact for its cutting power.

2.8 CONCRETE:

- A. All concrete required for work of the Electrical Contract will be done by others.
- B. Provide to the appropriate trade all information required to properly complete concrete work.
- C. Concrete pads under equipment shall extend not less than four (4) inches beyond equipment base on all sides and shall be six inches above floor, in all cases not less than is indicated on the Drawings.
- D. Provide at the time of pouring concrete, all necessary anchor bolts. Anchor bolts shall be the hook type, or proper size and length to suit the equipment. Anchor bolts shall be set in pipe sleeves of approximately twice the bolt diameter and one half the embedded length of the bolt. Assume full responsibility for proper emplacement of bolts.
- E. Drop-in wedge anchor bolts or self-drilling anchors may be used in place of hook bolts. Minimum embedment in concrete of wedge anchor bolts shall be in accordance with manufacturer's instructions. Wedge anchor bolts shall be manufactured by Phillips Drill Co., or USM Corp. Self-drilling anchors shall be manufactured Phillips Drill Co.
- F. After equipment is set in place and bolted down, any space between equipment base and floor slab or foundation shall be completely filled with non-shrink grout equal to Masters Builders Co., Ltd. Embeco 153 grout.

2.9 TESTING AND ENERGIZING:

- A. On completion of the installation and wiring covered by this Specification the installation shall be thoroughly proved free from grounds and short circuits, and left ready for operation. Necessary adjustments to all equipment shall be made in cooperation with the manufacturer.
- B. Balance all three-phase panels to within at least ten percent (10%). Submit a report of current readings obtained for each panel after balancing has been completed.
- C. Test all special systems or equipment for proper operation as described in the respective specification sections.

- D. Test all motors for proper rotation. Indicate that rotation by affixing an adhesive arrow equal to Brady Label Co., to the end bell or case of the motor.
- E. Indicate by letter on Company letterhead that all the above testing has been successfully completed.

2.10 ELECTRICAL EQUIPMENT BY OTHERS:

- A. All electrical equipment furnished and installed under contracts other than the Electrical Contract will be furnished with the full complement of control equipment, starters, control wiring conduit and all other items necessary for satisfactory operation.
- B. The Electrical Contractor shall provide disconnect switches for all motor driven equipment with starters not in sight of panelboard, except when combination motor starters are furnished under other contracts or where packaged control panels are mounted on equipment by equipment manufacturer. Refer to schedule on HVAC and Plumbing drawings for such packaged systems provided with combination starters. Refer to the HVAC and Plumbing Specifications for packaged control panels. The Electrical Contractor shall provide disconnect switches at motors when motors are located out of sight of starters or where otherwise required by National Electrical Code. Disconnect switches shall be lockable.
- C. The Electrical Contractor shall mount all starters or unmounted control panels furnished by other trades and shall complete electrical power connections through the disconnect, starter and motor or other device terminals. He shall be responsible for final power connections.
  - 1. Where packaged control panels are furnished by other trades for equipment such as cooling towers, air handling units, or similar items, electrical contractor shall be responsible for all wiring required to connect the motors, contactors, heating elements, sensors, etc., of that equipment to the central panel per wiring diagrams provided by the equipment manufacturer.
  - 2. It shall be assumed that all wiring instructions provided by equipment manufacturers describe wiring methods, materials, and equipment that complies with the requirements of the National Electrical Code, latest edition. If any such given instruction is found to result in non-NEC compliant conditions, this Contractor shall stop work and request direction from Design Professional.
- D. Single phase motors integral with equipment (heat pumps, unit ventilators, unit heaters, VAV boxes, and similar HVAC equipment; sump pumps, circulators, and similar plumbing equipment) will be furnished with integral or equipment mounted overload heaters by the respective Trade Contractors. The Electrical Contractor shall furnish a motor rated toggle-type disconnect switch for each unit where shown. If the motor or equipment does not have integral overload protection, the HVAC, Plumbing Contractor or equipment supplier will furnish a switch with thermal overload element(s) for installation by the Electrical Contractor.
- E. Where equipment supplied by others is controlled by line-voltage devices (thermostats, speed controllers, timers, etc.), these devices will be furnished for mounting and wiring to the Electrical Contractor by the other trades. See HVAC and plumbing drawings as well as electrical drawing for these devices.
- F. The Electrical Contractor shall complete all power wiring for single phase equipment, through the disconnect and/or the thermal cutouts and local control stations to the equipment as required.

- G. Certain equipment will be furnished and set in place by others. Coordinate work related to co-generation system.
- H. The Electrical Contractor shall provide all rough-ins and make final connections for the various electrical services required for all Owner furnished equipment.
- I. Obtain from Owner, dimensioned equipment drawings, wiring diagrams, and other installation data as may be required to properly complete rough-ins and final connections.

2.11 SUBSTITUTIONS:

- A. Equipment may be shown or specified in several ways:
  - 1. Manufacturer and catalogue or model number with the words "no substitutions," "no equal," "(manufacturer) only," or words of similar respect. Contractor shall furnish the specified item.
  - 2. Several manufacturers and model numbers listed; or one manufacturer and model number, followed by "equals by (mfr A), (mfr B), (mfr C)," or words of similar respect.
    - a. If one of the manufacturers is listed on the drawings, that manufacturer shall be considered the basis of design. If none is so listed, the first manufacturer named in the Specification shall be considered the basis of design.
    - b. Where manufacturer's or supplier's name, style and catalog numbers are mentioned in the description of material and equipment in the specifications or on the drawings, it is to be understood that they are for the purpose of setting a standard.
    - c. If Contractor elects to furnish equipment other than the basis of design, he shall verify capacities, physical size, weight, electrical requirements, methods of connection to other parts of the system, and all other relevant data.
    - d. Contractor shall be responsible for informing the Design Professional of all changes required to other equipment, spaces, structure, or systems in order to install the substituted equipment. He shall furnish all required shop drawings or sketches required for Design Professional to evaluate the required changes and shall be responsible for all costs associated with such changes, including costs of design or engineering, if such are necessary, and costs of other trades.
  - 3. Where manufacturer's or supplier's names are listed in conjunction with the manufacturer or supplier that is basis of design, they are given to approve the firm name only. Equipment or material submitted by such firms must meet the detailed technical specifications written for the respective item. Contractor shall be responsible for verifying capacities, physical sizes, weights, electrical requirements, methods of connection to other parts of the system, etc. Contractor shall furnish all required shop drawings for equipment, and for its connection and installation.
- B. If any substituted items are submitted after contracts have been awarded, and there is any question of equality of such items, samples may be required to be submitted both for the item specified and that to be substituted, or, further proof of equality may be required to the entire satisfaction of the Design Professional. In no case shall additional remuneration be allowed because of the rejection of a substitute.
- C. When the equipment is relocated to a place other than that shown on the drawings, or when equipment other than that specified is used, the Contractor shall pay the extra cost of required revisions such as structural steel, concrete, electrical, piping, etc.

- D. The Design Professional's costs to evaluate substitutions and to revise Drawings and Specifications because of substitutions will be paid by the Contractor.

2.12 SHOP DRAWINGS:

- A. Refer to Division 1.
- B. Furnish shop drawings, catalog cuts, performance data and other required data to the Design Professional for approval for all material and equipment specified hereinafter. Sufficient data shall be submitted to show compliance with the requirements of the plans and specifications. All shop drawings submitted shall be first checked and corrected before submitting for approval. Approval for shop drawings by the Design Professional will not relieve the Contractor from responsibility for errors or omissions therein. All such errors or omissions must be made good by the Contractor irrespective of any approval by the Design Professional.
- C. The following applies to all materials and equipment being submitted for this project. Refer to the individual specification sections for additional submittal requirements.
- D. It is the responsibility of the manufacturer's representative and the installing contractor to thoroughly review all shop drawing equipment submittals and state in writing that the products meet or exceed the design specifications and design intent as indicated on the contract documents, prior to submitting them for review by the engineer.
- E. The General Contractor or Construction Manager shall review and stamp all shop drawings noting his review process has taken place and that the shop drawings are in compliance with the design documents, prior to submitting them for review by the engineer. Any shop drawings found to not be in compliance shall be returned to the contractor stating such, with a copy of the statement (only) forwarded to the engineer.
- F. On submissions beyond the initial one, clearly identify changes made from the initial submittal other than those requested by the Design Professional will review only those changes he requested and those identified by the Contractor.
- G. The Engineer will review three submissions (one original submission and up to two revised submissions) on any single component requested for review. If the contractor and/or vendor fail to comply with the drawings, specifications, and/or review comments and additional submissions are required, the cost for those submissions will be borne by the contractor.
- H. The design documents are based and coordinated on the scheduled manufacturers. Any substitutions of products or materials (from those approved and listed in the specifications) must be thoroughly coordinated by the submitting contractor. This includes but is not limited to power, space, structural, control and performance requirements.
- I. Shop drawings required shall include, but not necessarily be limited to, the following:
  - 1. Shop drawings, cuts and catalogue information showing appearance, dimensions, performance, weight, etc., of all equipment, fixtures, appurtenances, etc. See section 260100, and respective equipment or system sections for more specific requirements.
  - 2. Schedules of all materials showing type and manufacturer.
  - 3. Wiring diagrams and schematics for equipment.
  - 4. Lighting fixtures, panels and protective devices, showing appearance, weight, dimensions, finishes, etc.
  - 5. Switchboards, panels, and other protective and distribution equipment.

6. Transformers substations and switchgear components.
  7. Motor control centers.
  8. Generator, transfer switches, paralleling gear, and system components.
  9. All special equipment and systems.
  10. Any special constructions.
  11. Other shop drawings as may be requested.
- J. Electronic and facsimile submission of shop drawings will be accepted as the submittal format.
- K. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristic, finishes for materials, and installation and startup instructions for each type of product indicated.
1. Each control device labeled with setting or adjustable range of control.
- L. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Schematic flow diagrams showing all controlled equipment and control devices.
  2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
  3. Details of control panel faces, including controls, instruments, and labeling.
  4. Written description of sequence of operation.
  5. Trunk cable schematic showing programmable control unit locations and trunk data conductors.
  6. Listing of connected data points, including connected control unit and input device.
  7. System graphics indicating monitored systems, data (connected and cSMSulated) point addresses, and operator notations.
  8. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
- M. Shop Drawings shall be submitted and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Shop drawings shall also contain complete wiring, routing, schematic diagrams, tag number of devices, software descriptions, calculations, and any other details required to demonstrate that the system will function properly. Drawings shall show proposed layout and installation of all equipment and the relationship to other parts of the work.
- N. Shop Drawings shall be approved before any equipment is installed. Therefore shop drawings must be submitted in time for review so that all installations can be completed per the project completion schedule. Ten working days shall be allowed for submittals to be reviewed.
- O. All drawings shall be reviewed after the final system checkout and updated or corrected to provide "as-built" drawings to show exact installation. All shop drawings will be acknowledged in writing before installation is started and again after the final checkout of the system. The system will not be considered complete until the "as-built" drawings have received their final approval. The Contractor shall deliver a complete set of "as-built" drawings.
- P. On submissions beyond the initial one, clearly identify changes made from the initial submittal other than those requested by the Design Professional. The Design Professional will review only those changes he requested and those identified by the Contractor.

- Q. If the Contractor elects to proceed to install equipment for which approved Shop Drawings have not been received, he does so at his own risk; Design Professional is not obligated to accept such equipment or work, nor will Design Professional be liable for claimed costs or delays required by correction of such work.

**Shop Drawing Review Comment Definitions**

**A> No Exception Taken:**

The shop drawing or equipment submittal as submitted is approved without exception. No changes or corrections required. The materials, equipment or system submitted can be released for fabrication and construction. No Further Submission Required.

**B> Make Corrections Noted:**

The shop drawing or equipment submittal as submitted is not completely correct but is approved as noted. Make the corrections noted on the shop drawing or submittal. The materials, equipment or system submitted can be released for fabrication and construction once the corrections have been made. Unless noted by “E: Resubmit” then the submittal must be corrected and resubmitted for record. See “E: Resubmit definition below.”

**C> Submit Specified Item:**

The shop drawing or equipment submittal as submitted is missing a component of the system that it represents or is not of the approved and specified manufacturers. Submit the missing or incorrect item. The materials, equipment or system submitted cannot be released for fabrication and construction.

**D> No Further Submission Required:**

The shop drawing or equipment submittal as submitted is approved as noted. No changes or corrections required. The materials, equipment or system submitted can be released for fabrication and construction. No Further Submission Required.

**E> Resubmit:**

The shop drawing or equipment submittal as submitted is not approved. The shop drawing or equipment submittal needs significant corrections and does require another submission to verify that the comments and changes have been incorporated. Make the corrections noted on the shop drawing or submittal. The materials, equipment or system submitted cannot be released for fabrication and construction.

**F> Rejected:**

The shop drawing or equipment submitted is not as specified or a non-approved manufacturer or product and rejected.

**G> Resubmit for Record Only:**

Make the corrections noted on the shop drawing or submittal. The shop drawing or equipment submittal as submitted is approved with minor exception. Changes or corrections are required. The materials, equipment or system submitted can be released for fabrication and construction.

PART 3 - EXECUTION

3.1 VISIT TO SITE:

- A. Before submitting bid, visit the site of the work and be thoroughly familiarized with the conditions affecting the work. No extra payment will be allowed on account of extra work made necessary by failure to do so.

3.2 WORKMANSHIP:

- A. All work shall be installed in a first class, neat and workmanlike manner by mechanics skilled in the trade involved. All details of the installation shall be mechanically and electrically correct. Should the Design Professional direct removal, change, or installation of any equipments or systems not installed in a neat and workmanlike manner, such charges shall be made by the Electrical Contractor at no expense to the Owner.
- B. Equipment shall be installed in strict accordance with manufacturer's instructions for type and capacity of each piece of equipment used. The Contractor shall obtain these instructions from the manufacturer and these instructions shall be considered part of these Specifications.
- C. Drawings and specifications have been prepared with best knowledge of conditions available at the time of design. If any obscurities or discrepancies exist, they shall be brought to the attention of the Design Professional before bids are submitted. If they are not discovered before bids are submitted, the Design Professional shall be notified and shall render decision. This decision shall be final.
  - 1. Drawings and Specifications are intended to be complementary; items described or shown in one but not both are to be furnished as if fully shown or described in both locations.
  - 2. In case of conflict between provisions of the Specifications, the more stringent requirement shall govern. Where a requirement is applied to a specific product, condition, system, or Specification Section which conflicts with a more general requirement elsewhere, the specific shall supersede the general.
- D. Drawings are generally indicative of the work to be installed, but do not indicate all conduit bends, fittings, boxes, and specialties which may be required, or the exact locations of all conduits. Contractor shall investigate structure and finish conditions affecting his work and arrange his work; accordingly, furnishing such fittings as may be required to meet such conditions. Contractor is responsible for exercising proper judgment to arrange his work and materials so as to avoid interference with other trades.
  - 1. The essentially diagrammatic nature of drawings shall not be interpreted as reason to redesign project. While raceways or cables shall be installed as required by local conditions rather than exactly as shown, all outlets indicated on one circuit shall be so installed. No reduction in size or number of raceways or cables will be permitted, except that it shall be permissible to "gang" two or three sequentially phased 15 or 20 ampere branch circuits to form a single phase, three-wire, or three phase four-wire multiwire branch circuit, per NEC Article 210.4. In general, number of wires in each raceway or cables has not been indicated but shall be provided as required.

2. Riser diagrams, details, and schematics generally indicate wiring to be used in various systems involved. This information may or may not be duplicated on the plans, but equipment shown on either plans or riser diagrams and schematics shall be provided as if shown on both.
  3. All grades, elevations, dimensions, and clearances of equipment shown on drawings are approximate and shall be verified at site.
  4. Where work or equipment is referred to in singular terms, such reference shall be deemed to apply to as many items of work or equipment as required to complete entire installation.
- E. Electrical junction boxes, pull boxes, panel boards, switches and controls and other apparatus requiring periodic maintenance and operation shall be accessible.

**3.3 LINES AND GRADES:**

- A. Lay out work and establish heights and grades for work in strict accordance with the intent expressed by the drawings and all the physical conditions at the building and be responsible for the accuracy of same.

**3.4 FIELD MEASUREMENTS:**

- A. Before ordering any material or doing any work, verify all measurements at the building and site and be responsible for the correctness of same. No extra compensation will be allowed on account of differences between actual dimensions and measurements and those indicated on the drawings. Any difference which may be found shall be submitted to the Design Professional for consideration before proceeding any further with the work.

**3.5 DELIVERY OF EQUIPMENT:**

- A. Be responsible for delivery of equipment, unload and store in a manner not to interfere with the operation of other trades. Additional expense incurred because of equipment or material delivery delays shall be assumed by the responsible Contractor.

**3.6 PROTECTION OF WORK:**

- A. All work, equipment and materials shall be protected at all times. All raceway openings shall be closed with caps or plugs during the installation. All equipment shall be tightly covered and protected against dirt, water, plaster, paint and other foreign material or mechanical injury during entire progress of installation. Make good all damage caused either directly or indirectly by workmen employed to fulfill requirements of the Electrical Work.

**3.7 REMOVAL OF RUBBISH:**

- A. During the course of construction, periodically remove from the premises all rubbish resulting from work of this trade so as to prevent its accumulation. At the completion of the work contemplated under these Specifications remove from the building and site all rubbish and accumulated materials of whatever nature not caused by the other trades and leave work, and equipment free of all foreign matter including plaster, cement, and paint and leave in a clean, orderly, acceptable, and usable condition.

**3.8 COORDINATION WITH OTHER TRADES:**

- A. Work in conjunction with each of the other trades to facilitate proper and intelligent execution of work with minimum interference.
- B. Carefully examine all architectural and structural drawings for the building and drawings for electrical trade and mechanical trades and be responsible for the proper fitting of all material and equipment into the building as planned and without interference with other piping, ductwork, conduit or equipment. Proper judgment shall be exercised to secure best possible headroom, door and window clearance, and space conditions throughout; to secure neat arrangement for piping, equipment and conduit, and to overcome all local difficulties and interferences to best advantage. Approval for any and all changes to plans and specifications which may thus be incurred shall be obtained from the Design Professional before proceeding.
- C. Contractor shall prepare preliminary shop drawings suitable for use in coordinating his work with the work of other trades. The HVAC section will prepare and furnish sepia prints at 3/8" = 1'-0" scale with all trades indicating piping, ductwork and conduit in relation to all structural elements of the construction, including floor elevations; steel locations, size, and elevations; partitions locations; door locations and direction of swing; and all other information required to assure coordination of the electrical, sheetmetal and piping trades and fire protection in relation to the Architectural function of the project. Coordination meetings will be held under the supervision of the Owner's Construction Manager and General Contractor. Each trade shall have proper representation at all coordination meetings for the purpose of detailing, on a sepia print mentioned above, the exact location and routing of their work. After the conclusion of the coordination at the working meetings, each trade shall sign the coordinated sepia, copies of which will be distributed by the GC to all contractors and parties concerned including the Owner. Final shop drawings of all trades shall be in accordance with the coordinated drawing, which final shop drawings shall be submitted for final approval.
- D. If contractor installs work so as to cause interference with work of other trades, he shall make necessary changes in work to correct the condition without extra charge.
- E. Dimensional layout plans of equipment rooms shall be made showing all bases, pads and inertia blocks required for mechanical equipment. Include dimensions of bases, bolt layouts, details, etc.
- F. Contractor shall furnish all necessary templates, patterns, etc. for installing work and for purpose of making adjoining work conform, furnish setting plans and shop details to other trades as required.

**3.9 COORDINATION OF ELECTRICAL CHARACTERISTICS:**

- A. Electrical Contractor shall carefully examine the drawings of all other trades for equipment requiring electrical connection and shall ascertain that all electrical characteristics of equipment scheduled thereon matches the service available. If any discrepancies are noted, he shall immediately refer to Design Professional for resolution. If characteristics are correct, Electrical Contractor is responsible for ascertaining method of connection, "rough-in" dimensions, correct plug and receptacle configurations, etc. While Design Professional has made every effort to provide such information as is known at time of design, Contractor shall obtain final data from shop drawings before proceeding.

- B. For all equipment of other trades which electrical characteristics are not scheduled on drawings of that trade, the Electrical Contractor shall assume the responsibility of notifying the Contractor furnishing such equipment as to the characteristics required; Electrical Contractor will be held responsible for correction of all problems arising from failure to do so.

**3.10 EQUIPMENT IDENTIFICATION:**

- A. All panels, relays, contactors, starters, circuit breakers, safety switches, or similar items shall be identified by equipment name, function, and/or control. Unless otherwise noted, tags shall be engraved plastic black field with white letters. Size of nameplate shall be determined to fit the individual conditions. Nameplates shall be securely and permanently mounted. Use sheet metal screws, drive rivets, or "pop" rivets. Cement or adhesive strips will not be accepted.
- B. Any existing equipment, panels, switchboards, or other items on which work is to be done under this Contact, and which does not have an identifying tag or label, shall be provided with a nameplate as noted in A, by this Contractor.
- C. A schedule of nameplates proposed to be used shall be submitted for approval, and no identification material shall be ordered until approval is received.
- D. Identify electrical conductors in splice or pull boxes, panels, cabinets, or other locations with round or square tags made of heavy paper and fastened with nylon or cotton cord. Such identification shall indicate circuit number; gauge of conductors; and either designation (at source location) or source (at destination and intermediate locations). Lace all conductors of one circuit together prior to tagging.

**3.11 FIRE STOPPING:**

- A. Refer to Architectural section 078413 for "Fire Stopping".
- B. All penetrations through fire-resistance-rated floor, fire resistance rated, floor/ceiling assemblies and roof construction and through fire-resistance-rated walls and partitions shall be fire stopped.
- C. Penetrations to be fire stopped include both empty openings and those containing cables, pipes, ducts, conduits and any other items.
- D. Fire rating of sealed penetrations shall meet or exceed the rating of the assembly being penetrated.
- E. Materials shall be installed in accordance with manufacturer's recommendations and their UL listing.

END OF SECTION 260000



SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER 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. Building wires and cables rated 2000 V and less.
  - 2. Connectors, splices, and terminations rated 2000 V and less.

1.3 DEFINITIONS

- A. PV: Photovoltaic.
- B. VFC: Variable-frequency controller.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.
  - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

**2.1 CONDUCTORS AND CABLES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. General Cable
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable used in VFC circuits.
- E. Conductors: Aluminum and copper, complying with NEMA WC 70/ICEA S-95-658.
  - 1. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2 and Type SO.
- F. Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC Type SO with ground wire.

**2.2 CONNECTORS AND SPLICES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. General Cable
  - 2. 3M Electrical Products.
  - 3. AFC Cable Systems; a part of Atkore International.
  - 4. Gardner Bender.
  - 5. Hubbell Power Systems, Inc.
  - 6. Ideal Industries, Inc.
  - 7. ILSCO.
  - 8. NSi Industries LLC.
  - 9. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 10. Service Wire Co.
  - 11. TE Connectivity Ltd.
  - 12. Thomas & Betts Corporation; A Member of the ABB Group.
- B. Description: Factory-fabricated connectors and splices 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 application.

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 4-3 AWG; copper or aluminum for feeders No. 4-3 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal-clad cable, Type MC.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- H. Branch Circuits in Cable Tray: Metal-clad cable, Type MC.
- I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- J. VFC Output Circuits: Type XHHW-2 in metal conduit.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

#### 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.
  - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

#### 3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

#### 3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

#### 3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

#### 3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following 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. Insulation-resistance test on each conductor with respect to ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
    - g. Continuity test on each conductor and cable.
    - h. Uniform resistance of parallel conductors.
  3. Consider the cost and benefit of infrared scanning of cable and conductor splices before retaining "Initial Infrared Scanning" Subparagraph below.
  4. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
    - a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Cables will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports to record the following:
1. Procedures used.
  2. Results that comply with requirements.
  3. 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 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 grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
  - 1. Underground distribution grounding.
  - 2. 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. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
  - 1. Test wells. (Quantity 2)
  - 2. Ground rods.
  - 3. Ground rings.
  - 4. Grounding arrangements and connections for separately derived systems.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. 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. Instructions for periodic testing and inspection of grounding features 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: Member company of NETA or an NRTL.
  - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Burndy; Part of Hubbell Electrical Systems.
  - 2. Dossert; AFL Telecommunications LLC.
  - 3. ERICO International Corporation.
  - 4. Fushi Copperweld Inc.
  - 5. Galvan Industries, Inc.; Electrical Products Division, LLC.
  - 6. Harger Lightning & Grounding.
  - 7. ILSCO.
  - 8. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 9. Robbins Lightning, Inc.
  - 10. Siemens Power Transmission & Distribution, Inc.
  - 11. Thomas & Betts Corporation; A Member of the ABB Group.

### 2.2 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.

### 2.3 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, with 9/32-inch holes spaced 1-1/8 inches apart. 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.

## 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. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

## 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. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 4/0 AWG minimum.
  - 1. Bury at least 24 inches below grade.
  - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- C. 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, 6 inches above finished floor unless otherwise indicated.
2. 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.

D. 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.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- 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.

3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
1. Feeders and branch circuits.

2. Lighting circuits.
  3. Receptacle circuits.
  4. Single-phase motor and appliance branch circuits.
  5. Three-phase motor and appliance branch circuits.
  6. Flexible raceway runs.
  7. Armored and metal-clad cable runs.
- C. 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.
- D. 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.
- 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. Metallic Fences: Comply with requirements of IEEE C2.
1. Grounding Conductor: Bare copper, not less than No. 8 AWG.
  2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
  3. Barbed Wire: Strands shall be bonded to the grounding conductor.

### 3.5 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground 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.

- 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. Test Wells: 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 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 60 feet apart.
  - I. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.
- 3.6 FIELD QUALITY CONTROL
- A. Testing Agency: Engage a qualified testing agency to 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. 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: 10 ohms.
  2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
  3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 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 260529 - HANGERS AND SUPPORTS 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. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

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 the following:
    - a. Hangers.
    - b. Steel slotted support systems.
    - c. Nonmetallic support systems.
    - d. Trapeze hangers.
    - e. Clamps.
    - f. Turnbuckles.
    - g. Sockets.
    - h. Eye nuts.
    - i. Saddles.
    - j. Brackets.
  - 2. Include rated capacities and furnished specialties and accessories.
- B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.
  - 1. Trapeze hangers. Include product data for components.
  - 2. Steel slotted-channel systems.
  - 3. Nonmetallic slotted-channel systems.
  - 4. Equipment supports.
  - 5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Suspended ceiling components.
  2. Structural members to which hangers and supports will be attached.
  3. Size and location of initial access modules for acoustical tile.
  4. Items penetrating finished ceiling, including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Projectors.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M.
  2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit; a part of Atkore International.
    - b. B-line, an Eaton business.
    - c. ERICO International Corporation.
    - d. Flex-Strut Inc.
    - e. GS Metals Corp.
    - f. G-Strut.
    - g. Haydon Corporation.
    - h. Metal Ties Innovation.
    - i. Thomas & Betts Corporation; A Member of the ABB Group.
    - j. Unistrut; Part of Atkore International.
    - k. Wesanco, Inc.
  2. Material: Galvanized steel.
  3. Channel Width: As required to support load.

4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
  8. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Hilti, Inc.
      - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      - 3) MKT Fastening, LLC.
      - 4) Simpson Strong-Tie Co., Inc.
  2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) B-line, an Eaton business.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti, Inc.
      - 4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      - 5) MKT Fastening, LLC.
  3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
  4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
  5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
  6. Toggle Bolts: All-steel springhead type.

7. Hanger Rods: Threaded steel.

## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
  2. To New Concrete: Bolt to concrete inserts.
  3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  4. To Existing Concrete: Expansion anchor fasteners.
  5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
  7. To Light Steel: Sheet metal screws.
  8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03.
- C. Anchor equipment to concrete base as follows:
  1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Section 099113 "Exterior Painting" Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES 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. Metal conduits, tubing, and fittings.
  - 2. Nonmetal conduits, tubing, and fittings.
  - 3. Metal wireways and auxiliary gutters.
  - 4. Nonmetal wireways and auxiliary gutters.
  - 5. Surface raceways.
  - 6. Boxes, enclosures, and cabinets.
  - 7. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit 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 conduit groups with common supports.
  - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.

- C. Source quality-control reports.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems; a part of Atkore International.
  - 2. Allied Tube & Conduit; a part of Atkore International.
  - 3. Anamet Electrical, Inc.
  - 4. Calconduit.
  - 5. Electri-Flex Company.
  - 6. FSR Inc.
  - 7. Korkap.
  - 8. Opti-Com Manufacturing Network, Inc (OMNI).
  - 9. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 10. Perma-Cote.
  - 11. Picoma Industries, Inc.
  - 12. Plasti-Bond.
  - 13. Republic Conduit.
  - 14. Southwire Company.
  - 15. Thomas & Betts Corporation; A Member of the ABB Group.
  - 16. Topaz Electric; a division of Topaz Lighting Corp.
  - 17. Western Tube and Conduit Corporation.
  - 18. Wheatland Tube Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- I. 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.
    - b. Type: Setscrew or compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, 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, with overlapping sleeves protecting threaded joints.
- J. 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.

## 2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems; a part of Atkore International.
  2. Anamet Electrical, Inc.
  3. Arnco Corporation.
  4. CANTEX INC.
  5. CertainTeed Corporation.
  6. Condux International, Inc.
  7. Electri-Flex Company.
  8. Kraloy.
  9. Lamson & Sessions.
  10. Niedax Inc.
  11. RACO; Hubbell.
  12. Thomas & Betts Corporation; A Member of the ABB Group.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. ENT: Comply with NEMA TC 13 and UL 1653.
- D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. LFNC: Comply with UL 1660.
- F. Rigid HDPE: Comply with UL 651A.
- G. Continuous HDPE: Comply with UL 651B.
- H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
- I. RTRC: Comply with UL 1684A and NEMA TC 14.
- J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- K. Fittings for LFNC: Comply with UL 514B.

**2.3 METAL WIREWAYS AND AUXILIARY GUTTERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. B-line, an Eaton business.
  - 2. Hoffman; a brand of Pentair Equipment Protection.
  - 3. MonoSystems, 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.
- 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: Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

**2.4 SURFACE RACEWAYS**

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hubbell Incorporated; Wiring Device-Kellems.
    - b. MonoSystems, Inc.
    - c. Panduit Corp.
    - d. Wiremold / Legrand.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hubbell Incorporated.
    - b. MonoSystems, Inc.
    - c. Panduit Corp.
    - d. Wiremold / Legrand.

**2.5 BOXES, ENCLOSURES, AND CABINETS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Adalet.
  2. Crouse-Hinds, an Eaton business.
  3. EGS/Appleton Electric.
  4. Erickson Electrical Equipment Company.
  5. FSR Inc.
  6. Hoffman; a brand of Pentair Equipment Protection.
  7. Hubbell Incorporated.
  8. Kraloy.
  9. Milbank Manufacturing Co.
  10. MonoSystems, Inc.
  11. Oldcastle Enclosure Solutions.
  12. O-Z/Gedney; a brand of Emerson Industrial Automation.
  13. Plasti-Bond.
  14. RACO; Hubbell.
  15. Spring City Electrical Manufacturing Company.
  16. Stahlin Non-Metallic Enclosures.
  17. Thomas & Betts Corporation; A Member of the ABB Group.
  18. Topaz Electric; a division of Topaz Lighting Corp.
  19. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: 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, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Metal Floor Boxes:
1. Material: Cast metal.
  2. Type: Fully adjustable or Semi-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. Nonmetallic Floor Boxes: Nonadjustable, round or rectangular.
1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- I. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- J. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- K. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.
- L. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- M. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- N. Gangable boxes are prohibited.
- O. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 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: Plastic.
  3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- P. Cabinets:
  1. NEMA 250, Type 1 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 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
  1. Exposed Conduit: GRC.
  2. Concealed Conduit, Aboveground: EMT.
  3. Underground Conduit: RNC, Type EPC-40-PVC,.
  4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
  1. Exposed, Not Subject to Physical Damage: EMT.
  2. Exposed, Not Subject to Severe Physical Damage: EMT.

3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
    - a. Loading dock.
    - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - c. Mechanical rooms.
  4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  6. Damp or Wet Locations: GRC.
  7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways 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.
  4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.
- 3.2 INSTALLATION
- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
  - B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
  - C. Complete raceway installation before starting conductor installation.
  - D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Raceways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
  - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
  - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
  - 5. Change from ENT to RNC, Type EPC-40-PVC, before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. 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.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- S. Surface Raceways:
1. Install surface raceway with a minimum 2-inch radius control at bend points.
  2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, 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 raceway sealing fittings according to NFPA 70.
- U. Install devices to seal raceway 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 raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where an underground service raceway enters a building or structure.
  3. Where otherwise required by NFPA 70.
- V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- W. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
  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 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    - d. Attics: 135 deg F 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 deg F 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 deg F 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.

- X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.
  - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- Y. 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 top of box unless otherwise indicated.
- Z. 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 surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- AA. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.
- BB. Locate boxes so that cover or plate will not span different building finishes.
- CC. 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.
- DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- EE. Set metal floor boxes level and flush with finished floor surface.
- FF. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

### 3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
  - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
  - 2. Install backfill as specified in Section 312000 "Earth Moving."
  - 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
  - 4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
  - 5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
    - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.

- b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
- 6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
- 7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

### 3.4 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."

### 3.5 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.6 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and 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 260533



SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS 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 raceway and cable penetration of non-fire-rated construction walls and floors.
  - 2. Sleeve-seal systems.
  - 3. Sleeve-seal fittings.
  - 4. Grout.
  - 5. Silicone sealants.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 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 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.
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- 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 sheet steel.
2. Minimum Metal Thickness:
  - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
  - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

## 2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 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 rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  3. Pressure Plates: Carbon steel.
  4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

## 2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. HOLDRITE.

## 2.4 GROUT

- A. Description: Nonshrink; 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, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. 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.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking 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 raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "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 annular clear space between sleeve and raceway 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 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 raceways 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 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 annular clear space between raceway 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 raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway 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.
- 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.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

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. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels, including arc-flash warning labels.
8. Miscellaneous identification products.

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 electrical 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: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- 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. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

## 2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
- B. 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 36 INCHES."

## 2.3 LABELS

- A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Champion America.
    - c. emedco.
    - d. Grafoplast Wire Markers.
    - e. HellermannTyton.
    - f. LEM Products Inc.
    - g. Marking Services, Inc.
    - h. Panduit Corp.
    - i. Seton Identification Products.
- B. Self-Adhesive Labels:
  - 1. Manufacturers: Subject to compliance with requirements, provide products 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. Preprinted, 3-mil-thick, polyester or vinyl flexible label with acrylic pressure-sensitive adhesive.
- a. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized to fit the raceway diameter, such that the clear shield overlaps the entire printed legend.
3. Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- a. Nominal Size: 3.5-by-5-inch.
4. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
5. Marker for Tags: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

#### 2.4 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlton Industries, LP.
    - b. Champion America.
    - c. HellermannTyton.
    - 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 thick by 1 to 2 inches wide; compounded for outdoor use.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Carlton Industries, LP.
    - c. emedco.
    - d. Marking Services, Inc.
- C. Tape and Stencil for Raceways Carrying Circuits 600 V or Less: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. HellermannTyton.
  - b. LEM Products Inc.
  - c. Marking Services, Inc.
  - d. Seton Identification Products.
  
- D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlton Industries, LP.
    - b. Seton Identification Products.
  
- E. Underground-Line Warning Tape
  1. Manufacturers: Subject to compliance with requirements, provide products 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 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".
  
- F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## 2.5 SIGNS

- A. Baked-Enamel Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Carlton Industries, LP.
  - b. Champion America.
  - c. emedco.
  - d. Marking Services, Inc.

**B. Metal-Backed Butyrate Signs:**

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Brady Corporation.
  - b. Champion America.
  - c. emedco.
  - d. Marking Services, Inc.

**C. Laminated Acrylic or Melamine Plastic Signs:**

1. Engraved legend.
2. Thickness:
  - a. For signs up to 20 sq. inches, minimum 1/16-inch-.
  - b. For signs larger than 20 sq. inches, 1/8 inch thick.
  - c. Engraved legend with black letters on white face.
  - d. Self-adhesive.
  - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Brady Corporation.
  - b. Carlton Industries, LP.
  - c. emedco.
  - d. Marking Services, Inc.

**2.6 CABLE TIES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:**
1. HellermannTyton.
  2. Ideal Industries, Inc.

3. Marking Services, Inc.
  4. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
1. Minimum Width: 3/16 inch.
  2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
  3. Temperature Range: Minus 40 to plus 185 deg F.
  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, Type 6/6 nylon.
1. Minimum Width: 3/16 inch.
  2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
  3. Temperature Range: Minus 40 to plus 185 deg F.
  4. Color: Black.
- D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.
1. Minimum Width: 3/16 inch.
  2. Tensile Strength at 73 deg F according to ASTM D 638: 7000 psi.
  3. UL 94 Flame Rating: 94V-0.
  4. Temperature Range: Minus 50 to plus 284 deg F.
  5. Color: Black.

## 2.7 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. 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.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
  - 2. In Spaces Handling Environmental Air: Plenum rated.
- I. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.
- J. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- K. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands 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.
- L. 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 exceeds 16 inches overall.

### 3.3 IDENTIFICATION SCHEDULE

- A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch-wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high black letters on 20-inch centers. Stop stripes at legends. Apply stripes to the following finished surfaces:
  - 1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
  - 2. Wall surfaces directly external to raceways concealed within wall.
  - 3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

- B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, for Life Safety, legally required, critical, and optional standby circuits: Identify with self-adhesive vinyl label. Install labels at 10-foot maximum intervals.
- C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:
  - 1. "EMERGENCY POWER."
  - 2. "Legally Required."
  - 3. "Critical Power."
  - 4. "Optional Standby Power."
- D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
  - 1. Color-Coding for Phase-and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder conductors.
    - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
    - b. Colors for 208/120-V Circuits:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
    - c. Colors for 480/277-V Circuits:
      - 1) Phase A: Brown.
      - 2) Phase B: Orange.
      - 3) Phase C: Yellow.
    - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches 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.
- E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
  - 1. Limit use of underground-line warning tape to direct-buried cables.
  - 2. Install underground-line warning tape for direct-buried cables and cables in raceways.

- G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
1. Comply with 29 CFR 1910.145.
  2. Identify system voltage with black letters on an orange background.
  3. Apply to exterior of door, cover, or other access.
  4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
    - a. Power-transfer switches.
- H. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.
1. Comply with NFPA 70E and ANSI Z535.4.
  2. Comply with Section 260574 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.
- I. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and 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 unless equipment is provided with its own identification.
1. Labeling Instructions:
    - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine plastic label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    - d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
  2. Equipment To Be Labeled:
    - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
    - b. Enclosures and electrical cabinets.
    - c. Access doors and panels for concealed electrical items.
    - d. Switchboards.
    - e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.

- f. Emergency system boxes and enclosures.
- g. Motor-control centers.
- h. Enclosed switches.
- i. Enclosed circuit breakers.
- j. Enclosed controllers.
- k. Variable-speed controllers.
- l. Push-button stations.
- m. Power-transfer equipment.
- n. Contactors.
- o. Remote-controlled switches, dimmer modules, and control devices.
- p. Power-generating units.
- q. Monitoring and control equipment.

END OF SECTION 260553

SECTION 262416 - PANELBOARDS

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. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
  - 1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
  - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details.
  - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
  - 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.

4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Include evidence of NRTL listing for series rating of installed devices.
7. Include evidence of NRTL listing for SPD as installed in panelboard.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include wiring diagrams for power, signal, and control wiring.
10. Key interlock scheme drawing and sequence of operations.
11. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Panelboard Schedules: Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

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. Keys: Two spares for each type of panelboard cabinet lock.
  2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
  - b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

A. 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 NEMA PB 1.

C. Comply with NFPA 70.

D. Enclosures: Flush and Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.
  - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
  - b. Outdoor Locations: NEMA 250, Type 3R.
  - c. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
2. Height: 84 inches maximum.
3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
  6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
  7. Finishes:
    - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Galvanized steel.
- E. Incoming Mains:
1. Location: Coordinate for each location.
  2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.
- F. Phase, Neutral, and Ground Buses:
1. Material: Tin-plated aluminum.
    - a. Plating shall run entire length of bus.
    - b. Bus shall be fully rated the entire length.
  2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
  3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
  4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
  5. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and listed and labeled by an NRTL acceptable to authority having jurisdiction, as suitable for nonlinear loads in electronic-grade panelboards and others designated on Drawings. Connectors shall be sized for double-sized or parallel conductors as indicated on Drawings. Do not mount neutral bus in gutter.
- G. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Tin-plated aluminum.
  2. Terminations shall allow use of 75 deg C rated conductors without derating.
  3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
  4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
  5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
  6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
  7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
  8. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.
  9. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

- H. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
  - 1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
  - 2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

## 2.2 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Square D; by Schneider Electric.
  - 2. Eaton.
  - 3. General Electric Company; GE Energy Management - Electrical Distribution.
  - 4. Siemens Energy.
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
  - 1. For doors more than 36 inches high, provide two latches, keyed alike.
- D. Mains: Refer to contract drawings.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

## 2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Square D; by Schneider Electric.
  - 2. Eaton.
  - 3. General Electric Company; GE Energy Management - Electrical Distribution.
  - 4. Siemens Energy.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Refer to contract drawings.
- D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- F. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

## 2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Square D; by Schneider Electric.
  - 2. Eaton.
  - 3. General Electric Company; GE Energy Management - Electrical Distribution.
  - 4. Siemens Energy.
- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers:
    - a. Inverse time-current element for low-level overloads.
    - b. Instantaneous magnetic trip element for short circuits.
    - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  - 3. Electronic Trip Circuit Breakers:
    - a. RMS sensing.
    - b. Field-replaceable rating plug or electronic trip.
    - c. Digital display of settings, trip targets, and indicated metering displays.
    - d. Multi-button keypad to access programmable functions and monitored data.
    - e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
    - f. Integral test jack for connection to portable test set or laptop computer.
    - g. Field-Adjustable Settings:
      - 1) Instantaneous trip.
      - 2) Long- and short-time pickup levels.
      - 3) Long and short time adjustments.
      - 4) Ground-fault pickup level, time delay, and I squared T response.
  - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  - 5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
  - 6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
  - 7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
  - 8. Subfeed Circuit Breakers: Vertically mounted.
  - 9. MCCB Features and Accessories:

- a. Standard frame sizes, trip ratings, and number of poles.
- b. Breaker handle indicates tripped status.
- c. UL listed for reverse connection without restrictive line or load ratings.
- d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
- e. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
- f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at [55] [75] percent of rated voltage.
- g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
- h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

## 2.5 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
  - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

## 2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 INSTALLATION**

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NEMA PB 1.1.
- D. Equipment Mounting:
  - 1. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- F. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- G. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- H. Mount panelboard cabinet plumb and rigid without distortion of box.
- I. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- J. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.
- K. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.
- L. Install overcurrent protective devices and controllers not already factory installed.
  - 1. Set field-adjustable, circuit-breaker trip ranges.
  - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- M. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- N. Install filler plates in unused spaces.
- O. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

**3.3 IDENTIFICATION**

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

**3.4 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- D. Tests and Inspections:
  - 1. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- E. Panelboards will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

**3.5 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 as specified in Section 260573 "Overcurrent Protective Device Coordination Study."
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.
  - 1. Measure loads during period of normal facility operations.
  - 2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  - 3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
  - 4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

**3.6 PROTECTION**

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Straight-blade convenience, isolated-ground, and tamper-resistant receptacles.
2. USB charger devices.
3. GFCI receptacles.
4. Twist-locking receptacles.
5. Cord and plug sets.
6. Toggle switches.
7. Decorator-style convenience.
8. Wall switch sensor light switches with passive infrared sensors.
9. Digital timer light switches.
10. Wall-box dimmers.
11. Wall plates.
12. Floor service outlets.
13. Poke-through assemblies.
14. Prefabricated multioutlet assemblies.

1.3 DEFINITIONS

- A. Abbreviations of Manufacturers' Names:

1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
3. Leviton: Leviton Mfg. Company, Inc.
4. Pass & Seymour: Pass& Seymour/Legrand.

- 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.

- H. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

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.

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. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
  - 2. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
  - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  - 2. Devices shall comply with the requirements in this Section.
- D. Devices for Owner-Furnished Equipment:
  - 1. Receptacles: Match plug configurations.

2. Cord and Plug Sets: Match equipment requirements.

E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

## 2.2 STRAIGHT-BLADE RECEPTACLES

A. Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Eaton (Arrow Hart).
- b. Hubbell Incorporated; Wiring Device-Kellems.
- c. Leviton Manufacturing Co., Inc.
- d. Pass & Seymour/Legrand (Pass & Seymour).

## 2.3 GFCI RECEPTACLES

A. General Description:

1. 125 V, 20 A, straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Eaton (Arrow Hart).
  - b. Hubbell Incorporated; Wiring Device-Kellems.
  - c. Leviton Manufacturing Co., Inc.
  - d. Pass & Seymour/Legrand (Pass & Seymour).

C. Tamper-Resistant, Duplex GFCI Convenience Receptacles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Hubbell Incorporated; Wiring Device-Kellems.
  - b. Pass & Seymour/Legrand (Pass & Seymour).

## 2.4 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Single Pole:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Eaton (Arrow Hart).
      - 2) Hubbell Incorporated; Wiring Device-Kellems.
      - 3) Leviton Manufacturing Co., Inc.
      - 4) Pass & Seymour/Legrand (Pass & Seymour).
  2. Two Pole:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Eaton (Arrow Hart).
      - 2) Hubbell Incorporated; Wiring Device-Kellems.
      - 3) Leviton Manufacturing Co., Inc.
      - 4) Pass & Seymour/Legrand (Pass & Seymour).
  3. Three Way:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Eaton (Arrow Hart).
      - 2) Hubbell Incorporated; Wiring Device-Kellems.
      - 3) Leviton Manufacturing Co., Inc.
      - 4) Pass & Seymour/Legrand (Pass & Seymour).
  4. Four Way:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Eaton (Arrow Hart).
      - 2) Hubbell Incorporated; Wiring Device-Kellems.
      - 3) Leviton Manufacturing Co., Inc.
      - 4) Pass & Seymour/Legrand (Pass & Seymour).
- C. Pilot-Light Switches: 120/277 V, 20 A.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).
  2. Description: Single pole, with LED-lighted handle, illuminated when switch is off.

2.5 DECORATOR-STYLE DEVICES

- A. Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).
  
- B. Tamper-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).
  - 2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.
  
- C. Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).
  - 2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section, when installed in wet and damp locations.
  
- D. GFCI, Non-Feed-Through Type, Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).

- E. GFCI, Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Pass & Seymour/Legrand (Pass & Seymour).
  - 2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.
- F. Toggle Switches: Square Face, 120/277 V, 15 A; comply with NEMA WD 1, UL 20, and FS W-S-896.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).
- G. Lighted Toggle Switches: Square Face, 120 V, 15 A; comply with NEMA WD 1 and UL 20.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).
  - 2. Description: With LED-lighted handle, illuminated when switch is off.
  - 3. Comply with NEMA WD 1, UL 20, and FS W-S-896.

## 2.6 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Dimmers shall be coordinated with the fixtures they are controlling. Provide dimmer type to match fixture manufacturer's recommendations.

**2.7 WALL PLATES**

- A. 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: Material and finish shall be selected by the Architect.
  - 3. Material for Unfinished Spaces: Galvanized steel.
  - 4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant thermoplastic with lockable cover.

**2.8 POKE-THROUGH ASSEMBLIES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Wiremold / Legrand.
  - 2. Hubbell Incorporated; Wiring Device-Kellems.
  - 3. Pass & Seymour/Legrand (Pass & Seymour).
  - 4. Square D; by Schneider Electric.
  - 5. Thomas & Betts Corporation; A Member of the ABB Group.
- B. Description:
  - 1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
  - 2. Comply with UL 514 scrub water exclusion requirements.
  - 3. Refer to Electrical plans for requirements.

**2.9 FINISHES**

- A. Device Color:
  - 1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
  - 2. Isolated-Ground Receptacles: As specified above, with orange triangle on face.
- B. Wall Plate Color: As selected by Architect.

**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 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.

**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.

**G. Dimmers:**

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

### 3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

### 3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. 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.

E. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 262726

## Section 27 00 00 – General Technology Requirements

### Part 1 - General

- 1.1 Project Summary
  - A. Scope: Successful bidder shall provide, install, configure, and provide warranty service for technology systems described herein.
- 1.2 Related Documents
  - A. Documents: Provisions of General Conditions, Supplementary Conditions, and the sections included under Procurement & Contract Requirements are included as part of this section as though bound herein.
- 1.3 Related Work
  - A. Section 27 00 00 – General Technology Requirements
  - B. Section 27 05 00 – Communications General Requirements
  - C. Section 27 05 23 – Pathways for Technology Systems
  - D. Section 27 05 26 – Grounding and Bonding for Technology Systems
  - E. Section 27 11 00 – Communications Equipment Rooms
  - F. Section 27 13 00 – Communications Backbone Cabling
  - G. Section 27 15 00 – Communications Horizontal Cabling
  - H. Section 27 16 00 – Communications Connecting Cords
  - I. Section 27 18 00 – Communications Labeling and Identification
  - J. Section 27 21 00 – Network Electronics and UPS Systems
  - K. Section 27 60 00 – Physical Security General Requirements
  - L. Section 27 62 00 – Electronic Access Control System
  - M. Section 27 66 00 – Video Surveillance System
- 1.4 Definitions
  - A. Approved or Approval: Where approval is called for, only persons with the authorized authority may grant approval. Owner reserves all rights to govern over and grant approval and will appoint authority of agents acting on their behalf.
  - B. As Required: Contractor shall provide the quantity of said item that is necessary. Owner and Consultant reserve the right to make the final determination of necessary quantities to provide for a complete system.

- C. Basis of Design: The documentation of the concepts, calculations, decisions, and product selections used to meet the Owner’s project requirements. These Consultant produced documents are not shop drawings. Product selections depict minimum functionality and overall quality and are open to substitution requests.
- D. Consultant: same as Owner
- E. Contractor: The qualified party responsible to provide all items and perform services as described within these documents. The Contractor referred to within a specific specification section shall be the successful qualified party contracted to perform and complete that work.
- F. Documents: The complete package of Bid and Contract Requirements, General Technology Requirements, related Division 27 sections, drawings, schedules, and addenda that make up this Request for Bid.
- G. End-User: Individual(s) who will ultimately operate the completed system.
- H. ETR: Existing to Remain. Item is to remain in current location and maintain current functionality.
- I. Furnish: To supply and deliver to project site, ready for installation.
- J. Install: To place in a position of service or use.
- K. NIC: Not in Contract. Item will be the responsibility of others.
- L. Notice to Proceed: Formal communication from Owner to Contractor stating the date the Contractor can begin work subject to the conditions of the contract. The performance time of the contract starts from the Notice to Proceed date.
- M. OFCI: Owner Furnished Contractor Installed. Item will be provided by Owner and shall be installed by Contractor.
- N. OFE: Owner Furnished Equipment. Item will be provided and integrated by Owner.
- O. OFOI: Owner Furnished Owner Installed. Item will be provided and installed by Owner.
- P. Owner: The party named in the Procurement and Contract Requirements as the advertising party.
- Q. Provide: To furnish and install, complete and ready for intended use.
- R. Substantial Completion: The stage in the progress of installation when the systems described herein are sufficiently complete, in accordance with the Contract Documents, so that the Owner can utilize such systems for their complete intended use.
- S. Turnkey: Of or involving the provision of a complete product or service that is ready for immediate use.

- T. Work: The provision of products and/or services to meet the requirements specified in these documents.
- 1.5 Reference Standards and Codes
- A. Standards and other procedures referenced by this bid package are as follows:
    1. ADA – Americans with Disabilities Act of 2010  
[www.ada.gov/2010ADASTandards\\_index.htm](http://www.ada.gov/2010ADASTandards_index.htm)
    2. AIA – American Institute of Architects  
[www.aia.org](http://www.aia.org)
    3. ANSI – American National Standards Institute  
[www.ansi.org](http://www.ansi.org)
    4. ASTM – American Society of Testing and Materials  
[www.astm.org](http://www.astm.org)
    5. BICSI – Building Industry Consulting Service International, Inc. (RCDD Standards)  
[www.bicsi.org](http://www.bicsi.org)
    6. CFR – Code of Federal Regulations  
[www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR](http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR)  
(Available from the Government Printing Office)  
(Material is usually first published in the Federal Register)
    7. U.S. Copyright Law, December 2011  
[www.copyright.gov/title17](http://www.copyright.gov/title17)
    8. ECIA – Electronic Components Industry Association  
ESC – EIA Standards Council  
[www.eciaonline.org](http://www.eciaonline.org)
    9. IACS – International Annealed Copper Standard  
[www.ndt-ed.org/GeneralResources/IACS/IACS.htm](http://www.ndt-ed.org/GeneralResources/IACS/IACS.htm)
    10. IEC – International Electrotechnical Commission  
[www.iec.ch](http://www.iec.ch)
    11. IEEE – Institute of Electrical and Electronics Engineers  
[standards.ieee.org](http://standards.ieee.org)
    12. ISO – International Organization for Standardization  
[www.iso.org](http://www.iso.org)
    13. ITU-T – International Telecommunication Union – Telecommunication  
[www.itu.int](http://www.itu.int)
    14. NEC – National Electrical Code (NFPA 70)  
maintained by NFPA – National Fire Protection Association  
[www.nfpa.org](http://www.nfpa.org)

15. NECA – National Electrical Contractors Association  
[www.necanet.org](http://www.necanet.org)
16. NEMA – National Electrical Manufacturers' Association  
[www.nema.org](http://www.nema.org)
17. OSHA – Occupational Safety and Health Administration  
(U.S. Department of Labor, OSHA)  
[www.osha.gov](http://www.osha.gov)
18. TIA – Telecommunications Industry Association  
[www.tiaonline.org/standards](http://www.tiaonline.org/standards)
19. UL – Underwriters' Laboratories  
[www.ul.com](http://www.ul.com)

- B. Standards: Referenced standards and/or procedures shall be binding on the Contractor and work shall be judged against such standards and procedures unless otherwise stated in writing.
- C. Local/State Codes: Contractor shall comply with all local and state code requirements as determined by the authority having jurisdiction (AHJ).
- D. Owner Standards: Contractor shall obtain and abide by all published Owner standards as they pertain to the work described herein.
- E. Contractor shall use the latest versions of all standards and codes unless otherwise directed by the authority having jurisdiction (AHJ) or expressly noted herein.

1.6 Qualifications

- A. Refer to related sections for specific requirements.

1.7 Permits and Inspections

- A. Responsibility: Obtain permits and inspections required for the work. Contractor is responsible for all permit and inspection costs.
- B. Performance: Perform tests required herein, or as may be reasonably required to demonstrate conformance with the specifications or with the requirements of any legal authority having jurisdiction.
- C. Review: Obtain approvals from authorities responsible for enforcement of applicable codes and regulations to establish that the work is in compliance with all requirements of reference codes indicated herein and required by the appropriate jurisdiction. Make corrections, changes or additions as required and deliver certificates of acceptance, operation, and/or compliance with the Operation and Maintenance Manuals described herein.

1.8 Drawings and Basis of Design

- A. General: Work, equipment, or material delineated on any drawing in this package is expected to be provided by Contractor unless noted otherwise.

- B. Interpretation: Work shall be installed in accordance with the basis of design diagrammatically expressed on the drawings and described in the written specifications and equipment schedule(s). Contractor shall not make limiting interpretation that provides for incomplete work or a non-functioning system.

**1.9 Product Substitution Procedures**

- A. Requests for Substitutions: Should the Contractor request a change in the material that is to be supplied, from that which was specified in the contract, the Contractor shall provide the Owner and the Consultant with a written request for said change.
- B. Substitutions for Non-specified Products: Where no product specification is provided, Contractor may use manufacturer's specification for the identified product as a guide for suggesting appropriate substitutions.
- C. Requirements: The Request for Substitution shall include:
  - 1. Reason for substitution.
  - 2. Material data sheets for both the proposed item(s) and the item(s) to be replaced.
  - 3. Any cost impact to the Owner.
- D. Changes: Proposed changes to Contract Documents shall be clearly identified in the pre-construction submittals.
- E. Approval: The Owner may approve or deny any Requests for Substitution. The Owner reserves the right to govern over and proclaim whether proposed products are equal to the specifications. The Contractor shall not procure any substitute materials until the Owner has approved and signed the Request for Substitution and passed copies to the Contractor and the Consultant. Any procurement or work performed prior to this approval is at the Contractor's own risk.
- F. Deviation: Products provided or installed that deviate from the products specified in make, model, color, or other significant characteristic (i.e., non-approved substitutions) shall be removed and replaced with specified products at no additional expense to Owner.

**1.10 Submittal Conditions**

- A. The Contractor shall not consider the Consultant or Owner's review of submittals to be exhaustive or complete in every detail. Approval of shop drawings or submittals including substitutions indicates only the acceptance of the Contractor's apparent intent to comply with general design or method of construction and quality as specified. The finished product shall meet functional requirements, operations, arrangements, and quantities and comply with the contract documents unless specifically approved otherwise.
- B. The Contractor shall be held responsible for delivery of systems as specified. Any errors or omissions in the submittals shall not relieve Contractor of responsibility to deliver complete systems as specified.

1.11 Pre-Construction Procedures

- A. Prior to Work: Pre-construction submittals shall be provided to Consultant with appropriate promptness as to cause no delay to the work.
- B. Project Timeline: Project timeline will not be altered due to lateness of submittals. Contractor is bound to deliver a timely, complete, and finished project as stipulated in their contract and specified herein.
- C. Format and Distribution: Contractor shall provide one (1) electronic copy in PDF format to Consultant of all pre-construction submittals. The Contractor shall provide hard copies sets as required up to five (5) sets.
- D. Provision: Contractor shall submit pre-construction submittals including any corrections or additions to Consultant prior to the procurement of equipment or commencement of work.
- E. Review: Pre-construction submittals shall be received and formally approved by Consultant prior to the procurement of material or the commencement of work. Any procurement or work performed prior to this approval is at Contractor's own risk.
- F. Failure to Provide: The failure of Contractor to provide pre-construction submittals as required herein may result in the withholding of payment for work and/or the cancellation of the contract.

1.12 Pre-Construction Submittals

- A. Pre-construction submittals are intended to document the details of installation. Exact copies of original drawings and specifications are not acceptable as pre-construction submittal drawings. Consultant schematic diagrams describe the basis of design as defined herein.
- B. Contractor shall provide to Consultant the following pre-construction submittals for approval in addition to specific requirements identified in subsequent sections.
  - 1. Qualifications: Shall include documentation of all required qualifications.
  - 2. Shop Drawings:
    - a. Title: Each drawing shall have a descriptive title and all subparts of each drawing shall have unique identifiers.
    - b. Floor Plans: Shall include device locations, Contractor provided furniture and installation notes.
    - c. System Drawings: Shall include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal type, cable identification detail, connectors, adapters, intra/inter-rack power distribution, installation notes and any other information required to convey the complete turnkey system design.

- d. Equipment Rack and Cabinet Elevations: Shall include placement of all mounted equipment.
  - e. Structurally Mounted Elements: Shall include both plan view of placement as well as a detail of structural mounting techniques to be used.
  - f. Furniture: Shall include all Contractor provided furniture showing dimensional drawings, cable management and finishes with samples for Owner approval.
3. Product Data:
- a. Equipment Schedules: Shall include manufacturers, part numbers, quantities and unit pricing.
  - b. Product Cut Sheets: Shall identify (highlight, arrow, etc.) actual part numbers to be utilized including but not limited to equipment, mounting hardware, cabling, connectors, software and power distribution equipment.
4. Manufacturer's Recommendations:
- a. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, copies of these recommendations shall be provided prior to installation. Installation of the items will not be allowed to proceed until the recommendations are received and approved.

**1.13 Construction Progress Procedures**

- A. Meeting Attendance: Contractor is required to attend job progress meetings in accordance with requirements set by Owner or Consultant.
- B. Additional Coordination: Contractor shall request additional job construction coordination meetings it deems to be necessary to ensure coordination of their responsibilities with other parties.
- C. Progress Inspection: Consultant may perform periodic progress inspections. At Consultant's request, Contractor shall make Project Manager and/or Lead Technician available.
- D. Test Plan: Ten (10) business days prior to the proposed Contractor test date, Contractor shall provide a test plan defining the tests required.
  - 1. The test plan shall be approved by Consultant prior to any testing.

**1.14 Construction Progress Submittals**

- A. Completion: Contractor shall complete and submit via email all construction progress documentation in PDF format as requested by Owner and Consultant.
- B. Contractor shall provide to Consultant the following construction progress submittals in addition to specific requirements identified in subsequent sections.

1. Weekly Report: Weekly written report to be submitted to Consultant through appropriate project channels in PDF format outlining progress from previous week, plans for progress in the current week, and any coordination issues that may require Consultant or Owner attention.
2. Test Plan: Shall ensure the system meets Owner operational and performance specifications and include the following:
  - a. Identification of the capabilities and functions to be tested.
  - b. Detailed instructions for the setup and execution of each test.
  - c. Procedures for evaluation and documentation of the results.
- C. Failure to Complete: Failure to complete requested construction progress documentation may result in the withholding of payment by Owner.

1.15 Closeout Procedures

- A. Notification: Contractor shall provide written notification to Consultant and Owner when Contractor is satisfied that the work has reached Substantial Completion and is ready for inspection.
- B. Pre-Inspection Submittals: Contractor shall submit an electronic copy of all closeout submittals to Consultant in accordance with the requirements found in these documents no less than ten (10) business days prior to the scheduled Final Inspection.
  1. Test Results
  2. As-built drawings (full-size sheets)
  3. Operation and Maintenance Manuals
  4. End User Software
- C. Punch List: Work or materials found to be incomplete, of unsatisfactory quality, failing to meet the specifications in these documents, and/or unacceptable to Consultant or Owner shall be documented by Consultant and provided to Contractor to rectify at no additional cost. Contractor shall provide written notification to Consultant and Owner when all punch list items have been completed.
- D. Final Inspection: At Consultant's request, Contractor shall make Project Manager and/or Lead Technician available.
- E. Re-Inspection: If more than one (1) re-inspection is necessary, the costs of the additional travel, time, and expenses of Owner and Consultant may be deducted by Owner from the contract amount due to the Contractor.
- F. Punch List Approval: Once all punch list items are complete, the Contractor shall return an initialed punch list to the Consultant and Owner for verification. Punch list

shall be considered complete only after having been signed by Owner and Consultant.

- G. Closeout Submittals: Upon approval of closeout submittals and prior to final acceptance, Contractor shall provide three (3) electronic copies to Owner and Consultant in format(s) noted below.
  - 1. Record Drawings – AutoCAD 2010 editable .dwg format AND PDF.
  - 2. Operation and Maintenance Manuals – CD OR DVD.
  - 3. End User Software – CD OR DVD.
  - 4. Documentation of testing and system certification.
- H. Closeout Submittal Format and Distribution: Upon approval of closeout submittals and prior to final acceptance, Contractor shall provide a total of three (3) bound hard copies and one (1) digital copy with labeled dividers of all record drawings (full-size sheets) and operation and maintenance manuals, three (3) copies to Owner and one (1) digital copy to Consultant. Title on front and spine of binder shall be “Operation and Maintenance Manual – [Project Name]”. The following additional items shall be identified on the binder cover:
  - 1. Client Name
  - 2. Contractor Name and Contact Information
  - 3. Consultant Name and Contact Information
  - 4. Date
- I. All documentation prepared by the Contractor, including hard copy and electronic forms, shall become the property of the Owner.
- J. Payment Authorization: Final payment will be authorized only after all closeout procedures and requirements have been followed and fulfilled by Contractor and approved in writing by Owner and Consultant, including punch list(s) and/or re-inspection(s) and delivery of closeout deliverables.

1.16 Closeout Submittals

- A. Closeout submittals are intended to document the details of the final installation that substantially conforms to the construction documents and functions as intended to meet the Owner’s needs.
- B. Contractor shall provide to Consultant the following closeout submittals for approval in addition to specific requirements identified in subsequent sections.
  - 1. As-built drawings: As-built drawings are prepared by the Contractor. They show, in red ink, on-site changes to the Consultant-approved pre-construction submittal documents. As-built drawings shall be submitted to Consultant for approval prior to submitting record drawings and include:

- a. Changes made by Addenda, Change Orders, Requests for Information (RFIs), or Architect’s Supplemental Instruction (ASIs) in addition to any other changes to the original documents.
  - b. Actual device locations, conduit routing, wiring and relationships as they were constructed.
  - c. Nomenclature showing as-built wire designations and colors.
  - d. Room numbers coinciding with Owner space planning numbering.
2. Record drawings: Record drawings are the final drawings prepared by the Contractor and incorporate all as-built drawing changes previously approved by Consultant. Record drawings should be electronically produced without any handwritten, red ink, or clouded changes.
3. Operation and Maintenance Manuals: Notwithstanding requirements specified elsewhere, submit one (1) copy of each of the following per binder:
- a. A final Bill of Materials for each system.
  - b. A Microsoft Excel (.xlsx format) spreadsheet for each device that resides on the network provide the following:
    - i. IP Address
    - ii. MAC Address
    - iii. Serial Number
    - iv. Manufacturer
    - v. Model Number
    - vi. Device Username
    - vii. Device Password
    - viii. Telecom Closet or Rack Location
    - ix. Patch Panel Port Number
    - x. Switch Port Number
    - xi. Any other relevant information as requested by Owner
  - c. Manufacturers Instruction Manuals: Specification sheets, operation manuals and service sheets published by the manufacturers of the components, devices and equipment provided.
  - d. Information for testing, repair, troubleshooting, assembly, disassembly, and recommended maintenance intervals.
  - e. Replacement parts list with current prices. Include list of recommended spare parts, tools, and instruments for testing and maintenance purpose.
  - f. Performance, Test, and Adjustment Data: Comprehensive documentation of performance verification according to parameters specified herein.

- g. Warranties: Provide an executed copy of the Warranty Agreement and copies of all manufacturers' Warranty Registration papers as described herein.
  - h. Sufficient information, (detailed schematics of subsystems, assemblies, and subassemblies to component level) clearly presented, shall be included to determine compliance with drawings and specifications.
  - i. Any other items defined herein.
- 4. Local Reference Diagrams: Within each equipment rack, enclosure, or cabinet, the Contractor shall place a functional diagram of the system(s) in a clear plastic sleeve secured to the equipment rack, cabinet, or enclosure.
  - 5. Intellectual Property: Provide all required items and written release as described herein.
  - 6. Training Program: Proposed training materials and program outline.
  - 7. Spare Parts and Remote Controls: Contractor shall submit record of Owner sign-off of turnover of spare parts and remote controls.

**1.17 Project Management**

- A. Project Manager: Contractor shall appoint a Project Manager who will be the main point of contact for Owner and Consultant regarding the project.
- B. Responsibility: Project Manager is responsible for the following:
  - 1. Successfully completing the contract in a timely manner.
  - 2. Overseeing work and performance of all employees and Subcontractors who have been hired by Contractor, and ensuring compliance with specification.
  - 3. Completing and submitting required documentation.
  - 4. Attending project coordination meetings as required by Owner, Consultant, and Contractor. Contractor is responsible for taking minutes of these meetings and distributing copies to all participants in a timely manner.
  - 5. Coordinating with Owner, Consultant, Architect, General Contractor, and other Contractors involved in the project to ensure smooth flow of work and on-time project completion.
  - 6. Providing a written weekly progress update to the Owner and Consultant in a PDF format emailed to the project team.
  - 7. Reporting all unexpected conditions and problems that may result in delay or expense to Owner and Consultant immediately upon discovery.
- C. Change of Project Manager: If Contractor seeks to change Project Manager during the course of the Project, such change is subject to prior written approval from Owner.

- D. The Owner reserves the right to request a change of project manager at any time for any reason.

**1.18 Examination of Existing Conditions**

- A. Examination: Contractor shall examine the facility and construction documents to the extent necessary to plan for efficient installation strategies prior to the delivery of materials to the site or the commencement of work. Other documents (Architectural Drawings, hardware schedules...) may be made available upon request. Failure to adequately complete the examination shall not result in change order requests.
- B. Acceptance of Conditions: Commencement of work by Contractor shall indicate acceptance of existing conditions, unless a written notice of exceptions has been provided to Owner prior to commencement.
- C. Observation: If Contractor observes—during preliminary examinations or subsequent work—existing violations of fire stopping, electrical wiring, grounding, or other safety- or code-related issues, Contractor shall report these to Owner in a timely manner.
- D. Pre-Existing Damage: If Contractor observes damage to finished surfaces before they begin installation in any area, Contractor shall document by taking digital photos of the damaged area(s) and immediately notify Construction Manager and Consultant via email with attached photos.
- E. Damage during Installation: Any damage caused by, or reasonably believed by the Construction Manager to be caused by the Contractor shall result in back-charges for said damages. Repairs shall match preexisting color and finish of walls, floors, and ceilings. Any Contractor damaged ceiling tiles, floor, and carpet shall be replaced to match color, size, style, and texture.

**1.19 Product Storage and Handling Requirements**

- A. Storage: Contractor shall provide secure material storage. If Contractor chooses to store cabling or equipment at project site, that Contractor shall receive written approval from GC or Owner to identify acceptable location. All equipment provided by the Contractor remains the responsibility of that Contractor until Owner has beneficial use of the equipment.
- B. Protection: Contractor shall take all necessary precautions to protect materials from the following:
  - 1. Theft
  - 2. Vandalism/Tampering
  - 3. Dents
  - 4. Scratches
  - 5. Dust

**SECURITY UPGRADES – FIRE STATIONS**  
**CITY OF WHEELING**

6. Temperature
  7. Weather
  8. Cutting
  9. Paint
  10. Other hazardous conditions
- C. Replacement: Contractor shall replace any damaged or lost material as required by Owner or Consultant.
  - D. Installed Materials: Installed materials remain the responsibility of the Contractor until Acceptance. Contractor shall take necessary precautions to ensure the safety and security of installed materials.
- 1.20 Interference with the Facility
- A. Transportation and storage of materials at the facility, work involving the facility, and other matters affecting the habitual use by the Owner of the Owner's buildings, shall be conducted to minimize interference, and at times and in a manner acceptable to the Owner.
- 1.21 On-Site Conduct
- A. Conduct: Any demonstration of rudeness, use of profanity, or lack of respect by Contractor Personnel to a building tenant will be cause for immediate removal from the premises, and such Personnel will not be allowed to return. Contractor and Contractor's Personnel are to remain in project area.
  - B. Vandalism: Graffiti or vandalism will not be tolerated. Any Contractor/Personnel caught in the act shall be immediately removed from the premises and will not be allowed to return.
  - C. Hazardous Conditions: No one shall be allowed to endanger the building, its premises, or its occupants in any manner whatsoever. In the event that a situation occurs which threatens the building or its occupants in any manner, Contractor, Contractor Personnel, Subcontractor, etc. shall take immediate steps to correct the hazardous condition. In the event that Contractor's Personnel fail to correct hazardous condition, Owner reserves the right to immediately take steps to correct the situation at Contractor's expense.
- 1.22 Safeguards and Protection
- A. Barriers: Provide and maintain suitable barriers, guards, fences and signs where necessary to accommodate the safety of others relative to and/or for the protection of this work.
  - B. Regulations: Comply with OSHA, Federal, State, Local, and Owner regulations and standards pursuant to this work.

- C. Protection: Protect all materials and equipment to prevent the entry or adhesion of any and all foreign material. If necessary, cover equipment with temporary protective material suitable for this purpose.
- D. Finishing: Check, clean and remove defects, scratches, fingerprints and smudges if necessary from all equipment and devices immediately prior to Acceptance of the Installation.
- E. Damage: Replace all damaged or defective material or work at no additional cost prior to Final Acceptance.
- F. Documentation: Provide written description of accidents by workers, staff, and general public of any incident occurring on the project. Report incident in writing to Owner's representative immediately and to the Project Manager for follow up.

**1.23 Owner-Furnished Products**

- A. Delivery: Owner is responsible for delivery of Owner-furnished products to the project site, unless otherwise specified in this document.
- B. Placement: Contractor is responsible for locating, inspecting, and moving Owner-furnished products to their final installation position.
- C. Inspection: Contractor shall report any damage, discrepancies in quantity, type, or function to Owner and Consultant immediately upon discovery.
- D. Warranty: Contractor assumes no responsibility for any material warranty for Owner-furnished products. Contractor shall be responsible for integrating, cabling, and installing Owner-furnished products under the same warranty conditions as other products furnished by Contractor.

**1.24 Quality Assurance**

- A. Assurance: It is the intent of these specifications to describe and provide for a complete, professional, and reliable installation.
- B. Qualifications: Contractor employees who are engaged in installation shall be properly trained in the tasks they are expected to perform.
- C. Acceptability: Owner shall determine the acceptability of work.
- D. Regulatory Requirements: Contractor shall comply with code requirements that apply to the work being performed.
- E. Certifications: Where manufacturer certifications are required for warranty or for authorized resale, installation personnel shall have received such certification prior to the start of installation of those manufacturers' materials.

1.25 Quality Control

- A. Installation: During installation period, when connections are made to the Owner's existing infrastructure, Contractor shall use care to ensure that such connections will not have a negative impact which could reduce or hamper existing systems.

1.26 Owner's Right to Use Equipment

- A. The Owner reserves the right to use equipment, material and services provided as part of this work prior to Acceptance of the Work, without incurring additional charges and without commencement of the Warranty period.

1.27 Intellectual Property Ownership

- A. All intellectual property shall remain in escrow for an unlimited period of time. All supporting documentation including but not limited to: software, firmware, programming, uncompiled source code, graphic files, diagrams, written and electronic files, including all latest versions of the documentation and software necessary to edit and adapt the system(s), shall be provided to the Owner on a CD or DVD for all spaces and all systems. The integrator and/or programmer shall also maintain a current live copy incorporating all system modifications to be provided at the Owner's request and for system restoration upon a failure.
- B. A written release shall be given by the Contractor and all other required parties for all programming and configuration done by the Contractor and/or Subcontractors. This release will acknowledge the Owner's ownership and right to modify the intellectual property directly, or to have the intellectual property modified by any party of the Owner's choosing.

**Part 2 - Products**

2.1 Basic Equipment and Materials Requirements

- A. Standards: Equipment and materials used to accomplish the goals of this project shall meet standards for good engineering practice as defined within this document.
- B. Quality: Products specified in these documents are intended to establish a baseline or operational, functional, and performance-based standards that all proposed products shall meet or exceed by functionality and quality.

2.2 Factory-Assembled Products

- A. Manufacturer: Reference to specific equipment manufacturers does not imply that all products produced by that manufacturer meet the specification requirements.
- B. Age of Equipment: Equipment shall be new and unused with full manufacturer's warranties. Contractor shall supplement such warranties as required by the specification. Contractor shall immediately notify Consultant of any product that will be or is expected to be discontinued by the end of the project for resolution.

- C. No Modification: Where a product is available from a factory/manufacturer to meet the needs as outlined, that product shall be used without modification to ensure the full factory warranty is maintained.
- D. Like Materials: Like materials used shall be of the same manufacturer, model, and quality unless otherwise specified.
- E. Software/Firmware: No software or firmware is to be used unless specifically authorized by Owner or its appointed representative.

**2.3 Racks, Cabinets, Hardware**

- A. Equipment Racks and Cabinets: Provide racks and cabinets as specified herein and/or described in accompanying documents, appendices, or drawings. Verify that any existing racks and/or cabinets provided by others are complete, bringing any discrepancies to the attention of Owner and Consultant prior to beginning the installation.
- B. Shelves and Mounts: Contractor shall supply necessary mounting hardware to install rack-mounted equipment. Mounting hardware shall be a product of the manufacturer of the equipment to be mounted, or manufacturer of the rack system, or approved by either for use with their product. Provide supporting channels, shelves, rack mounts, and/or rack ears as recommended by equipment manufacturers.
- C. Screws and Washers: Contractor shall provide screw head types appropriate to the level of security required for the equipment and racking. Screws shall include polyethylene or nylon washer.
  - 1. Public Access Areas: Star post or square post security screws shall be used for hardware and equipment mounted in equipment racks and consoles in areas that are accessible to the public.
  - 2. Restricted Access Areas: Philips head screws may be used where a secure room entrance or locked rack/console door prevents public access.

**2.4 Power Devices**

- A. Power Strips: Unless otherwise specified, power strips shall be UL listed, surface mounted, and rated for 20 amp continuous electronic loads. Outlets shall be 125 volt, 20 amp, three-wire, grounded, and NEMA 5-20R compliant. Cords shall be 12/3 SJT with molded plug.
- B. Power Distribution Panels: Unless otherwise specified, power distribution panels shall be UL listed, rack mounted, rated for 20 amp continuous electronic loads, with switch and pilot light. Up to eight outlets shall be mounted to the back, each rated 125 volt, 20 amp, three-wire, grounded, and NEMA 5-20R compliant. Switch and pilot shall be mounted to the front. Cords shall be 12/3 SJT with molded plug.
- C. Contractor shall provide acceptable power distribution units as required in order to provide sufficient outlet connectivity for Contractor-furnished and Owner-furnished

equipment indicated on drawings and equipment schedules, plus up to 15% additional capacity for future growth. This may be in addition to any power distribution equipment indicated on equipment schedules.

**2.5 Cable and Connectors**

- A. Cable: Cable shall be selected and applied in a manner defined by signal type, consistent with best industry practices. Highest quality products shall be used with attention given to transmission characteristics, termination methods, resistive and complex impedance at operating frequencies, and insulating material characteristics. Where required by the NEC, substitutions of air handling plenum cable shall exactly match the normally applied product and shall meet the standards of UL Standard #900 and the NEC Articles 800 and 820.
- B. Connectors: Highest quality products shall be used with attention given to transmission characteristics, termination methods, resistive and complex impedance at operating frequencies, and insulating material characteristics. Strain reliefs and cable clamps shall be sized for the connector and the cable.
- C. Color: Cable and connector color shall be coordinated with Consultant to maintain consistency with cable and connector color schemes used by other trades.

**2.6 Cable Management**

- A. Plastic Cable Ties: Single use white nylon plastic cable ties, appropriate screw fittings, or mounting clips may be used for AC power cable management within racks and enclosures. Plastic/nylon cable ties shall not be used for signal and DC cables.
- B. Velcro Cable Ties: Velcro straps shall be used for all signal and DC cables. Velcro straps shall be black, with no logo or decoration, except as authorized by Consultant.

**2.7 Ancillary Hardware**

- A. General: Contractor shall provide ancillary and required accessory items necessary to provide a complete and fully functional system to Owner.
- B. Interpretation: Exclusion of or limitation in the language used in the drawings or specifications shall not be interpreted as meaning that ancillary or accessory items of work or equipment necessary to complete or make the installed system fully functional can be omitted.

**2.8 Grounding Hardware**

- A. Refer to Section 27 05 26 for specific Grounding and Bonding requirements.
- B. Provide data/telecommunication grounding systems indicated in the project drawings and specifications. Products shall include, but are not limited to, cables/wires, connectors, terminals, compression lugs, grounding rods/electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional

accessories needed for a complete installation. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, ANSI/TIA and established industry standards for applications indicated.

**2.9 Fire Stopping Materials**

- A. All penetrations of walls shall be approved by the General Contractor before any penetrations are made. Should the Contractor find it necessary to penetrate any walls extending to the slab, it will be the responsibility of that Contractor to provide satisfactory sleeving and fire caulking both inside and outside of that sleeving. If existing sleeving is to be utilized, it will be the responsibility of the Contractor to fire caulk inside the sleeving.
- B. The Contractor is responsible for adhering to the following standards:
  - 1. Conduit penetrations through fire-rated or smoke walls: Completely seal around the conduit penetration with Hilti FS 601 fire-rated sealant or equivalent by Tremco, 3M, or equal.
  - 2. Conduit sleeves through fire-rated or smoke wall: Completely seal around the conduit penetration with Hilti FS 601 fire-rated sealant or equivalent by Tremco, 3M, or equal. Completely seal inner opening of the conduit sleeve with fire wool packing and Hilti FS 611A intumescent firestop sealant.
  - 3. Cable bundles through fire-rated or smoke walls (without sleeves): Completely seal openings with Hilti FS 611A intumescent firestop sealant or equivalent by Tremco, 3M, or equal.
  - 4. Cable tray penetrations through fire-rated or smoke walls: Completely seal openings with Hilti FS 635 (trowelable type), or equivalent by Tremco, 3M, or equal.
- C. A submitted response to this specification assumes that all firestopping will be provided as specified. The firestop manufacturer's specifications and instructions shall be submitted with the final documentation.

**2.10 Compatibility of Related Equipment**

- A. Existing Equipment: Equipment and systems specified in these documents shall be assumed to be compatible with the systems already installed at Owner site(s) and as identified in this document as related to this project.
- B. Installed Equipment: Specified equipment and systems shall be compatible with all other equipment and systems as offered by Contractor, thus placing the responsibility on Contractor to ensure proper interaction.

**2.11 Licenses**

- A. Any and all licenses required for system functionality shall be provided.

2.12 Spare Parts

- A. Suggested List: Contractor is requested to submit a list of suggested spare parts with an offered price, allowing Owner to select appropriate parts.
- B. Means of Obtainment: Contractor shall state where spare parts can be obtained after the installation.

2.13 Maintenance Manuals

- A. Contractor shall produce a maintenance manual showing interconnection of equipment and any special procedures necessary for proper operation and maintenance of the systems.

**Part 3 - Execution**

3.1 General

- A. Contractor shall provide, furnish, deliver, transport, erect, install, connect and configure all of the material and equipment described herein or depicted on any bid package document or drawing, as required for a turnkey solution.

3.2 Coordination

- A. General: Contractor shall cooperate with other Contractors for proper provisioning, anchorage, placement, and execution of all work. Interference between the work of various Contractors shall be resolved before installation. In the event of conflict on space requirements or location of devices, refer the matter to Owner and Consultant for decision.
- B. Related Work: References to the following related work do not limit or release Contractor from the responsibility of coordination with other trades or from having the necessary knowledge of other non-referenced work.
  - 1. Work by General Contractor.
  - 2. Work by other Technology Contractors.
  - 3. Work by Electrical Contractor, including electrical rough-ins and surface-mounted raceway.
- C. Delays: Contractor shall coordinate with all other trades to avoid causing delays in the installation schedule.
- D. AC Power: Contractor shall coordinate with General Contractor its requirements for proper AC power to service all equipment installed by Contractor.
- E. Low Voltage Sleeving: Contractor shall provide openings through walls as necessary, with sleeving and fire-stopping materials installed in a professional manner to meet local and national codes.

- F. Grounding and Bonding: Contractor shall coordinate with General Contractor its requirements for proper grounding and bonding to their equipment.

**3.3 Basic Execution Requirements**

- A. General: Contractor is responsible for following industry standards of good practice for telecommunications and networking equipment.
- B. Aesthetic Factors: With the installation of equipment and cables, consideration shall be given not only to operational efficiency but also to overall aesthetic factors. Contractor shall redo, at no cost to Owner, any work deemed by Owner to appear sloppy, hastily done, or unprofessional. Owner shall make final decision over whether work shall be redone.
- C. Manufacturers' Recommendations: Manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers or as indicated in their published literature unless otherwise noted herein.
- D. Protection of Work Area: Work shall be properly protected during construction; including shielding soft or fragile materials, protecting against dust and dirt, protecting and supporting cable ends off of the floor and from other traffic, protecting floor box lids, and temporarily plugging open conduits during construction. Upon completion, installation shall be thoroughly cleaned and all tools, equipment, obstructions, or debris present as a result of work shall be removed from the premises.
- E. Protection of Cable and Equipment: Contractor shall make appropriate preparations to protect all cabling and equipment from foreign material. Foreign material is defined as any substance or material that would void the manufacturer's performance warranty, impact ratings (UL, Plenum, etc.), or cover up markings needed for inspection. Foreign material includes, but is not limited to, paint overspray (intentional or not), fire-stopping material, drywall compound, or any other chemical, liquid, or compound that could come in contact with cables, cable jackets, cable termination points, or other equipment.
  - 1. Cleaning of cables or equipment with harsh chemicals from a failure to comply with Protection of Cable and Equipment clause is unacceptable. Contractor shall replace any affected cable, cable components, or equipment in their entirety at Contractor's sole cost.
- F. Waste Materials: Contractor shall keep work area neat, orderly, and free from accumulation of waste materials. Remove trash and debris from the building and job site as required to maintain a clean work environment at all times. Rubbish shall be moved to a common trash point or receptacle on the job site as determined and directed by General Contractor or Owner.
- G. Dumpsters: No construction debris shall be placed in building's dumpsters. Contractor shall provide a dumpster for construction waste and debris at own expense. Said dumpster shall be emptied on a regular schedule. Location of

dumpster shall be arranged through Building Management. Appropriate measures shall be taken to protect asphalt or other ground surfaces.

- H. Ceiling Grid: Contractor shall not hang cable supports from ceiling grid wire.
- I. Roof Deck: Contractor shall not shoot into the roof deck for mounting cable hangers.
- J. Mounting: Equipment and enclosures shall be mounted plumb and square in relation to the structure.
- K. Raised Floor: All cabling installed below the raised floor shall be placed in the provided cable trays with appropriate means to hold cable in place. If no cable tray exists, Contractor shall provide J-hooks to hold cables in place. Sleeves shall be utilized for cable egress.
- L. Motorized Furniture: Care shall be taken to properly dress all cables placed within motorized furniture and provide sufficient cable length and strain relief to allow motorized elements to operate within their full range of travel.
- M. Flexible Furniture: Care shall be taken to properly dress all cables placed within flexible or re-configurable furniture to provide sufficient cable length and strain relief to allow full range of travel for flexible furniture configurations.

#### 3.4 Preparation

- A. Existing Equipment: Prior to any installation, the Contractor shall prepare the site by removing any remaining debris, leveling equipment racks (where appropriate), and verifying information and systems stated to be in-place are ready for use.
- B. Equipment for Installation: Prior to installation, Contractor shall ensure that required major equipment has been secured and is ready for installation.

#### 3.5 Cleaning

- A. Tool Clean-up: Contractor is not permitted to use restrooms for tool clean-up. A slop-sink may be provided in janitorial closet on each floor for cleaning of tools and equipment and as a source of water. Janitorial closet or maintenance area or shop shall be kept clean at all times. Contractor or Contractor's Personnel found using restrooms for clean-up or other similar purposes shall be subject to removal from building.
- B. Daily: At the end of each work period or day, Contractor shall remove excess packing, drilling remnants, and other non-equipment related parts, materials, or debris to ensure a clean, safe, and professional working environment.
- C. Carpet: Contractor shall ensure that no damage to carpeting occurs as a result of their work. Contractor shall cover carpets in areas of work to prevent wire and other debris from entering the carpet.

3.6 Fire Stopping

- A. Contractor is responsible for applying fire-stopping material in and around all openings that it creates or are created for it, whether or not specifically indicated in specifications or project drawings, where code requires the use of fire stopping material.
- B. Contractor shall ensure that all fire-stopping materials meet appropriate codes and are installed in a neat and workman like manner.

3.7 Waterproofing

- A. Contractor is responsible for creating a waterproof seal in and around any openings to the outside environment that are created by Contractor or for systems being installed.
- B. Contractor shall ensure that all waterproof materials meet appropriate codes and are applied according to good engineering practice.

3.8 Racks, Cabinets, and Hardware

- A. Racks and Cabinets: Contractor shall assemble and install racks and cabinets.
- B. Installation Hardware: Install hardware in a secure manner. Screws shall be tightened to a torque just sufficient to secure equipment without deforming washers beyond their original diameter.
- C. Considerations: Rack mount equipment shall be secured as recommended by the manufacturer with consideration to airflow, power, and in/out connections.
- D. Cross Connections: Where cross connections are required between equipment, interconnections shall be installed using cable management devices to secure cables in a neat and workmanlike manner, applying best industry practices.

3.9 Installation Requirements

- A. Cable pulling shall be done in accordance with cable manufacturer's recommendations and ANSI/IEEE C2 standards. Recommended pulling tensions and pulling bending radius shall not be exceeded. Any cable bent or kinked to radius less than recommended dimension shall not be installed.
- B. All cable shall be pulled by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to ensure that the maximum tensile load for the cable as defined by the manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of a "break-away", or other approved method.
- C. Qualified personnel utilizing state-of-the-art equipment and techniques shall complete all installation work. During pulling operation, an adequate number of workers shall be present to allow cable observation at all points of pathway entry and exit.

- D. All cable shall be free of tension at both ends.
- E. PLENUM rated cable shall be used in areas used for air handling or where required by code.
- F. Contractor shall replace any cables that have been damaged or abraded during installation.
- G. Pulling lubricant may be used to ease pulling tensions. Lubricant shall be of a type that is non-injurious to the cable jacket and other materials used and will not harden or become adhesive with age.
- H. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit or surface mount raceway.

**3.10 Cable**

- A. Cable treatment: Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the rating of the manufacturer.
- B. Splicing
  - 1. Voice, data, and other twisted pair cables: No splices shall be installed in any voice, data or twisted pair cables.
  - 2. Technology systems: No splices shall be installed in any cable less than five hundred (500) feet in length.
  - 3. Digital multimedia/video cables: No splices are allowed in any digital multimedia/videocable.
  - 4. Overhead paging systems: Cable splices for constant voltage overhead paging system shall occur only at speaker, amplifier or volume control knob locations.
- C. Lengths
  - 1. Variations: Where cables are to be of the same length, variations in the length shall be less than plus or minus ½ inch. Lengths of cables are based on the length of the unterminated signal conductors.
  - 2. Labeling: Cables, regardless of length, shall be marked with a labeling scheme approved by Consultant.
  - 3. Service Loops: A surplus of cable, located at or near the point of termination to facilitate potential future changes, shall be provided where appropriate. Cables shall have a minimum cable slack of 10ft (3m) at the telecommunication room(s) and 3.28ft (1m) at each telecommunications outlet in the suspended ceiling unless noted otherwise. Service loops shall be stored in an extended loop or in a figure-eight configuration, not in bundled loops.

- D. Grouping
  - 1. Cables shall be separated into like groups according to signal or power levels.
  - 2. Power Cable Group: Power cables shall be secured to one side of the rack separate from any low-energy signal cable groups. Separation shall be a minimum of 4" in all directions.
  - 3. Signal Cable Group: Signal cables shall be grouped according to signal type and secured to one side of the rack separate from any power cable groups. Separation shall be a minimum of 4" in all directions.
- E. In Equipment Racks
  - 1. Equipment rack wiring and cabling shall be neatly dressed.
  - 2. Fastening: Rack cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame.
- F. Support for Cables Outside of Equipment Racks
  - 1. External wire and cables shall be supported at least every 5 feet (1.5m) from the structure and as required to maintain less than 12 inches of cable sag between supports without over-tensioning the cables. Contractor shall vary the precise distance between cable supports on long runs to avoid harmonics issues.
  - 2. Hardware: Cables shall be supported by J-hooks, cable tray, or ladder rack. Hardware shall be secured to building structure using 3/8" threaded rod supports.
    - a. Right Angles: Cables are to run at right angles to the structure, placed above ceiling in halls or corridors.
    - b. Height: Cables shall not run above red iron joist.
- G. Concealment: Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests. Cabling systems installed in public areas shall be installed within walls, ceiling, or floors or within surface wiring pathways, as dictated by codes and good engineering practice.
- H. Velcro Straps for Horizontal Cabling: Straps shall be installed snugly without deforming cable insulation. Straps shall be spaced at uneven intervals not to exceed 4 feet.
- I. Cable Ties and Velcro Straps within Equipment Racks and Cabinets: Ties and straps shall be installed snugly, without deforming cable insulation, at uneven intervals not to exceed 8 inches. Cable ties shall only be used for non-signal carrying cables. No sharp burrs shall remain where excess length of the cable tie has been cut.
- J. Obstruction: Contractor shall notify Owner immediately if any obstruction or hazard is discovered in a pathway provided by others.

**3.11 Connectors**

- A. Preparation: Cables shall be carefully prepared and connectors installed as directed by the manufacturer. Proper stripping devices and crimping tools shall be used.
- B. Terminations: Connectors shall be carefully fitted to mating devices on equipment to avoid damage to mating contacts, inserts, or bodies. Specialized terminations shall be made in a neat and secure manner suited to the service of the wire and as directed by the manufacturer. Contractor shall use manufacturer specified terminations when those specifications exist.
- C. Soldering: A person skilled in that practice shall execute soldered terminations. Any excessive insulation displacement resulting from soldering shall be grounds to require the Contractor to re-terminate the connector.
- D. Adapters: Adapters shall be used only where the identity of the necessary type of connector is unknown at the time of installation, such as for Owner-provided equipment or in anticipation of future equipment upgrades, with Consultant's approval.

**3.12 Spare Parts and Remote Controls**

- A. Keys: Contractor shall turnover all keys, tagged and organized by type on individual key rings, to Owner upon project completion.
- B. Refer to individual sections for spare parts and remote control requirements.

**3.13 Equipment Installation**

- A. General: Contractor shall make system properly operational and physically secure by mounting equipment and related accessories into furniture, consoles, and racks as required. Manufacturer's guidelines for installation shall be followed. Discrepancies in installation procedure or inability to complete a given task due to a shortage of materials or malfunctioning equipment shall be reported to Consultant immediately upon discovery.
- B. Equipment Placement: Contractor shall locate equipment as indicated on drawings and as specified herein. Where such information is not provided, Contractor shall follow industry best practices and locate operable devices at convenient positions; heat generating devices at the top and seldom-accessed equipment below.
  - 1. Unless otherwise specified, end user-operable devices shall be positioned within the range of front wheelchair access per ADA standards.
- C. Equipment Installation: Equipment shall be installed as directed by the manufacturer using equipment manufacturer's desktop mounting frames, equipment tubs, installation hardware, and techniques. Contractor shall be responsible for moving equipment from storage and for providing necessary personnel or devices to carry and lift equipment around obstacles and into operating position.

3.14 Firmware

- A. Firmware shall be latest version supported by software and/or equipment as of Date of Acceptance.

3.15 Rough-In

- A. Scheduling: Contractor shall make every effort to install systems per this specification in a timely manner including rough-in of cabling and other apparatus where appropriate to stay on schedule.
- B. Protection of Environment: Where cabling and/or equipment is installed prior to other trades completing their work in an area, Contractor shall take necessary precautions to cover, wrap, or otherwise protect to reduce possible damage which may result from plastering, painting, cleaning, or other such work completed after installation and before substantial completion of the project.

3.16 Cutting, Drilling, Patching, and Painting

- A. Coordination: Contractor is responsible for coordinating with the General Contractor and other trades when any cutting or drilling is required for the installation or proper performance of the specified systems.
- B. Restoration: Contractor is responsible for returning all surfaces (including walls, floors, and ceilings) to their previous condition after any cutting.

3.17 Labeling

- A. General: Rack-mounted equipment and hardware shall be labeled as required herein. Connectors, jacks, receptacles, outlets, cables, cable terminations, terminal blocks, rack mounted equipment, active slots of card frame systems, etc. shall be clearly, logically, and permanently labeled in a manner acceptable to Consultant.
- B. Approval: Proposed wording and/or numbering schemes for labeling shall be provided to Consultant for review and written approval prior to procurement or installation.
- C. Labels used shall be permanent and secure. Provide labeling as follows unless otherwise noted in a specific section:
  - 1. Like Size: All labels, including engraved labels, shall be sized to match other labels used for same purpose.
  - 2. Equipment Racks: For enclosed racks containing equipment, provide labels on each equipment rack rear door or console rear panel reading "No user serviceable parts. Refer service to qualified technician."
  - 3. Installer and Consultant Identification: Position at the front top center section of each equipment rack a label that states the names of system Installer and Consultant.

4. Custom Panels: Custom panel nomenclature shall be engraved, etched, or screened. Markings are to be designed to ensure consistency and clarity within and without of system. Verify markings and placements by submitting label sample layouts to Consultant for approval prior to procurement.
5. Documentation: Labeling information shall appear on the as-built drawings.

3.18 Fire-Stopping

- A. If Contractor removes anything from an opening in a fire-rated wall, Contractor shall restore the fire-rating condition of the wall to the same condition as before Contractor started its work. Depending on the size of the opening, this may involve sheetrock patching, in addition to use of other appropriate fire-stopping materials

3.19 Additional Engineering Services

- A. General: Contractor is responsible for securing necessary engineering services where needed to meet the needs of the installation.
- B. Change Orders: Only when Contractor can show that additional engineering services are needed as a result of changes to the scope of the services being requested in the contract documents will Owner entertain a Change Order Request for these services.

3.20 Testing

- A. Procedure: Contractor shall develop a rigorous testing procedure to ensure full functionality and durability of installed systems under heavy-use conditions.
- B. Supplies: Contractor shall supply testing equipment needed to verify compliance with specifications found in these documents.
- C. Schedule: Contractor shall complete required testing prior to the substantial completion inspection by Owner and Consultant.
- D. Data: Test data shall be properly documented and recorded so that it is available for final inspection.
- E. Quality Control: Testing may be repeated during the inspection process at the request of Owner or Consultant.
- F. Prior to energizing or testing the system, Contractor shall ensure the following:
  1. Installation: Products are installed in a proper and safe manner per the manufacturer's instructions.
  2. Cleanliness: Products are neat, clean, and unmarred and parts securely attached. Dust, debris, solder, splatter, etc. is removed.
  3. Cables and Connections: Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
  4. Grounding: Electronic devices are properly grounded.

5. AC Power: Each AC power receptacle is tested with a circuit checker for proper hot, neutral, and ground connections prior to connecting equipment.

3.21 Grounding

- A. Refer to Section 27 05 26 for specific Grounding and Bonding installation requirements.

3.22 Training Program

- A. Contractor shall provide training in the manner delineated below in addition to specific requirements identified in subsequent sections.
- B. Contractor shall provide audio-video recording of each training session to Owner.
- C. Prior to scheduling or delivering End User training, Contractor shall confirm that:
  1. Closeout submittals have been accepted by Owner and Consultant.
  2. Final closeout inspection has been completed and punch list items rectified.
  3. Training schedule dates have been coordinated with and approved by Owner and Consultant.
- D. Training shall include:
  1. Approved handouts.
  2. Practical and comprehensive operation of systems.
  3. Basic system troubleshooting techniques.
  4. Basic system maintenance.
- E. Training Blocks
  1. Training time is defined as those hours specifically set aside for the sole purpose of training end users. Credited time will not be given for any time spent providing instructions to the Owner's staff for a system not completed or that has not passed final acceptance by the Owner and Consultant, or training performed outside of the approved training program.
  2. This training will be divided into training session "Blocks" as coordinated with the Owner.
    - a. The first training session block shall consist of training intended for the common system operators. Such training, at a minimum, shall include the day to day use of the system.
    - b. The second training session block shall consist of training administrators of the day to day administration of the system. Such training, at a minimum, shall include use of the administration control functions of the systems, user setup, and filtering and pulling reports.

- c. The third training session block shall consist of training administrators on system troubleshooting, maintenance, and updates. Such training, at a minimum, shall include using the system tools to diagnose issues, diagnosing common physical equipment issues, performing simple maintenance, and performing system updates.
  - d. The fourth training session block shall consist of a training session structured for high-level users, for example staff trainers who will provide instruction to other users and will include advance system configuration and operational knowledge needed to maintain and manage all specified technology systems. The Contractor may elect to engage the Manufacturer(s) in certifying the high-level end users in the systems at no cost to the Owner.
- F. The Contractor shall issue a certificate of training completion to the trainees upon completion of their training. Such certificates must be signed by both the trainer and trainee(s) for the Contractor to receive training credit.

**3.23 Warranty and Maintenance Program**

- A. Contractor shall provide a warranty conforming to the stipulations below in addition to specific requirements identified in subsequent sections.
- B. As part of the base bid cost, the Contractor shall include a 1-year turnkey warranty period with full support costs.
  - 1. Pricing for warranty services to be provided in years two through five shall be itemized on the Contract's Unit Pricing Form as part of a complete response. The Owner may fund the additional warranty services separately or not at all at the Owner's discretion.
- C. The Warranty period shall begin after all punch list items have been rectified. The Contractor shall receive a letter of completion from the Consultant and Owner indicating project completion and starting the warranty period.
- D. The warranty and support work included in this contract shall cover the following materials, software, and services, without additional cost to the Owner:
  - 1. Inspections, preventative maintenance, and testing of equipment and components. The Contractor shall schedule a 10-month on-site preventative system review 10-months into each year of warranty and support including system inspections, preventive maintenance, software upgrades/patches, and testing of equipment and components.
  - 2. Regular Service, Emergency Service, and Normal Service.
  - 3. Labor, travel, equipment, materials, and transportation cost for all services covered by this warranty.
- E. Response Time: Contractor shall respond to calls for warranty services in a timely manner as delineated below.

1. The Owner reserves the right to make the final determination of emergency or normal service calls and the right to coordinate the best times for service of any system failure.
  2. Emergency service calls are defined as failures which prohibit the use of a typical system function(s) and pose a life safety concern, or such failures which cause a major impact to the Owner's daily operations.
    - a. The Contractor shall provide remote service diagnosing the impact within two (2) hours after notification by the Owner.
    - b. If remote service does not correct the reported issue, the Contractor shall provide on-site service correcting the impact within four (4) hours after notification by the Owner.
  3. Normal service calls are defined as failures which prohibit the use of typical system function(s) but which do not inhibit critical system usage, do not pose life safety concerns, and do not create a major impact to Owner's daily operations.
    - a. The Contractor shall provide remote service correcting the impact within twenty-four (24) hours after notification by the Owner.
    - b. If remote service does not correct the reported issue, the Contractor shall provide on-site service correcting the impact within forty-eight (48) hours after notification by the Owner.
  4. The Contractor shall supply Service Request forms and or proper contact procedure to the Owner with instructions for proper notification of the Contractor for warranty service. By following said instructions, the Owner shall constitute proper notification for any needed warranty service
- F. Repair Time: Contractor shall locally stock critical parts in sufficient quantities such that emergency repair or replacement shall be guaranteed within twelve (12) hours. Temporary replacements within this time period shall be acceptable, provided temporary replacements do not compromise system functionality and provided permanent replacement is achieved within ninety-six (96) hours. Contractor may contact the Owner for use of Owner supplied spare parts where delay of system repair will have negative impact on system performance.
- G. Transmittal: A copy of this Warranty shall be delivered to and signed for by the Owner's representative whose primary responsibility is the operation and care of these systems. A copy of the signed Warranty document shall be delivered for review as part of the Final Submittals.
- H. Registration: Contractor shall register Warranty papers for all equipment and software in the name of the Owner and furnish reproductions of all equipment Warranty papers to the Owner with the Final Submittals.
- I. Resolution of Conflicts:

1. The Owner retains the right to resolve unsatisfactory warranty service performance at any time by declaring the work unsatisfactory and stating specific areas of dissatisfaction in writing.
2. If the Contractor or his approved Subcontractor does not resolve such stated areas of dissatisfaction within ninety-six (96) hours, the Owner may appoint an alternative service agency or person to fulfill the terms of the Warranty at the expense of the Contractor. This action may be taken repeatedly until the Owner is satisfied that Warranty service performance is satisfactory. Satisfactory resolution of a malfunction shall be considered adequate when the device, equipment, system or component which is chronically malfunctioning is brought into compliance with the standards of performance as contained herein and published by the manufacturers of the equipment installed.

**End of Section**



## Section 27 05 00 – Communications General Requirements

### Part 1 - General

#### 1.1 Scope

- A. Refer to Section 27 00 00 for additional project scope information.
- B. This section describes the products and execution requirements related to furnishing and installing Category 6/6A Cabling and Termination Components and related subsystems as part of a Structured Cabling System.
- C. The Electrical Contractor shall install conduits for new technology outlet locations unless otherwise noted.
- D. The Telecommunication Contractor shall provide and install all sleeves through the wall penetrations as required whether or not specifically marked on Project Drawings, unless otherwise noted.
- E. All cables and related terminations support, and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Contractor, as detailed in the following section(s).
- F. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the Electrical Code in the state where the work is to be performed, and present manufacturing standards.
- G. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

#### 1.2 Related Work

- A. Section 27 00 00 – General Technology Requirements
- B. Section 27 05 23 – Pathways for Technology Systems
- C. Section 27 05 26 – Grounding and Bonding for Technology Systems
- D. Section 27 11 00 – Communications Equipment Rooms
- E. Section 27 13 00 – Communications Backbone Cabling
- F. Section 27 15 00 – Communications Horizontal Cabling
- G. Section 27 16 00 – Communications Connecting Cords
- H. Section 27 18 00 – Communications Labeling and Identification
- I. Section 27 21 00 – Network Electronics and UPS Systems

- J. Section 27 60 00 – Physical Security General Requirements
  - K. Section 27 62 00 – Electronic Access Control System
  - L. Section 27 66 00 – Video Surveillance System
- 1.3 Reference Standards and Codes
- A. Refer to Section 27 00 00 for additional requirements.
  - B. All references relate to the current version adopted by the city/county according to the authority having jurisdiction (AHJ). If the city/county has not adopted a version the latest version shall be utilized.
  - C. ASTM B633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel
  - D. ASTM A653: Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process
  - E. ASTM A123: Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel
  - F. ASTM A510: Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
  - G. ANSI/TIA 569-C: Telecommunications Pathways and Spaces
  - H. ANSI/TIA 568-C.0, 1, 2, 3, 4: Commercial Building Telecommunications Standard
  - I. ANSI/TIA-598-C-2005 – Optical Fiber Cable Color Coding
  - J. ANSI/TIA 606-B: Administration Standard for Telecommunications Infrastructure
  - K. ANSI/TIA 942-A: Telecommunications Infrastructure Standard for Data Centers
  - L. ANSI/TIA 607-B: Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
  - M. IEEE: National Electrical Safety Code® (NESC®)  
[standards.ieee.org/about/nesc](https://standards.ieee.org/about/nesc)
- 1.4 Qualifications
- A. Refer to Section 27 00 00 for additional requirements.
  - B. Premises Distribution System: Written certification that the premises distribution system complies with the EIA ANSI/TIA/EIA-568-C.0,1, 2, 3, EIA ANSI/TIA/EIA-569-B, and ANSI/TIA/EIA-606-A.
  - C. Materials and Equipment: Where materials or equipment are specified to conform, be constructed, or be tested to meet specific requirements, Contractor shall supply, upon request by Consultant or Owner, certification that the items provided conforms to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements,

or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

D. Certifications

1. The Contractor shall have an RCDD (Registered Communication Distribution Designer) on staff assigned to manage this Project; documented proof shall accompany the bid response.
2. All installing personnel shall have completed and be certified in manufacturer training or BICSI (Building Industry Consulting Service International) installation training for UTP infrastructure systems, or the Contractor shall contract with manufacturer for installation of all proposed components. Company Certifications shall accompany the bid response.
3. The Contractor's technicians shall be certified and trained in the connectivity hardware which is being installed.
4. The Contractor shall submit certification that installers are factory certified to install and test the provided products. No less than half of the crew to be used for the telecommunications installation shall be trained by that manufacturer for the work.

1.5 Pre-Construction Submittals

A. Shop Drawings in addition to requirements in Section 27 00 00:

1. Equipment rack elevation details
2. Elevations of telecommunication room walls with planned mounted equipment
3. Outlet faceplate details for all outlet configurations, sizes, and cable types
4. Overhead telecommunication room enlargements, providing dimensions of room and clearance for maintenance and operation

1.6 Construction Progress Submittals

A. Refer to Section 27 00 00 for requirements.

1.7 Closeout Submittals

A. Refer to Section 27 00 00 for requirements.

1. Data cable test results
2. CD containing:
  - a. As-built drawings (CAD format)
  - b. As-built drawings (PDF format)
  - c. Detailed test results in original tester format (e.g. Fluke Linkware)

- d. Detailed cable test results in PDF format
  - 3. Warranty certification from connectivity manufacturer
- 1.8 Delivery, Storage, and Handling
- A. Contractor shall be responsible for all materials until completion of Project.
  - B. Cable shall be stored according to manufacturer’s recommendations at minimum. In addition, cable shall be stored in a location protected from vandalism and weather.
  - C. If cable is stored outside, it shall be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees Fahrenheit, the cable shall be moved to a heated (minimum 50 degrees Fahrenheit) location. If necessary, cable shall be stored off site at the Contractor’s expense.
  - D. If the Contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.
  - E. Commercial off-the-shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

**Part 2 - Products**

- 2.1 Substitutions
- A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

**Part 3 - Execution**

- 3.1 Warranty
- A. Refer to Section 27 00 00 for additional requirements.
  - B. The Contractor shall provide to the Owner a manufacturer’s 15-year minimum warranty certificate for all materials, equipment, etc. Upon successful completion of the installation and subsequent inspection, the Owner shall receive the numbered certificate from the manufacturing connectivity hardware (patch panels, jacks, patch cords 110 blocks, etc.) company registering the installation. This warranty shall include all labor, materials, and travel time.
  - C. The warranty shall ensure against product defects and guarantee that all approved cabling components exceed the specifications of TIA/EIA-568-C and ISO/IEC IS 11801 for cabling links/channels, and that the installation will exceed the loss and bandwidth requirements of TIA/EIA 568-C ISO/IEC IS 11801 for fiber links/channels

for a fifteen (15) year period. The warranty shall apply to all passive structured cabling system components.

- D. The warranty shall cover the failure of the wiring system to support the application that it was designed to support, as well as additional application(s) introduced in the future by recognized standards or user forums that use the TIA/EIA 568-C or ISO/IEC IS 11801 component and link/channel specifications for cabling. Such warranty shall apply for a minimum of a fifteen (15) year period.
- E. The warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective products(s), labeling of the new components, and testing of the circuit(s) at no cost to the Owner.

### 3.2 Examination

- A. Verification of Conditions: Contractor shall examine areas and conditions under which work is to be performed and identify conditions detrimental to proper and timely completion.
- B. Contractor shall verify that cable lengths comply with published standards.
- C. Contractor shall notify Owner of any proposed installation which is expected to exceed maximum lengths prior to installation of cable.
- D. Contractor shall consult with Owner regarding alternative routing or location of cable.
- E. Contractor shall not proceed until unsatisfactory conditions have been corrected.

### 3.3 Installation Requirements

- A. Refer to Section 27 00 00 for additional requirements.

### 3.4 Cooperation

- A. The Contractor shall cooperate with other trades and General Contractor's personnel in locating work in a proper manner.
- B. Should it be necessary to raise, lower, or move longitudinally any part of the work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

### 3.5 Testing and Acceptance

- A. The Contractor shall perform acceptance tests as indicated below for each subsystem (backbone, station, etc.) as it is completed.
- B. The Contractor shall supply all equipment and personnel necessary to conduct the acceptance tests. Prior to testing, the Contractor shall provide a summary of the proposed test plan for each cable type, including equipment to use, setup, test

frequencies or wavelengths, results format, etc. The Consultant will approve the method of testing.

- C. The Contractor shall visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. The Contractor shall provide the Consultant with a written certification that this inspection has been made.
- D. The Contractor shall conduct acceptance testing according to a schedule coordinated with the Consultant. Representatives of the Owner may be in attendance to witness the test procedures. The Contractor shall provide a minimum of one (1) week advance notice to the Consultant and Owner to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.
- E. Tests related to connected equipment of others shall be done only with the permission and presence of Contractor involved. The Contractor shall ascertain that testing only as required to prove the wiring connections are correct.
- F. The Contractor shall provide Consultant with test results and descriptions of the testing methodology, including the date of the tests, the equipment used, and the procedures followed. At the request of the Consultant, the Contractor shall provide copies of the original test results.
- G. All cabling shall be 100% fault free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the Contractor's expense. The applicable tests shall then be repeated.
- H. Backbone voice cables shall be free of shorts within the pairs and be verified for continuity, pair validity and polarity, and conductor position on the termination blocks (e.g., 110). Any mispositioned pairs shall be identified and corrected. The percentage of "bad" pairs shall not exceed 1% in any backbone (riser or tie) cable based on total pair count. All bad pairs shall be identified and documented.
- I. The Consultant or Owner may request that a 10% random field re-test be conducted on the cable system to verify documented findings.
  - 1. If requested, the Contractor shall test up to 10% of cable links at no cost to the Owner.
  - 2. Tests shall be a repeat of those defined above and under Testing and Acceptance. If findings contradict the documentation submitted by the Contractor, additional testing shall be performed to the extent determined necessary by the Consultant, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

### 3.6 Fire Stopping

- A. Contractor shall seal any openings created for cable pass-through between floors or through fire rated walls. Sealing material and application of this material shall be

accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

- B. Creation of such openings as are necessary for cable passage between locations as shown on the Drawings shall be the responsibility of the Contractor. Any openings created by or for the Contractor and left unused shall also be sealed as part of this work.

**End of Section**



## Section 27 05 23 – Pathways for Technology Systems

### Part 1 - General

- 1.1 Related Work
  - A. Section 27 00 00 – General Technology Requirements
  - B. Section 27 05 00 – Communications General Requirements
  - C. Section 27 05 26 – Grounding and Bonding for Technology Systems
  - D. Section 27 11 00 – Communications Equipment Rooms
  - E. Section 27 13 00 – Communications Backbone Cabling
  - F. Section 27 15 00 – Communications Horizontal Cabling
  - G. Section 27 16 00 – Communications Connecting Cords
  - H. Section 27 18 00 – Communications Labeling and Identification
  - I. Section 27 21 00 – Network Electronics and UPS Systems
  - J. Section 27 60 00 – Physical Security General Requirements
  - K. Section 27 62 00 – Electronic Access Control System
  - L. Section 27 66 00 – Video Surveillance System

### Part 2 - Products

- 2.1 Substitutions
  - A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.
- 2.2 Cable Tray
  - A. The Contractor shall provide and install sufficient cable tray systems to support horizontal cable bundles as shown on the drawing.
  - B. Wire basket cable tray is allowed within all telecommunications rooms.
  - C. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install complete cable tray systems.
  - D. Cable tray systems shall include, but are not limited to, straight sections, field formed horizontal and vertical bends, tees, drop outs, supports, and accessories.
  - E. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.

- F. Contractor shall ensure that all straight section longitudinal wires are installed with no bends, kinks, or twisting.
- G. All fittings shall be field formed as needed.
- H. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel. Splicing assemblies shall provide a continuous ground connection.
- I. Cable Tray shall be grounded only at the Telecommunications Room ground bus bar.
- J. Cable Drop Out/Waterfall
  - 1. Where cables bundles transition from tray to tray or tray to conduit or sleeve of varying elevations the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 20% future growth.
- K. T-sections of tray shall be made using T-section fittings.
- L. Straight section splices shall be made using splice plates.
- M. Cable tray runway supports shall be of the trapeze hanger type.
- N. Trapeze hangers shall be supported by 3/8 inch diameter rods.
- O. Tray shall have an electro zinc finish or a flat Black finish wherever finished installation will be visible to end users.
- P. Accessories (connectors, splice plates...) shall be painted to match tray finish.
- Q. Contractor shall refer to project drawings for cable tray sizing.
- R. Manufacturer: Cable trays and accessories shall be of one of the following manufacturers
  - 1. Cooper B-Line
  - 2. Legrand Cablofil
  - 3. Pentair Hoffman
  - 4. Or approved equal

**2.3 Cable Hook Systems**

- A. In the areas where the cables are required to be run in a “free-air” plenum, a cable hook system shall be used.
- B. Cable hooks shall be capable of supporting a minimum of 30 lbs. with a safety factor of 3.

- C. Spring steel cable hooks shall be capable of supporting a minimum of 100 lbs. with a safety factor of 3 where extra strength is required.
- D. Follow manufacturer's recommendations for allowable fill capacity for each size of cable hook.
- E. Installation and configuration shall conform to the requirements of the ANSI/EIA/TIA Standards 568A & 569, NFPA 70 (National Electrical Code), and applicable local codes.
- F. Cable hooks shall:
  - 1. Have a flat bottom and provide a minimum of 1 5/8" cable bearing surface.
  - 2. Have 90-degree radiused edges to prevent damage while installing cables.
  - 3. Be designed so the mounting hardware is recessed to prevent cable damage.
  - 4. Have a stainless steel cable latch retainer to provide containment of cables within the hook.
  - 5. Have a retainer that shall be removable and reusable.
  - 6. Be factory assembled for direct attachment to walls, hanger rods, beam flanges, purlins, strut, and floor posts, to meet job conditions.
- G. Factory assembled multi-tiered cable hooks shall be used where required to provide separate cabling compartments, or where additional capacity is needed.
- H. Cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653 G90. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3.
- I. Cable hooks for corrosive areas shall be stainless steel, AISI type 304.
- J. Cable hooks shall be B-Line series BCH21, BCH32 or other manufacturer that meets these specifications

#### 2.4 Cable Pathway Sleeves

- A. The Contractor shall provide all necessary wall penetration for cable pathways whether or not specifically shown on Project Drawings.
- B. All wall penetrations shall have a metallic sleeve(s) as required to maintain a maximum 40% fill ration.
- C. All sleeves shall be properly firestopped by this Contractor.
- D. Contractor shall provide all core holes, pathways and sleeves (minimum 1.25" c).
- E. Contractor shall install non-metallic threadless insulating bushings on end of all conduits.

- F. Conduit Core Holes and Sleeves thru Floor: For all floor penetrations, Contractor shall provide IMC conduits with threaded steel couplings set flush with finish floor. Extend 6" above finish floor with IMC before any termination.
- G. Manufacturer:
  - 1. STI EZ Path
  - 2. Hilti Speedsleeve
  - 3. Or approved equal

**Part 3 - Execution**

**3.1 Cable Tray**

- A. Cable tray shall be installed in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of NEC, applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.
- B. Coordinate installation of cable tray with other electrical work as necessary to properly interface installation of cable tray with other work.
- C. Provide sufficient space encompassing cable tray to permit access for installing and maintaining cables.
- D. Test cable tray to ensure electrical continuity of bonding and grounding connections and to demonstrate compliance with specified maximum grounding resistance.

**3.2 Cable Hook System**

- A. J-hooks fabricated to contain data/voice and video cables may be used to support 25 or fewer cables in each hook. J-hooks are to be fastened to building steel with beam clamps, suspended from ceiling slab with threaded rod, or anchored to the wall. All J-hooks shall be hung straight and level. No other installation technique will be authorized unless pre-approved.
- B. Three tiered double-sided J-hook configurations shall contain a maximum of 25 cables per hook or 150 cables. Smaller configurations may be used as bundles decrease in size, maintaining no more than 25 cables per hook.
- C. Bundles surpassing 150 cables shall be supported by hangers, fabricated of 3/8" threaded rod and 24" Unistrut. Hangers shall also be installed where the installation of a three-tiered J-hook system is not appropriate for the ceiling space, or where blocked by other trades' work.
- D. Cable bundles consisting of fewer than 10 cables may be supported by single J hooks.
- E. All cable support in the main cable path shall be installed every four feet. Small cable bundles (under 25) not in the main path may be supported every five feet.

- F. A sag shall be maintained between supports of 6", to reduce cable strain. Velcro is an appropriate method of securing cables, when properly used and not over tightened.
- G. Proper cable support is extremely important to the Owner, and care shall be taken by the Contractor to provide and install the appropriate supports. Supports found to be inadequate will be replaced.
- H. Cable bundles including voice/data cabling shall not have plastic cable ties.
- I. All cable trunks shall have radius controlled cable waterfalls where trunk drops from conduit, sleeve or tray from horizontal path to vertical path.

### 3.3 Pathway Applications

- A. Indoors: Apply pathway products as specified below unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT
  - 2. Concealed in Ceilings and Interior Walls and Partitions: EMT
- B. Minimum Pathway Size for Data: 1-inch trade size. Cable fill shall not exceed a 40% fill ratio.
- C. Pathway Fittings: Compatible with pathways and suitable for use and location.
  - 1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  - 2. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.

### 3.4 Installation

- A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Comply with requirements in Division 27 Section "Hangers and Supports for Communication Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. All conduit penetrations shall comply with all applicable fire codes. All conduit penetrations in fire-rated walls or floors shall be sealed and fire proofed to at least the rating of the penetration area.
- J. Conduits shall be routed in the most direct route, with the fewest number of bends.
- K. There shall be no continuous conduit sections longer than 100 feet. For runs that total more than 100 feet, insert junction or pull boxes (or gutters if appropriate) so that no continuous run between pull boxes is greater than 100 feet.
- L. There shall be no more than two 90-degree bends (180 degrees total) between conduit pull boxes.
- M. Changes in direction shall be accomplished with sweeping bends observing minimum bend radius requirements above. Do not use pull boxes for direction changes unless specifically designated otherwise in the Drawings.
- N. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT for pathways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- O. 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.
- P. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- Q. 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.
- R. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- S. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb. tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

## 3.5 Outlet Boxes

- A. 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.
- B. Exact locations of the outlet boxes shall be coordinated with the electrical contractor and other trades.
- C. The approximate locations of the outlets are indicated on the drawings. The exact locations shall be determined at the building. The right is reserved to change without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.
- D. 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 rain tight connection between box and cover plate or supported equipment and box.
- E. Horizontally separate boxes by a minimum of 12" mounted on opposite sides of walls so they are not in the same vertical channel.
- F. Outlet boxes installed back to back in fire-rated walls shall be separated horizontally by a minimum of 24".
- G. Install all outlet boxes in finished areas flush with the wall. Maintain ¼" or less space between outlet box front and finished wall surface.
- H. 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.
- I. Outlet boxes shall be firmly anchored in place and shall not depend on the cover plate to hold it secure to the wall.
- J. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- K. Any surface boxes shall have rounded corners and edges. Surface boxes must be approved by Owner prior to installation.

## 3.6 Riser Conduits

- A. Conduits entering equipment rooms shall be reamed or bushed and terminated not more than 4" from a wall and within 12" of room corners.
- B. Conduits entering equipment rooms from below floor shall be terminated not more than 4" above finished floor.
- C. Conduits shall not be less than 4" trade size and be equipped with a measured pull line at 12" increments rated at a minimum 1200 pound test.

- D. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction.
  - E. Provide an insulating press fit bushing on all telecommunications riser conduits. Bushings must be rated to be used in an environmental air handling space (Plenum).
- 3.7 Sleeve-Seal Installation for Communications Penetrations
- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.
- 3.8 Firestopping
- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

**End of Section**

## Section 27 05 26 – Grounding and Bonding for Technology Systems

### Part 1 - General

- 1.1 Related Work
  - A. Section 27 00 00 – General Technology Requirements
  - B. Section 27 05 00 – Communications General Requirements
  - C. Section 27 05 23 – Pathways for Technology Systems
  - D. Section 27 11 00 – Communications Equipment Rooms
  - E. Section 27 13 00 – Communications Backbone Cabling
  - F. Section 27 15 00 – Communications Horizontal Cabling
  - G. Section 27 16 00 – Communications Connecting Cords
  - H. Section 27 18 00 – Communications Labeling and Identification
  - I. Section 27 21 00 – Network Electronics and UPS Systems
  - J. Section 27 60 00 – Physical Security General Requirements
  - K. Section 27 62 00 – Electronic Access Control System
  - L. Section 27 66 00 – Video Surveillance System
- 1.2 Reference Standards and Codes
  - A. IEEE C2 - National Electrical Safety Code
  - B. IEEE Std. 837-2002, or latest version – Standard for Qualifying Permanent Connections Used in Substation Grounding
  - C. ANSI/TIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
  - D. NFPA 70E - Standard for Electrical Safety in the Workplace
  - E. ANSI/NECA/BICSI-607 - Telecommunications Bonding and Grounding Planning and Installation methods for Commercial Buildings
  - F. UL 467 - Standard for Grounding and Bonding Equipment
  - G. Refer to Section 27 00 00 for additional requirements.

- 2.1 Substitutions
  - A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.
- 2.2 Grounding and Bonding Cable
  - A. The grounding and bonding cable shall be solid stranded copper conductors.
  - B. The grounding and bonding cables shall have a green jacket color and riser or plenum rated as required.
  - C. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications, or as required by NFPA 70, whichever is larger. Differentiate between normal ground and isolated ground when both are used within the same facility.
- 2.3 Grounding and Bonding Busbars
  - A. Telecommunications Main Grounding Busbar (TMGB)
    - 1. Factory-drilled solid copper with holes to accommodate lugs. Field manufactured busbars are not acceptable.
    - 2. 0.25" thick x 4" wide
    - 3. Sized for current applications and future growth
    - 4. Insulated from its support
    - 5. Shall be an electro-tin plated busbar
    - 6. Maintain a minimum of 2" of clearance from wall
    - 7. UL listed and BICSI certified
  - B. Telecommunications Grounding Busbar (TGB)
    - 1. Factory-drilled solid copper with holes to accommodate lugs. Field manufactured busbars are not acceptable.
    - 2. 0.25" thick x 2" wide
    - 3. Sized for current applications and future growth
    - 4. Insulated from its support
    - 5. Shall be an electro-tin plated busbar
    - 6. Maintain a minimum of 2" of clearance from wall
    - 7. UL listed and BICSI certified
  - C. Horizontal Equipment Rack or Cabinet Busbar

1. Mounts to standard 19" Rack or Frame
  2. Capacity: 6 Double hole lugs
  3. Shall be an electro-tin plated busbar
  4. UL listed and BICSI certified
- D. Vertical Equipment Rack or Cabinet Busbar
1. Mounts to vertical rail or inside of cabinet in 19" or 23" equipment rack or frame.
  2. Capacity: 9 Double hole lugs
  3. Shall be an electro-tin plated busbar
  4. UL listed and BICSI certified
- 2.4 Mechanical Connectors
- A. Mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers, and lock washers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.
  - B. Split bolt connector types are not allowed.
  - C. Connectors shall meet or exceed UL 467.
- 2.5 Compression Lugs
- A. Shall be UL & CSA listed
  - B. Shall meet or exceed the performance requirements of IEEE 837, latest revision
  - C. Compression type
  - D. Shall be manufactured from pure wrought copper. Conductivity of this material shall be no less than 99% by IACS standards.
  - E. Shall be electro-tin plated
  - F. Lugs shall be 2-hole. Single hole lugs are not allowed
  - G. Long barrel that will allow a minimum of two crimps with standard industry colors
  - H. Each connector shall be filled with an oxide-inhibiting compound
  - I. Crimped with a compression, tool and die system, according to manufacturer's recommendation

2.6 Taps

- A. Connections to the Conductor shall be made with irreversible compression connectors
- B. Shall be UL & CSA listed
- C. Requires a minimum of (2) crimps for C Tap or H Tap, 1 crimp for I-Beam and busbar Tap
- D. Crimp according to manufacturer’s recommendation

**Part 3 - Execution**

3.1 General

- A. Install products in accordance with manufacturer’s recommendations.
- B. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- C. Mechanical connections shall be accessible for inspection and maintenance.
- D. No insulation shall be installed over mechanical ground connections.
- E. Ground connection surfaces shall be cleaned and all connections shall be made so that disconnection or removal is impossible.

3.2 Resistance Measurement

- A. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 2 ohms.

3.3 Telecommunications Bonding Backbone (TBB)

- A. The intended function of a TBB is to reduce or equalize potential differences between telecommunications systems. While the TBB will carry some current under ac power ground fault conditions, it is not intended to provide the only ground fault return path.
- B. The TBB shall:
  - 1. Be connected to the TMGB & TGB.
  - 2. Be a continuous copper conductor that shall be sized no less than 6 AWG to a maximum of 3/0 AWG. The TBB shall be sized in accordance to the following table:

Linear Length – ft.	Size (AWG)
Less than 13	6
14 - 20	4

21 - 26	3
27 - 33	2
34 - 41	1
42 - 52	1/0
53 - 66	2/0
Greater than 67'	3/0

- 3. The TBB conductors shall be installed and protected from physical and mechanical damage.
- 4. The TBB conductors should be installed without splices.
  - a. Where splices are necessary, the number of splices should be kept to a minimum and they shall be accessible and located within telecommunications spaces or j-box labeled as a telecommunications bonding backbone splice.
  - b. Joined segments of a TBB shall be connected using exothermic welding, irreversible compression-type connectors or equal.

C. A metallic cable shield shall not be used as a TBB.

**3.4 Grounding Equalizer (GE)**

- A. The GE shall be a continuous copper conductor that shall be sized no less than 6 AWG to a maximum of 3/0 AWG. The GE shall match the size of the TBB.
- B. The GE shall connect to the telecommunications grounding busbar(s) in the same-floor telecommunications rooms on the first, top, and every third floor in a building greater than 4 floors.
- C. A metallic cable shield shall not be used as a GE.

**3.5 Telecommunications Equipment Bonding Conductor (TEBC)**

- A. Connects the TMGB/TGB to equipment racks and cabinets.
- B. Shall be a continuous copper conductor that shall be sized per the length of cable.
- C. Shall be separated from ferrous materials by 2" or be bonded to the ferrous metal.
- D. May be routed within cable trays or suspended 2" under or off the side of the cable tray or ladder rack.
- E. Shall be supported every 3ft.
- F. 8" minimum bend radius.
- G. May come cross other cable groups at a 90 degree angle only.
- H. A metallic cable shield shall not be used as a TEBC.

- 3.6 Rack or Cabinet Bonding Conductor
- A. A bonding conductor shall be used to connect the equipment racks and cabinets directly to the TMGB, TGB or underfloor ground mesh network.
  - B. All metallic enclosures, including remote mounted equipment cabinets and racks for telecommunications, security or audio/visual shall be bonded to the nearest TMGB or TGB using a minimum sized conductor of 6 AWG. Remote bonds shall be labeled on both ends stating the destination of the bond.
- 3.7 Electrical Distribution Panel (EDP)
- A. The AC EDP serving the Telecommunications Room shall be bonded to the TMGB or TGB using a minimum of a 6 AWG cable.
  - B. A qualified electrician shall make all connections within an AC electrical distribution panel.
- 3.8 Optical Fiber Conductive Cables
- A. Conductive fiber-optic cables should be bonded and grounded as specified in the NEC.
- 3.9 Conduit and Sleeve Bonding
- A. All conduits and sleeves entering a telecommunications room shall be grounded.
- 3.10 Ladder Rack and/or Cable Tray
- A. All low voltage cable runway sections shall be bonded together and bonded back to the nearest Telecommunications Room the runway is serving as close TMGB or TGB as practical.
  - B. Maintain an 8" minimum bend radius on the TEBC.
  - C. Keep a 2" separation from other cables both power and telecommunications.
  - D. Remove any paint, oxidation, etc. from the runway surfaces that are being bonded.
  - E. Drill two holes as required to accommodate the 2-hole compression lug.
  - F. Apply a thin coat of antioxidant around the holes and on the surface where the lug will be in contact.
  - G. Attach straps to the runway using stainless steel hardware sized for the lug holes.
  - H. Wipe off any excess antioxidant after installation of the lug.
- 3.11 Labeling
- A. Each grounding/bonding cable shall be labeled at the TMGB or TGB.
  - B. All taps to the TBB shall be within an enclosure and labeled as to its purpose.

- C. Mechanical connectors shall be clearly marked with the catalog number, conductor size, and manufacturer.
- D. Compression lugs shall be clearly marked with manufacturer, catalog number, conductor size, and required compression tool settings.

3.12 Testing

- A. Refer to Section 27 00 00 for additional requirements.
- B. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

**End of Section**



## Section 27 11 00 – Communications Equipment Rooms

### Part 1 - General

#### 1.1 Scope

- A. This section describes the products and execution requirements relating to telecommunications cabling, termination components, racks, pathways, telecommunication rooms and related subsystems. Covered systems include the following:
  - 1. Equipment room cable management system and equipment racks
  - 2. Horizontal and backbone cable terminating equipment
  - 3. Telecommunications grounds and related components

#### 1.2 Related Work

- A. Section 27 00 00 – General Technology Requirements
- B. Section 27 05 00 – Communications General Requirements
- C. Section 27 05 23 – Pathways for Technology Systems
- D. Section 27 05 26 – Grounding and Bonding for Technology Systems
- E. Section 27 13 00 – Communications Backbone Cabling
- F. Section 27 15 00 – Communications Horizontal Cabling
- G. Section 27 16 00 – Communications Connecting Cords
- H. Section 27 18 00 – Communications Labeling and Identification
- I. Section 27 21 00 – Network Electronics and UPS Systems
- J. Section 27 60 00 – Physical Security General Requirements
- K. Section 27 62 00 – Electronic Access Control System
- L. Section 27 66 00 – Video Surveillance System

### Part 2 - Products

#### 2.1 Substitutions

- A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 Category 6 Patch Panels

- A. Cables shall be terminated at the telecommunication closets on high-density integrated patch panels incorporating Category 6 jacks (non-keyed 8-pin), meeting the specifications for the telecommunications outlet detailed in the section above.
- B. Patch panel configuration shall be 48 ports.
- C. The patch panel shall exceed ANSI/TIA/EIA 568-C.2-1 Category 6 component compliance standard. All pair combinations shall be considered, with the worst-case measurement being the basis for compliance.
- D. The patch panels shall be interoperable and backwards compatible to lower performing cabling systems.
- E. Panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers' minimum bend radius specifications are adhered to.
- F. The patch panel shall have color-coded designation strips to identify cable count.
- G. Manufacturers:
  - 1. Leviton
  - 2. Panduit
  - 3. Uniprise

2.3 Category 6 Patch Panels

- A. Cables shall be terminated at the telecommunication closets on high-density integrated patch panels incorporating Category 6A rated jacks (non-keyed 8-pin), meeting the specifications for the telecommunications outlet detailed in the section above.
- B. Patch panel configuration shall be 48 ports.
- C. The patch panel shall exceed ANSI/TIA/EIA 568-C.1 Category 6 compliance standard. All pair combinations shall be considered, with the worst-case measurement being the basis for compliance.
- D. The patch panels shall be interoperable and backwards compatible to lower performing cabling systems.
- E. Panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers' minimum bend radius specifications are adhered to.
- F. The patch panel shall have color-coded designation strips to identify cable count.
- G. Manufacturers:

1. Leviton
2. Panduit
3. Uniprise

**2.4 Voice Patch Panels**

- A. At the MER and each TR the voice backbone cables originating from the primary distribution point shall be terminated on rack mounted voice patch panels.
- B. Backbone cables 25-pair or less shall be terminated on 24-port patch panels and backbone cables greater than 25-pair shall be terminated on 48-port patch panels.
- C. The voice patch panel shall utilize 25-pair Amphenol connectors on the rear and RJ-45 jacks on the front.
- D. Manufacturers:
  1. Leviton
  2. Panduit
  3. Uniprise

**2.5 Fiber Optic Patch Panels**

- A. The Contractor shall provide a fiber optic patch panel at each location where a fiber optic cable terminates.
- B. All terminated fibers shall be mated to duplex LC couplings mounted on enclosed patch panels. Couplers shall be mounted on a panel that, in turn, snaps into the enclosure. The proposed enclosure shall be designed to accommodate a changing variety of connector types, including SC, ST, Fixed Shroud Duplex (e.g., "FDDI Connector"), Biconic, and FC by changing panels on which connector couplings are mounted.
- C. The patch panel enclosure shall be sized to accommodate the total fiber count to be installed at each location as defined in the specifications and Drawings, including those not terminated (if applicable), PLUS 50% future growth.
- D. The Contractor shall provide all required connector panels and connector couplings (sleeves, bulkheads, etc.) adequate to accommodate the number of fibers to be terminated.
- E. Patch panels shall be designed for easy installation, front removal, and expansion of snap-in adapter panels.
- F. Patch panels shall be enclosed assemblies affording protection to the cable subassemblies and to the terminated ends. The enclosures shall incorporate a hinged or retractable front cover designed to protect the connector couplings and fiber optic jumpers.

- G. The patch panel's enclosure shall provide for strain relief of incoming cables and shall incorporate radius control mechanisms to limit bending of the fiber to the manufacturer's recommended minimums or 1.2", whichever is larger.
- H. Access to the inside of the patch panel enclosure during installation shall be from the front and rear. Panels that require any disassembly of the cabinet to gain entry will not be accepted.
- I. All patch panels shall provide protection to both the "facilities" and "user" side of the coupling. The patch panel enclosure shall be configured to require front access only when patching. The incoming cables (backbone, riser, etc.) shall not be accessible from the patching area of the panel. The enclosure shall provide a physical barrier to access of such cables.
- J. Where singlemode fibers are installed, the fibers contained in these cables may be terminated either by (1) splicing of factory-terminated cable assemblies ("pigtailed") or (2) use of a "fan-out" kit. In the latter approach, individual fibers are to be secured in a protective covering (such as an Aramid reinforced tube, for example) with connectors mated to the resulting assembly. In both instances, the proposed termination hardware shall incorporate a mechanism by which cable and subassemblies are secured to prevent damage. Splicing shall be by the "fusion" method. Individual splice loss shall not exceed 0.2 dB.
- K. Fiber optic patch panels shall be Corning PCH-02 in TR/IDF and PCH-4U in MDF or Server Rooms.
- L. 50-micron LC adaptor panels shall be Corning CCH-CP12-E4.
- M. Singlemode LC adaptor panels shall be Corning CCH-CP12-A7.

2.6 Cable Management System

- A. The cable management system shall be used to provide a neat and efficient means for routing and protecting fiber and copper cables and patch cords on telecommunication racks and enclosures. The system shall be a complete cable management system comprising 4-post and 2-post floor mount racks, wall mount racks, equipment cabinets and vertical and horizontal cable managers to manage cables on both the front and rear of the rack. The system shall protect network investment by maintaining system performance, controlling cable bend radius, and providing cable strain relief.

1. WD Wall-Mount Cabinet

2.1 WALL-MOUNT CABINETS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Great Lakes GL36WDM-B-AF; WD Wall-Mount Cabinet with mesh door and fan kit.

Description: Wall-mount cabinets manufactured from steel sheet. Non-seismic

applications - Maximum equipment weight of 300lb (136kg) when secured to the structural wall with standard anchors. Non-seismic load is tested per UL 2416 and the cabinet is UL Listed NWIN.E227626.

1. Color: Black textured powder coated steel
2. Size: 36 Inches, 18RMU
3. UL Listed: 300lb (136kg) Capacity
4. Construction Material: Body 14GA CRS, Doors 16GA CRS, Rails 12GA CRS
5. Front Door: Mesh
6. Access Control: Keyed quarter turn locks on front door.
7. Rear Section: 6 inches (152 mm) deep rear section with 16 inches C-to-C holes for mounting to the wall. 1", 2", 3" nominal concentric conduit knockouts are available on top and bottom.
8. Center Section: 24 inches (610mm) wide by 25.9 inches (658mm) deep center swing-out section provides front & rear access to cables. Heavy duty hinges come preinstalled. Draw latches are included for additional support and ease of lock operation when under the load.
9. Equipment Mounting Rails: Two pair of rails; spaced horizontally to support 19 inches (482.6 mm) wide EIA-310-E 18RMU of rack-mount space.
11. Mounting: Left or Right swing opening.
12. Usable Depth: 28 inches (711mm)
13. Vented sides and fan assembly (7217WS) with dust kit.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION OF WALL MOUNT CABINETS

Attach the cabinet to the wall so that the front door and cabinet body can be opened fully without obstruction by other building, storage or architectural components. Follow the manufacturer's installation instructions (Great Lakes MS-5.02-10) when securing the cabinet to the wall and backboard.

Attach the cabinet directly into studs through a 3/4 inch (19 mm) plywood backboard. The cabinet may be attached to a masonry wall when the installer provides hardware. Use appropriate hardware as defined by local code or the authority having jurisdiction. Cables shall enter/exit the cabinet through conduit knockouts in the top, back and/or bottom of the rear panel of the cabinet. Use edge-protection grommets on conduit knockouts when cables pass through a conduit knockout but are not enclosed in conduit.

#### 2.7 Power Devices

- A. Refer to Section 27 00 00 for additional requirements.
- B. Horizontal PDU
  1. Power strip shall provide 3,840 joules of surge protection and power conditioning.
  2. Contractor shall provide one (1) power strip per rack/cabinet.
  3. Power strip shall be rated for 20 amps.

4. Manufacturer:
  - a. Tripp-Lite IBAR12-20ULTRA
  - b. Or approved equal

2.8 Horizontal Cable Management

- A. Horizontal cable managers shall include components that aid in routing, managing, and organizing cable to and from equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" racks and constructed of steel bases with PVC duct attached. The duct fingers shall include retaining tabs to retain the cables in place during cover removal. The covers shall be able to hinge from either side yet still be easily removed to allow for quick moves, adds, and changes.
- B. The cable managers shall be provided with movable wire retainers to retain the cables during cover removal and #12-24 mounting screws. An integral strain relief bracket shall be provided on either end of the duct to allow for easy cover placement.
- C. Double-Sided horizontal cable managers shall be placed above and below each patch panel.
- D. Manufacturers:
  1. Chatsworth#55053-703
  2. Ortronics
  3. Panduit
  4. Pentair Hoffman
  5. Or approved equal.

2.9 Telecommunication Ground

- A. The Telecommunication Contractor is responsible for providing an appropriate ground for all racks, trays, and telecommunications equipment installed by this Contractor. Refer to the Grounding and Bonding for Technology Systems specification section.

2.10 Wire Basket Runway Tray

- A. Within each Telecommunications Room, the Contractor shall provide and install sufficient wire basket tray to support cable bundles from corridor to equipment racks or as shown on the Project Drawings, this Contractor shall provide and install sufficient basket tray to support cable bundles from corridor to equipment racks or cabinets.
- B. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install complete wire basket runway systems in the telecommunication closet.
- C. Wire basket runway systems shall include, but are not limited to, straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports, and accessories.
- D. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.
- E. All straight section longitudinal wires shall be straight (with no bends).
- F. Wire basket runway shall be made of high strength steel wires and formed into a standard 2-inch by 4-inch wire mesh pattern with intersecting wires welded together. All wire ends along runway sides (flanges) shall be rounded during manufacturing for safety of cables and installers.
- G. All fittings shall be field formed as needed.
- H. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel. Splicing assemblies shall provide a continuous ground connection.
- I. Wire Basket Tray shall be grounded to a Telecommunications Room ground bus bar.
- J. Cable Drop Out/Waterfall
  - 1. Where cables bundles transition from tray and drop to the rack, cabinets or ladder rack, the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 20% future growth.
- K. T-sections of tray shall be made using T-section fittings.
- L. Straight section splices shall be made using splice plates.
- M. Wire basket runway supports shall be wall mounted brackets and trapeze hangers when spanning the room.
- N. Trapeze hangers shall be supported by 3/8 inch diameter rods.
- O. Provide size as indicated on the drawings.

- P. Tray shall have flat Black finish.
  - Q. Accessories (connectors, splice plates...) shall be painted to match tray finish.
  - R. Manufacturer:
    - 1. Cooper B-Line
    - 2. Legrand Cablofil
    - 3. Pentair Hoffman
    - 4. Or approved equal
- 2.11 Ladder Rack
- A. Within each Telecommunications Room, the Contractor shall provide and install ladder rack as shown on the Project Drawings.
  - B. Within each Telecommunications Room with a vertical conduit riser the Contractor shall provide and install vertical ladder rack connecting the ground conduit sleeve penetrations with the ceiling conduit sleeve penetrations.
  - C. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install a complete ladder rack system in the telecommunications room as shown on the Drawings.
  - D. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.
  - E. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel.
  - F. Cable Drop Out/Waterfall
    - 1. Where cables bundles transition from tray and drop into the racks/cabinets, the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 20% future growth.
  - G. Size ladder rack as indicated on the Contract Documents.
  - H. Accessories (connectors, splice plates...) shall be painted to match tray finish.
  - I. Manufacturers:
    - 1. Chatsworth
    - 2. Cooper
    - 3. Legrand
    - 4. Pentair Hoffman

5. Or approved equal

### **Part 3 - Execution**

#### **3.1 Equipment Rack and Cabinets**

- A. Prior to permanently securing racks or cabinets, the Contractor shall coordinate a walk through with the Owner to determine exact placement of racks.
- B. The Contractor shall bolt the rack to the floor as recommended by the manufacturer. Multiple racks shall be joined and the ground made common on each. Rack shall also be stabilized by extending a brace extending to the wall. Alternately, overhead cable tray over which the cabling accesses the equipment rack(s) shall provide this function.
- C. A space between the rack upright and the wall (~6") shall be planned to allow for cabling in that area. The rear of the rack shall be ~40" from the wall to allow for access by maintenance personnel. In all cases, a minimum of 40" workspace in front of the rack is also required. Locations where these guidelines cannot be followed shall be brought to the attention of the Consultant for resolution prior to installation.
- D. All hardware and equipment is to be mounted at least 18" above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware shall be reviewed and approved by the Consultant and Site Coordinator(s) prior to installation.
- E. Equipment rack shall be equipped with cable management hardware to allow an orderly and secure routing of twisted pair cabling to the data patch panels. At minimum, one such horizontal jumper management panel shall be placed below each fiber optic patch panel installed by the Contractor. Additional jumper management panels may be required pending installation of other cable types on the rack. The rack shall be grounded to the telecommunications grounding backbone (TGB) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket).

#### **3.2 Wire Basket Tray and Ladder Rack Runway**

- A. Runway shall be installed in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of NEC, applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.
- B. Coordinate installation of runway with other electrical work as necessary to properly interface installation of wire basket runway with other work.
- C. Provide sufficient space encompassing runways to permit access for installing and maintaining cables.
- D. Test runways to ensure electrical continuity of bonding and grounding connections and to demonstrate compliance with specified maximum grounding resistance.

**End of Section**



## Section 27 15 00 – Communications Horizontal Cabling

### Part 1 - General

#### 1.1 Scope

- A. This section describes the products and execution requirements relating to telecommunications voice, data and video horizontal (station) cabling and termination components.
- B. Horizontal cabling is the cabling between the work area telecommunications outlet and the telecommunications room (TR). Horizontal cabling is often referred to as “station cabling”.
- C. The horizontal cabling system will consist of the following:
  - 1. Unshielded Twisted Pair (UTP) Cable
  - 2. Outlet Termination Modules (jacks)
  - 3. Outlet Termination Plates
  - 4. Above Ceiling Cable Support Systems
  - 5. Horizontal Cable Testing Requirements
  - 6. Cable Pathway/Sleeve Requirements

#### 1.2 Related Work

- A. Section 27 00 00 – General Technology Requirements
- B. Section 27 05 00 – Communications General Requirements
- C. Section 27 05 23 – Pathways for Technology Systems
- D. Section 27 05 26 – Grounding and Bonding for Technology Systems
- E. Section 27 11 00 – Communications Equipment Rooms
- F. Section 27 13 00 – Communications Backbone Cabling
- G. Section 27 16 00 – Communications Connecting Cords
- H. Section 27 18 00 – Communications Labeling and Identification
- I. Section 27 21 00 – Network Electronics and UPS Systems
- J. Section 27 60 00 – Physical Security General Requirements
- K. Section 27 62 00 – Electronic Access Control System
- L. Section 27 66 00 – Video Surveillance System

2.1 Substitutions

- A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 Category 6 Horizontal Copper Cables

- A. All cables and equipment shall be furnished, tested, installed and wired by the Contractor.
- B. All horizontal data cables shall terminate on modular patch panels in the telecommunications closet as specified on the Drawings.
- C. This specification defines the requirements for commercially available high performance Category 6 cable.
- D. This cable shall be suitable for installation free-air, in building risers, in conduit, and/or in cable tray and shall carry CMP rating.
- E. The cable design described herein shall exceed transmission performance of Category 6 cables.
- F. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the National Electrical Code, and meet the specifications of NEMA (low loss), UL 444, and ICEA. Conductor shall also conform to the requirements for solid annealed copper wire in accordance with ASTM B 3.
- G. All cables, termination components, and support hardware shall be furnished, tested, installed, and wired by the Contractor.
- H. The jacket color for data cables shall be WHITE.
- I. **IMPORTANT:** Cable and termination components (jack, patch panel, wiring blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer.
- J. Manufacturers:
  - 1. Berk-Tek Lanmark 1000
  - 2. General Cable Genspeed 6000
  - 3. Superior Essex Series 77

2.3 Category 6A Horizontal Copper Cables

- A. All cables and equipment shall be furnished, tested, installed and wired by the Contractor.

- B. All horizontal data cables shall terminate on modular patch panels in the telecommunications closet as specified on the Drawings.
- C. All wireless access points shall utilize Category 6A cable unless noted otherwise.
- D. This cable shall be suitable for installation free-air, in building risers, in conduit, and/or in cable tray and shall carry CMP rating.
- E. The cable design described herein shall exceed transmission performance of Category 6 cables.
- F. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the National Electrical Code, and meet the specifications of NEMA (low loss), UL 444, and ICEA. Conductor shall also conform to the requirements for solid annealed copper wire in accordance with ASTM B 3.
- G. All cables, termination components, and support hardware shall be furnished, tested, installed, and wired by the Contractor.
- H. The jacket color for data cables shall be WHITE.
- I. **IMPORTANT:** Cable and termination components (jack, patch panel, wiring blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer.
- J. Manufacturers:
  - 1. Berk-Tek
  - 2. General Cable
  - 3. Superior Essex

2.4 Information Outlet

- A. General
  - 1. Station cables shall each be terminated at their designated workstation location in the connector types described in the subsections below. Included are modular jacks, faceplates, and surface mount raceway. The combined assembly is referred to as the Standard Information Outlet (SIO). These connector assemblies shall snap into a mounting frame.
  - 2. SIOs shall be mounted in new outlet boxes, where existing boxes are in place, on surface mount raceway typically in surface raceway with barrier, in floor mount interface boxes, or on power poles either currently owned or new.
  - 3. The telecommunications outlet frame shall accommodate or incorporate the following:
    - a. A minimum of four (4) modular jacks, when installed on a wall-mounted assembly.

- b. A mechanism for adjusting the surface plate to a plumb position.
  4. When multiple jacks are identified in close proximity on the Drawings. The Contractor shall determine the optimum compliant configuration based on the products proposed.
  5. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each SIO type for review by the Consultant.
- B. Modular Jack
1. Data jacks shall be non-keyed 8-pin modular jacks.
  2. Termination components shall be designed to maintain the cable's pair twists as closely as possible to the point of mechanical termination.
  3. Jacks shall utilize a four-layer printed circuit board to control NEXT.
  4. Jack housings shall fully encase and protect printed circuit boards and IDC fields.
  5. Modular jack contacts shall accept 2500 plug insertions.
  6. Modular jack contacts shall be formed flat for increased surface contact with mated plugs. These contacts shall be arranged on the PC board in two staggered arrays of four to maximize contact spacing and minimize crosstalk.
  7. Modular jack contacts shall be constructed of Beryllium copper for maximum spring force and resilience.
  8. Contact Plating shall be a minimum of 50 micro inches of gold in the contact area over 50 micro-inch of nickel, compliant with FCC part 68.5.
  9. Jack termination shall be 110 IDC, integral to the jack housing, laid out in two arrays of four contacts.
  10. Jacks shall utilize a paired punch down sequence. Cable pairs shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
  11. Jacks shall utilize tin lead plated (60% tin/40%lead) phosphor bronze 110 insulation displacement contacts.
  12. Jacks shall terminate 22-26 AWG stranded or solid conductors.
  13. Jacks shall terminate insulated conductors with outside diameters up to .050".
  14. Jacks shall be compatible with single conductor 110 impact termination tools.
  15. Jacks shall be compatible with EIA/TIA 606 color code labeling and accept snap on icons for identification or designation of applications.
  16. Jacks shall be ORANGE in color.
  17. Jacks shall be marked as either T568A or T568B wiring.

18. Category 6 jacks shall be manufactured by:

- a. Ortronics
- b. Panduit
- c. Uniprise

**C. Outlet Faceplates**

1. Faceplates shall match the electrical outlets for material type and color.
2. Faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.
3. Any unused jack positions shall be fitted with a removable blank inserted into the opening.
4. Modular jacks shall have capability to incorporate a dust cover that fits over and/or into the jack opening. The dust cover shall be designed to remain with the jack assembly when the jack is in use. No damage to the jack pinning shall result from insertion or removal of these covers. Dust covers that result in deformation of the jack pinning shall not be accepted.
5. Wall-mounted “voice only” outlets shall be installed where identified on the floor plan Drawings to accommodate wall-mounted telephone sets. The wall plate shall be of stainless steel construction, accommodate one RJ-45 jack, mount on a standard single gang outlet box or bracket, and include mating lugs for wall phone mounting.
6. All standard information outlets and the associated jacks shall be of the same manufacturer throughout each/the building. An allowable exception, however, is the wall-mounted “voice only” outlet described above.
7. Faceplates shall be manufactured by modular jack manufacturer.

**D. Surface Mount Interface Box**

1. Low profile, surface mount boxes shall incorporate recessed designation strips at the top for identifying labels. Designation strips shall be fitted with clear plastic covers.
2. The box shall feature built-in cable management for both fiber and copper applications.
3. Any unused jack positions shall be fitted with a removable blank inserted into the opening.
4. Modular jacks shall have capability to incorporate spring-loaded shutter door for added protection from dust and other airborne contaminants. The dust cover shall be designed to remain with the jack assembly when the jack is in use.

5. The box shall have the capability to incorporate optional magnets that can be internally mounted.
6. Surface mount box shall be manufactured by modular jack manufacturer.

**2.5 Additional Modules for Copper Cabling**

- A. Additional modules for copper shall include the following:
  1. 50 and 75 Ohm BNC coax coupler modules, male-male
  2. F-type coax coupler module, male-male threaded
  3. RCA connector modules with black, red, yellow, and white inserts
  4. Solder, pass-through and punch-down termination types
  5. Video connector modules - coupler and punch-down termination types
  6. Blank module to reserve space for future additions
- B. The connectors shall be designed to allow snap-in installation into the outlet faceplates.

**Part 3 - Execution**

**3.1 Testing**

- A. Refer to Section 27 00 00 for additional requirements.

**3.2 Twisted Pair Test Equipment**

- A. Test equipment used under this contract shall be from a manufacturer who has a minimum of five years' experience in producing field test equipment. Manufacturers shall be ISO 9001 certified.
- B. All test tools of a given type shall be from the same manufacturer and have compatible electronic results output. Test adapter cable shall be approved by the manufacturer of the test equipment. Baseline accuracy of the test equipment shall exceed TIA Level III, as indicated by independent laboratory testing.
- C. Test equipment shall:
  1. Be capable of certifying Category 5E, 6 and 6A permanent links.
  2. Have a dynamic range of at least 100dB to minimized measurement uncertainty.
  3. Be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.
  4. Include S-band time domain diagnostics for NEXT and return loss.
  5. Be capable of running individual NEXT, return loss, etc., measurements in addition to AutoText.

6. Include a library of cable types, stored by major manufacturer.
  7. Store at least 1000 Category 5e, 6 or 6A autotests in internal memory.
  - D. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurements.
  - E. The approved manufacturer of the test equipment is Fluke.
- 3.3 Warranty
- A. Refer to Section 27 00 00 for additional requirements.
- 3.4 Station Cabling
- A. Information outlet cables with copper media (voice & data UTP and “TV” coax) shall be located as detailed on the Project Drawings.
  - B. The Contractor shall utilize these documents in determining materials quantities and routing.
  - C. Station cables shall be run to the information outlet from the telecommunications room serving each area in conduit, free-air above drop ceiling, in cable tray, and/or in modular furniture.
  - D. The maximum station cable drop length for UTP cables shall not exceed 295 feet (90 meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and shall include any slack required for the installation and termination. The Contractor shall install station cabling in a fashion to avoid unnecessarily long runs.
  - E. Contractor shall verify cable lengths comply with published standards; prior to installation of any horizontal cabling, this Contractor shall verify cable paths and confirm no horizontal cable will exceed 295 total feet. If it is determined that the cable will exceed 295’, this Contractor shall route the cabling to another telecommunications room or determine shorter path so cables are under 295’. If this is not possible, the Contractor shall notify the Consultant prior to installation. Failure to do this step will not result in a change order from the Contractor.
  - F. All cables shall be installed splice-free unless otherwise specified.
  - G. During pulling operation, an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as the feed cable and operate pulling machinery.
  - H. Avoid abrasion and other damage to cables during installation.
  - I. All cable shall be free of tension at both ends. In cases where the cable shall bear some stress, Kellom grips may be used to spread the strain over a longer length of cable.

- J. Where installed free-air, installation shall consider the following:
  - 1. Cable shall run at right angles and be kept clear of other trades' work.
  - 2. Cables shall be supported according to code, using "J-hooks" anchored to ceiling concrete, walls, piping supports, or structural steel beams.
  - 3. Hooks shall be designed to maintain cable bend to larger than the minimum bend radius (typically 4x the cable diameter).
  - 4. Supports shall be spaced at a maximum 4-foot interval unless limited by building construction. If cable "sag" at mid-span exceeds 6 inches, another support shall be used.
- K. Cable shall never be laid directly on the ceiling grid.
- L. Cables shall not be attached to existing cabling, plumbing, or steam piping, ductwork, ceiling supports, or electrical or communications conduit.
- M. Manufacturers' minimum bend radius specifications shall be observed in all instances. Use of plastic cable ties is not acceptable. Cable bundles shall be neatly dressed with use of Velcro type straps.
- N. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.
- O. A coil of one foot in each cable shall be placed in the ceiling at the last support (e.g., J-hook) before the cables enter a fishable wall, conduit, surface raceway, or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15 feet of slack shall be left in each station cable under 250 feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.
- P. To reduce or eliminate EMI, the following minimum separation distances from  $\leq 480V$  power lines shall be adhered to:
  - 1. Twelve (12) inches from power lines of  $< 5\text{-kVa}$
  - 2. Eighteen (18) inches from high voltage lighting (including fluorescent)
  - 3. Thirty-nine (39) inches from power lines of 5-kVa or greater
  - 4. Thirty-nine (39) inches from transformers and motors
- Q. All openings shall be sleeved and firestopped per prevailing code requirements upon completion of cable installation.

### 3.5 Information Outlet

- A. Information outlets shall be flush mounted on wall-mounted boxes, in floor-mounted boxes, on surface raceway, or on modular furniture.

- B. Any outlets to be added where these conditions are not met shall be positioned at a height matching that of existing services or as directed otherwise by the Site Coordinator and the Consultant. Nominal height (from finished floor to center line of outlet) in new installation shall be as follows:
  - 1. Standard Voice & Data Outlet (SIO) shall match adjacent electrical outlets.
  - 2. Wall-Mounted Telephone Outlet (Standard Voice only) shall meet ADA requirements for both front and side reach access.
- C. The Contractor shall coordinate the style of the telecommunication outlets to be installed in the floor mount boxes and surface mount raceways with the Owner.

### 3.6 Cable Termination

- A. At the telecommunication closet, all data and voice cables shall be positioned on termination hardware in sequence of the outlet ID, starting with the lowest number.
- B. Termination hardware (blocks and patch panels) positioning and layout will be reviewed and approved by the Consultant prior to construction. The review does not exempt the Contractor from meeting any of the requirements stated in this document.
- C. Cable Termination – Data/Voice UTP
  - 1. Data/voice patch panels shall be designed and installed in a fashion as to allow future station cabling to be terminated on the panel without disruption to existing connections.
  - 2. Data patch panels shall be sized to accommodate a minimum of 20% growth in the quantity of stations relative to the initial installation.
  - 3. At information outlets and data/voice patch panels, the installer shall ensure that the twists in each cable pair are preserved to within 0.5 inch of the termination for data/voice cables. The cable jacket shall be removed only to the extent required to make the termination.
- D. Cable Termination – Fiber Optic
  - 1. All fibers shall be terminated using the specified connector type.
  - 2. All terminated fibers at the telecommunications closets shall be mated to couplings mounted on patch panels. Couplings shall be mounted on a panel that, in turn, snaps into the housing assembly. Any unused panel positions shall be fitted with a blank panel inhibiting access to the fiber optic cable from the front of the housing.
  - 3. All couplings shall be fitted with a dust cap.
  - 4. Fibers from multiple locations may share a common enclosure, but they shall be segregated on the connector panels and clearly identified. Fibers from multiple destinations may be secured in a common enclosure, provided they are clearly

identified as such. Fibers from different locations shall not share a common connector panel (e.g., “insert”).

5. Slack in each fiber shall be provided as to allow for future re-termination in the event of connector or fiber end-face damage. Adequate slack shall be retained to allow termination at a 30” high workbench positioned adjacent to the termination enclosure(s). A minimum of one meter (~39”) of slack shall be retained regardless of panel position relative to the potential work area.
6. If the cable is armored the Contractor shall install a plastic twist-on bushing on each end of interlocking armored fiber to protect cable from sharp edges of the armor.

### 3.7 Elevator Interface

- A. The Contractor shall furnish and install an elevator interface box outside of the elevator equipment room.
  1. The Contractor shall provide an elevator telecommunications junction box located outside of the Elevator Machine Room, for interface of telecommunication cable to the elevator cab(s). This requirement complies with ANSI A17.1 code which prevents work within the Elevator Machine Room, other than specific elevator work.
  2. Telecommunications J-box shall include a keyed lockable door. Additionally, the J-box shall have proper punch down blocks and data jacks suitable for terminating all cables within the J-box.
  3. The Contractor shall provide any voice/data cables to this enclosure as required.
  4. Electronics or cable for other systems such as security shall not be placed within this enclosure.
  5. Coordinate exact location of elevator security junction box with the Elevator Contractor, Architect, and Consultant, prior to installation.
  6. Cables entering the elevator telecommunications J-box and elevator equipment room shall be appropriately labeled by the Contractor, so that the Elevator Contractor can connect the appropriate wires to the elevator controllers. Wires should be individually labeled to separate them from other elevator functions and to assist the Elevator Contractor in making proper connection points.

### 3.8 Test Data – Copper Media

- A. The test result records saved by the tester shall be transferred into a Windows-based database utility that allows for the maintenance, inspection, and archiving of these test records. A guarantee shall be made that these results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test. Comma separated value (CSV) format is not acceptable.

- B. The database for the completed job – including twisted-pair copper cabling links, if applicable – shall be stored and delivered on CD-ROM. This CD-ROM shall include the software tools required to view, inspect, and print any selection of test reports.
- C. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:
  - 1. The identification of the link in accordance with the naming convention defined in the overall system documentation.
  - 2. The overall Pass/Fail evaluation of the copper channel-under-test, including the NEXT worst-case margin (margin is defined as the difference between the measured value and the test limit value).
  - 3. The overall Pass/Fail evaluation of the fiber link-under-test, including the Attenuation worst-case margin (margin is defined as the difference between the measured value and the test limit value).
  - 4. The date and time the test results were saved in the memory of the tester.

**3.9 Copper Station Cables**

- A. Station cabling testing shall be from the jack at the outlet in the work area to the patch panel on which the cables are terminated.
- B. Testing shall be of the permanent link. Contractor shall warrant performance, however, based on channel performance and provide patch cords that meet channel performance criteria. All cabling not tested strictly in accordance with these procedures shall be retested at no cost to the Owner.
- C. Testing shall be from the jack at the SIO to the patch panel on which the cables are terminated at the wiring hub.
- D. Horizontal “station” cables shall be free of shorts within the pairs and shall be verified for continuity, pair validity and polarity, and wire map (conductor position on the modular jack). Any defective, split, or mispositioned pairs shall be identified and corrected.
- E. Testing of the cabling systems rated at TIA Category 5e/6/6a and above shall be performed to confirm proper functioning and performance.
- F. Testing of the transmission performance of station cables (Category 5e/6/6a) shall include the following:
  - 1. Length
  - 2. Attenuation
  - 3. Pair to Pair NEXT
  - 4. ACR
  - 5. PSNEXT Loss

- 6. Return Loss
  - 7. Pair to Pair ELFEXT Loss or ACRF
  - 8. PSEFEXT Loss or PS-ACRF
  - 9. Propagation Delay
  - 10. Delay Skew
  - 11. Return Loss
- G. The maximum length of station cable shall not exceed 90 meters, which allows 10 meters for equipment and patch cables.
- H. Worst case performance at 20°C, based on a horizontal cable length of 90 meters and equipment cord length of 4 meters, shall be as follows:

1. CATEGORY 6 (Permanent LINK)

Frequency (MHz)	Insertion Loss (Maximum dB)	NEXT Loss Pair to Pair (dB)	PS-NEXT Loss (dB; Worst Case)	ELFEXT Loss Pair to Pair (dB)	PSELFEXT loss (dB)
1.0	1.9	65.0	62.0	64.2	61.2
4.0	3.5	64.1	61.8	52.1	49.1
8.0	5.0	59.4	57.0	46.1	43.1
10.0	5.5	57.8	55.5	44.2	41.2
16.0	7.0	54.6	52.2	40.1	37.1
20.0	7.8	53.1	50.7	38.2	35.2
25.0	8.8	51.5	49.1	36.2	33.2
31.25	9.8	50.0	47.5	34.3	31.3
62.5	14.1	45.1	42.7	28.3	25.3
100.0	18.0	41.8	39.3	24.2	21.2
200.0	26.1	36.9	34.3	18.2	15.2
250.0	29.5	35.3	32.7	16.2	13.2

2. CATEGORY 6A (Permanent LINK)

Frequency (MHz)	Insertion Loss (Maximum dB)	NEXT Loss Pair to Pair (dB)	PS-NEXT Loss (dB; Worst Case)	ACRF Pair to Pair (dB)	PS-ACRF (dB)
1.0	1.9	65.0	62.0	64.2	61.2
4.0	3.5	64.1	61.8	52.1	49.1
8.0	5.0	59.4	57.0	46.1	43.1
10.0	5.5	57.8	55.5	44.2	41.2
16.0	7.0	54.6	52.2	40.1	37.1
20.0	7.8	53.1	50.7	38.2	35.2
25.0	8.8	51.5	49.1	36.2	33.2
31.25	9.8	50.0	47.5	34.3	31.3
62.5	14.1	45.1	42.7	28.3	25.3
100.0	18.0	41.8	39.3	24.2	21.2

Frequency (MHz)	Insertion Loss (Maximum dB)	NEXT Loss Pair to Pair (dB)	PS-NEXT Loss (dB; Worst Case)	ACRF Pair to Pair (dB)	PS-ACRF (dB)
200.0	26.1	36.9	34.3	18.2	15.2
250.0	29.5	35.3	32.7	16.2	13.2
300.0	32.7	34.0	31.4	14.6	11.6
400.0	38.5	29.9	27.1	12.1	9.1
500.0	43.8	26.7	23.8	10.2	7.2

- I. In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation method. The Contractor shall make additional tests as the Consultant deems necessary at no additional expense to the Owner or Consultant.
- J. All data shall indicate the worst-case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combination and in both directions when required by the appropriate standards.
- K. Cables shall be tested to the maximum frequency defined by the standards covering that performance category. Transmission Performance Testing shall be performed using a test instrument designed for testing to the specified frequencies. Test records shall verify “PASS” on each cable and display the specified parameters—comparing test values with standards-based “templates” integral to the unit.

**End of Section**

## Section 27 16 00 – Communications Connecting Cords

### Part 1 - General

#### 1.1 Scope

- A. This section describes the products relating to high quality Category 6 voice and data patch cords.
- B. In this section the term patch cords refers to the cords that connect Owner provided data network electronics to the horizontal cable infrastructure.
- C. It is important that the horizontal cable system and the provided patch cords work as one complete system for guaranteed channel performance. Patch cords shall be manufactured by the same manufacturer as the jack and patch panels.
- D. The Contractor shall provide and deliver all cords as listed in this section. The Owner will be responsible for installation of cords.

#### 1.2 Related Work

- A. Section 27 00 00 – General Technology Requirements
- B. Section 27 05 00 – Communications General Requirements
- C. Section 27 05 23 – Pathways for Technology Systems
- D. Section 27 05 26 – Grounding and Bonding for Technology Systems
- E. Section 27 11 00 – Communications Equipment Rooms
- F. Section 27 13 00 – Communications Backbone Cabling
- G. Section 27 15 00 – Communications Horizontal Cabling
- H. Section 27 18 00 – Communications Labeling and Identification
- I. Section 27 21 00 – Network Electronics and UPS Systems
- J. Section 27 60 00 – Physical Security General Requirements
- K. Section 27 62 00 – Electronic Access Control System
- L. Section 27 66 00 – Video Surveillance System

### Part 2 - Products

#### 2.1 Substitutions

- A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 Category 6 and 6A Patch Cords

- A. The Owner has the right to determine the final length of the patch cords after the contract is awarded.
- B. All patch cords shall be round and consist of eight insulated 23 AWG stranded copper conductors, arranged in four color-coded twisted pairs within a flame retardant jacket and be backwards compatible with lower performing categories. Modular patch cords shall utilize ISO termination method that is designed to reduce and control near-end cross talk (NEXT) and far end cross talk (FEXT) without compromising signal impedance.
- C. Both ends of the cord shall be equipped with modular 8-position (RJ45 style) plugs wired straight through with standards compliant wiring. All modular plugs shall exceed FCC CFR 47 part 68 subpart F and IEC 603.7 specifications, and have 50 micro inches of gold plating over nickel contacts. Cable shall be label-verifiable. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Patch cords shall have color-coded insert molded strain relief boot with a latch guard to protect against snagging. Additional color-coding shall be available by the use of snap-in icons.
- D. Patch cords shall be wired straight through. Pin numbers shall be identical at each end and shall be paired to match T568B patch panel jack wiring per ANSI/TIA/EIA-568-B. Patch cords shall be unkeyed.
- E. The manufacturer of the cords shall be the same as the manufacturer for UTP termination hardware (jacks & patch panels). Cords shall be highest quality patch cords available by connectivity manufacturer.
- F. The Contractor shall supply (1) 3' Category 6 patch cord and (1) 5' Category 6 patch cord for every horizontal Category 6 cable installed and (2) Category 6 patch cables for every security camera installed. Security camera patch cable lengths as required for security camera install. See drawing details for installation details. (for pricing purposes only; refer to section 3.01):

**Part 3 - Execution**

3.1 Ordering and Delivery

- A. Prior to ordering patch cords the Contractor shall schedule meeting with Owner and Consultant to verify patch cord lengths, colors, and quantities.
- B. Contractor shall coordinate delivery of patch cords with Owner. Contractor shall have list of delivered cords and shall have Owner sign delivery sheet at time of delivery.

**End of Section**

## Section 27 18 00 – Communications Labeling and Identification

### Part 1 - General

#### 1.1 Scope

- A. This section describes the products and execution requirements relating to labeling of telecommunications cabling, termination components, and related subsystems. Covered systems include the following:
  - 1. Equipment room backboards and equipment racks
  - 2. Station cable and terminating equipment
  - 3. Telecommunications grounds and related components

#### 1.2 Related Work

- A. Section 27 00 00 – General Technology Requirements
- B. Section 27 05 00 – Communications General Requirements
- C. Section 27 05 23 – Pathways for Technology Systems
- D. Section 27 05 26 – Grounding and Bonding for Technology Systems
- E. Section 27 11 00 – Communications Equipment Rooms
- F. Section 27 13 00 – Communications Backbone Cabling
- G. Section 27 15 00 – Communications Horizontal Cabling
- H. Section 27 16 00 – Communications Connecting Cords
- I. Section 27 21 00 – Network Electronics and UPS Systems
- J. Section 27 60 00 – Physical Security General Requirements
- K. Section 27 62 00 – Electronic Access Control System
- L. Section 27 66 00 – Video Surveillance System

### Part 2 - Products

#### 2.1 Substitutions

- A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 Labels

- A. All labels shall be permanent and be machine generated (e.g., Brady or Panduit). No handwritten or non-permanent labels shall be allowed. Labels shall be Brady “I.D. Pro” or XC-Plus or equivalent. Labeling on backboards and/or equipment racks may be pre-cut adhesive type.
- B. Characters on all labels shall be black printed on a white background.
- C. Label size shall be appropriate to the cable size(s), outlet faceplate layout, patch panel design, or other related equipment sizes and layouts.
- D. All labels to be used on cables shall be self-laminating, white/transparent vinyl, and be wrapped around the cable sheath. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminated over the full extent of the printed area of the label.
- E. Labels used to identify innerduct carrying fiber optic cable shall be labeled with a durable yellow polyethylene tag that reads “CAUTION Fiber Optic Cable” and includes blank spaces for adding (1) fiber count and (2) destination information. An example of a compliant product is VIP Products’ “Caution Write-On Coverall Tag.”

**Part 3 - Execution**

3.1 General

- A. The Contractor shall match the Owner’s standard labeling scheme.
- B. Clean surfaces before attaching labels.
- C. Install all labels firmly. Labels attached to terminating equipment such as backboards, faceplates, 110 blocks, and patch panels shall be installed plumb and neatly on all equipment.

3.2 Labeling of Cabling and Termination Components

- A. Backboard and Equipment Racks
  - 1. Backboards and equipment racks shall be labeled by the Contractor identifying the telecommunication room. Additionally, equipment racks shall have an alpha character after the room number unique to that particular communications closet. For example, TR1-A would be the first rack in TR1.
  - 2. Character height shall be 1-inch (minimum).
- B. Cabling
  - 1. Horizontal cables shall have a machine generated wrap around cable label within 4” of each end of the cable. Label shall be clearly legible and meet TIA-EIA 606 standards. Character height shall be .25” (minimum).

2. Voice/data/video backbone cables shall have a machine generated wrap around cable label within 12” of each end of the cable. Label shall be clearly legible and meet TIA-EIA 606 standard. Character height shall be .5” (minimum).

**3.3 Fiber Optic Backbone, Riser Cables, and Termination Components**

- A. All fiber optic backbone and copper (inter-building, riser, and tie) cables shall be identified AT BOTH ENDS with a designation that identifies where the opposite end of the same cable terminates (e.g., equipment room or telecommunications room I.D.). In addition, labeling of all fiber optic cables shall include the number of fibers in the cable.
- B. Each fiber optic termination panel shall be clearly labeled indicating the destination of the cable(s) and the fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.

**3.4 Standard Information Outlet (SIO) Faceplates**

- A. All faceplates shall be clearly labeled indicating the destination of the cable(s) (telecommunication room number), the data patch panel(s) letter designation, the data port number(s) on the data patch panel(s), and the voice cable number(s).
- B. Telecommunications outlets are to be labeled (1) on the cover of the assembly and (2) on each cable terminated at that location.
- C. Station cables shall be labeled within two inches of the cable end.

**3.5 Data Patch Panels**

- A. All data patch panels shall be clearly labeled indicating the telecommunication room number, the data patch panel letter designation, and the data port number on the data patch panel (ports 1 through 48). Each telecommunication room shall start with data patch panel ‘A’ and continue through the alphabet.
- B. A data port schedule for each telecommunication room shall be created in spreadsheet format (Excel) with the telecommunication room number, data patch panel letter designations, data port numbers, and room numbers identified in the spreadsheet. In addition, for each data patch panel port, a field shall be provided in the spreadsheet for the Owner to manage the cabling infrastructure by recording the device and any special notes pertaining to the room utilizing the data cable terminated to the port.
- C. Refer to Telecommunication “T” Series Project Drawings for standard information outlet faceplate and data & voice patch panel labeling scheme requirements. A sample of the data and voice port schedules is to be provided to the Owner, in the cable record book and in electronic format (Excel spreadsheet), with final documents provided on the Project Drawings.

- 3.6 Fiber Optic Cables and Termination Components
- A. All fiber optic cables, termination enclosures and connector panels, and splice closures shall be clearly labeled.
  - B. In addition, labeling of all fiber optic cables shall include the number of fibers in the cable.
  - C. Each fiber optic termination panel shall be clearly labeled indicating (1) the destination(s) of the cable(s) and (2) fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.
- 3.7 Ground System Labeling
- A. All grounds shall be labeled as close as practical to the point of termination (for ease of access to read the label). Labels shall be nonmetallic and include the following statement: “WARNING: If this connector or cable is loose or must be removed, please call the building telecommunications manger.” Refer to ANSI/TIA/EIA 606 for additional labeling requirements.

**End of Section**



## Section 27 21 00 – Network Electronics and UPS Systems

### Part 1 - General

#### 1.1 Qualifications

- A. Contractor and/or its subcontractors shall be fully authorized/certified to supply, upgrade, install, configure, provide warranty service, and troubleshoot the proposed equipment.

#### 1.2 Related Work

- A. Section 27 00 00 – General Technology Requirements
- B. Section 27 05 00 – Communications General Requirements
- C. Section 27 05 23 – Pathways for Technology Systems
- D. Section 27 05 26 – Grounding and Bonding for Technology Systems
- E. Section 27 11 00 – Communications Equipment Rooms
- F. Section 27 13 00 – Communications Backbone Cabling
- G. Section 27 15 00 – Communications Horizontal Cabling
- H. Section 27 16 00 – Communications Connecting Cords
- I. Section 27 18 00 – Communications Labeling and Identification
- J. Section 27 60 00 – Physical Security General Requirements
- K. Section 27 62 00 – Electronic Access Control System
- L. Section 27 66 00 – Video Surveillance System

#### 1.3 Definitions

- B. Network Contractor (also referred to as Contractor within this section): The entity contracted by the Owner to provide and implement the systems specified within this Section.

#### 1.4 Reference

- C. The provisions of Section 27 00 00 – General Technology Requirements are included as a part of this section as though bound herein.

#### 1.5 Standards

- A. These standards shall govern the work, as well as the standards, organizations, and sources referenced in Section 27 00 00 – General Technology Requirements.
  - 1. IEEE 802.3 (all letter suffixes)

2. ISO/IEC-11801 (all updates)
3. TIA/EIA 568A & 568B
4. TIA/EIA 569
5. ANSITP-PMD

1.6 Submittals for Network Systems

- A. Contractor must provide the following submittals within 10 working days of Notice to Proceed:
  1. Project Schedule including dates for progress meetings, and showing milestone dates for delivery and installation for each of the systems included in this RFP.
  2. Name of and contact information for Contractor's Project Manager
  3. Network diagram showing how all network electronics are inter-connected.
- B. Work shall not proceed without approval of submittals.

1.7 Scope of Services

- A. All network electronics and UPS systems will be supplied and installed by Contractor.
- B. Network Contractor Responsibilities
  1. Provide and install network electronics, as specified within this section.
  2. Provide and implement uninterruptible power supply (UPS) systems, as specified within this section.
  3. Supply all materials and labor necessary to mount network devices and UPS units in racks or locations as directed by Owner or Consultant.
  4. Configure all network electronics and UPS systems as specified within this section and as shown on the technology drawings.

1.8 Warranty Period

- A. The Contractor, by entering into a contract with the Owner, warrants and represents that all materials, equipment, and services delivered to the Owner pursuant to the contract conforms to all of the specifications contained or referred herein. The Contractor further guarantees to replace all materials, equipment, or services that may be rejected by the Owner due to defective materials or workmanship for a minimum of one year following acceptance. Failure or neglect of the Owner to require compliance with any term or condition of the contract specifications shall not be deemed a waiver of such term or condition.

- 2.1 General Product Requirements
  - A. Refer to Section 27 00 00 – E&A General Technology Requirements.
- 2.2 Network Equipment General Requirements
  - A. All devices must be installed with the most current software version, unless otherwise requested by Owner.
  - B. All installation services must be warranted by the Network Contractor for 12 months.
  - C. All network and UPS equipment must be rack mounted. Racks provided by Cabling Contractor.
  - D. External transceivers or media converters shall not be used.
  - E. Announced, but not yet shipping equipment will be considered, providing: 1) that the announced delivery date is on or before the installation dates of this project and 2) that the contractor allows a 60-day test period to ensure that equipment performs according to specifications.
  - F. All provided systems must be new and currently in manufacture.
  - G. All components must be “UL” approved and FCC certified.
  - H. All network equipment must be rack mounted.
  - I. Bid must include all software updates and upgrades for twelve (12) months after completion. Any cost for such must be included in the base bid.
- 2.3 Requirements for all Ethernet switches
  - A. All switches must be installed with the most current software version, unless otherwise requested by Owner.
  - B. Identical software images must be loaded on all switches of the same type (e.g., all access switches must have the same software load.)
  - C. All switches shall have the proper licensing to insure that all RFP requirements are met.
  - D. All switch devices must be capable of supporting IPv6
  - E. All switch devices must be support 802.1p and 802.1Q, to provide standards-based traffic prioritization and VLANs.
  - F. Switches must support a minimum of 256 VLANs.
  - G. All switches must support a minimum of four (4) classes of QoS.

- H. All switches must support IGMP snooping.
- I. All switches must support SNMPv3 and RMON Statistics, Alarms, Events, and History at a minimum.
- J. All switches must enable network manager to mirror traffic on any port to another port for analysis by a sniffer or RMON probe.
- K. Switch devices proposed must support 802.3ad link aggregation (“trunking”) of multiple Gigabit Ethernet connections to aggregate bandwidth.
- L. When Power over Ethernet (PoE) is called for, it is required to be a minimum of IEEE 802.3af (802.3at Type 1).
- M. All stacking cable connections shall be 10 Gbps, at minimum.
- N. All stacked switch configuration shall perform and be managed as one device.
- O. All switches must have the capability of adding 10 Gigabit uplinks.

#### 2.4 ETHERNET Switches

- A. Supply Ethernet switch for security equipment.
  - 1. Ten Port (minimum) Layer 2/3, Fully Managed, 10/100/1000 Mbps, PoE+ switch at each Fire Station.
  - 2. Forty-Eight Port (minimum) Layer 2/3, Fully Managed, 10/100/1000 Mbps, PoE+ switch at HQ.
  - 3. Contractor to supply all power supplies and necessary mounting hardware for all switches. Supply the number of PoE+ switch ports plus 10% for all devices connecting to the network.
- B. Contractor is to supply all necessary copper and fiber optic patch cables to interconnect switches and other (Owner’s) devices as necessary.

#### 2.5 Uninterruptible Power Supply (UPS) devices

- A. UPS systems shall be implemented to provide temporary power to Ethernet switches, security servers, and intercom servers specified as part of this RFP in the event of an electrical power outage, but also to level out power sags (brownouts), spikes and surges in order to protect the network devices.
- B. Include all necessary hardware and software for use with SNMP.
- C. Each UPS shall include an environmental sensor for detecting environmental conditions (temp, humidity, etc.) around each UPS unit.

- D. UPS systems shall protect against spikes, surges, power sags (brownouts) and blackouts. (Fully “online”.)
- E. UPS devices shall be rack mounted. Include in pricing all labor and necessary materials to rack mount all UPS devices. All necessary hardware shall be provided to accommodate whether a UPS unit is installed in a 2-post, 4-post, wall/floor rack, or wall/floor cabinet.
- F. Contractor is responsible to select appropriate manufacturer/model(s) based on the power draw you calculate. Proposer must determine the capacity needed based on the equipment you propose for all security/intercom components as well as the following information.
  - 1. UPS system must supply power for 30 minutes. Contractor to calculate PoE load based on quantity of security/intercom devices connecting to the network.

**Part 3 - Execution**

**3.1 Coordination**

- A. Refer to Section 27 00 00 – General Technology Requirements.
- B. Prior to ordering, furnishing, or installing any equipment, written approval of equipment, locations, layout, and installation shall be obtained from the Owner.
- C. Coordinate the installation of the switches with the Cable Contractor to insure horizontal cable management is installed correctly in and around the data switches.
- D. Network Contractor shall coordinate the installation of the rack/cabinet PDUs with the Cable Contractor to insure that they are installed in a proper position on the rack or cabinet.
- E. If there appears to be insufficient space in any rack for installation of devices, the Network Contractor must notify the Owner’s Project Manager immediately and wait for a decision before proceeding with installation at that location.

**3.2 Installation Requirements**

- A. The Contractor shall be responsible for installation of all network electronics and UPS components into provided racks. The Contractor shall power-up electronics, install all patch cables, and configure all data network electronics and UPS equipment.
  - 1. Work with Owner to understand its IP addressing scheme and to implement this scheme in the furnished devices, and ensure network visibility of those devices.
  - 2. Work with Owner to understand its VLAN scheme and to implement this scheme in the furnished system.
  - 3. Work with the Owner to develop SNMP configurations, community strings, and passwords for all devices and to implement these in the furnished system.

4. Work with the Owner to implement security features as required by the Owner.
  5. Work with the Owner to ensure the proper QoS configurations are implemented to support all applications provided under this RFP.
  6. Learn and understand the Owner’s device naming convention, and implement appropriate device names on all new devices.
  7. Label all equipment and cables as required by the Owner.
- B. The Contractor shall unpack equipment from shipping material and organize equipment. This includes checking to ensure that all equipment is complete and fully functional. Empty boxes and packaging shall be neatly organized per the Owner’s instructions and removed if requested.
  - C. The Contractor shall make the components physically secure by mounting equipment and related accessories into racks as required. Manufacturer’s guidelines for installation shall be followed.
  - D. All rack-mount equipment shall be secured as recommended by the manufacturer with consideration to airflow, power, and patch cable connections.
  - E. Network Contractor shall neatly dress all power cables and secure with Velcro tie wraps between devices and PDUs or UPS systems.
  - F. Systems described in this document shall be delivered to the installation location and installed by the Contractor without any additional cost or expense to the Owner, and the Owner shall not be deemed to have accepted any equipment until the date of acceptance.
  - G. All rubbish, debris, and dirt resulting from the Network Contractor’s work shall be cleaned up and removed from the buildings daily. The premises shall at all times be kept in a clean, safe, and professional manner.
  - H. Work shall be performed during normal hours of operation for the building where the work is taking place. Any deviations must be discussed with and approved by the Owner’s Project Manager prior to work occurring.
  - I. UPS unit delivery directly to location where unit will be installed and labor to install the UPS devices shall be included in the bid cost.
  - J. Supply, install, connect, and configure a network card in each UPS unit.
- 3.3 Project Closeout and Acceptance
- A. Punch List – Work or materials found to be incomplete, of unsatisfactory quality, failing to meet the specifications in the RFP package and resulting contract, and/or unacceptable to the Owner shall be documented in a punch list by the Owner and provided to the Contractor to rectify.
  - B. Punch List Approval – The punch list shall be considered complete only after having been signed by the Owner.

- C. Documentation – The Contractor shall provide the Owner logical diagrams showing all equipment installed per Telecommunications Room. All addressing and naming conventions shall be shown on the drawings. Contractor shall supply (2) electronic copies of all documentation.
  
- D. Acceptance – Acceptance shall occur after all of the following conditions have been met:
  - 1. All items/systems have been delivered and properly installed.
  - 2. All of the work has been completed in accordance with the contract and RFP specifications.
  - 3. All outstanding punch list items have been completed.
  - 4. The Contractor has certified in writing to the Owner that the system is installed in accordance with these specifications and is ready for use.
  - 5. The Owner or the Owner’s designated representative has inspected the installation and provided written approval.
  - 6. At this time, upon the Owner’s written acceptance, operational control becomes the responsibility of the Owner. This constitutes Date of Acceptance. The warranty for the entire system and all components begins as of this date.

**End of Section**



## Section 27 60 00 – Physical Security General Requirements

### Part 1 - General

#### 1.1 Scope

- A. Refer to Section 27 00 00 for additional project scope information.
- B. This section describes the general product and execution requirements related to furnishing and installing Physical Security Systems. Physical Security Systems includes Video Surveillance, Electronic Access Control, and their sub systems.
- C. Contractor shall be responsible for providing complete and functional systems as described in this specification and project drawings.
- D. Contractor shall provide low voltage power and control lines to and from power supplies, remotely controlled equipment, and other devices, even though not explicitly indicated on drawings or listed in equipment tables.
- E. Contractor shall be, or Contractor shall provide, an Electrical Contractor for provision of high voltage power and conduits/raceway, where necessary.
- F. Contractor shall be responsible for any and all related programming and end-user training unless noted otherwise.

#### 1.2 Related Work

- A. Section 27 00 00 – General Technology Requirements
- B. Section 27 05 00 – Communications General Requirements
- C. Section 27 05 23 – Pathways for Technology Systems
- D. Section 27 05 26 – Grounding and Bonding for Technology Systems
- E. Section 27 11 00 – Communications Equipment Rooms
- F. Section 27 13 00 – Communications Backbone Cabling
- G. Section 27 15 00 – Communications Horizontal Cabling
- H. Section 27 16 00 – Communications Connecting Cords
- I. Section 27 18 00 – Communications Labeling and Identification
- J. Section 27 21 00 – Network Electronics and UPS Systems
- K. Section 27 62 00 – Electronic Access Control System
- L. Section 27 66 00 – Video Surveillance System

- M. Training: Programmer shall have received manufacturer-provided and/or manufacturer approved training in the configuration of the physical security system(s) being provided.
- N. Certification: Programmer shall hold the highest applicable manufacturer programming certification(s) offered by the manufacturer(s) of the physical security system(s).
- O. Submittal: Certification certificate shall be submitted with physical security system(s) submittals.

1.3 Pre-Construction Submittals

- A. Refer to Section 27 00 00 for additional requirements.
- B. Hardware, Application Software, and Network Requirements: A system description including analysis and calculations used in sizing equipment required by the Physical Security Systems. The description shall show how the equipment will operate as a system to meet the performance requirements of the systems. The following information shall be supplied as a minimum:
  - 1. Server(s) processor(s), disk space and memory size
  - 2. Workstation(s) processor(s), disk space and memory size
  - 3. Description of site (field) control equipment (Controllers/Field Panels) and their configuration
  - 4. Operating System(s) Software, where software is provided or upgraded
  - 5. Application Software, with Optional and Custom Software Modules supplied in this project
  - 6. Integration Schemes: Proposed connectivity, software, development requirements, and SDK information, for inter-system communication.
  - 7. Network reliability requirements
  - 8. Number and location of LAN ports required
  - 9. Number of IP addresses required.
  - 10. Other specific network requirements, preferences, and constraints
  - 11. Backup/archive system size and configuration
  - 12. Start-up operations
  - 13. Battery backup requirements

1.4 Closeout Submittals

- A. Refer to Section 27 00 00 for additional requirements.

- B. Quick-Reference Guides: Contractor shall create a concise quick-reference guide covering normal system operation and basic troubleshooting procedures for each room/system type. Length of each quick-reference guide shall be commensurate with the information needed for successful operation, subject to Owner approval.
  - 1. Upon Owner approval, Contractor shall provide two (2) laminated copies and one (1) digital copy for each room/system type.
- C. Serial Numbers: Contractor shall provide a list of serial numbers for all supplied components with serial numbers and with a unit price greater than \$99. Organize list by room/system type.

## **Part 2 - Products**

### **2.1 Substitutions**

- A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

## **Part 3 - Execution**

### **3.1 Training**

- A. Refer to Section 27 00 00 for additional requirements.
- B. On-Site Training
  - 1. General: Present, review and describe equipment and materials to the Owner and Owner's operating personnel and fully demonstrate the operation and maintenance of the systems, equipment and devices specified herein.
  - 2. Include with new systems, Contractor to arrange and provide for video recording of each onsite training session.
    - a. Provide professional video and audio recording of each software screen option with Owner approval of content.
    - b. Provide end user video recording for Department of Safety & Security approved processes.
    - c. Provide Security Systems Specialists approved recording of maintenance and troubleshooting process.
  - 3. Training shall comprise two separate levels of training;
    - a. User Group upon substantial completion of the project.
      - i. User group training shall include a site/building walk through indicating locations of equipment and their usage.
      - ii. User group training shall include the operation of workstation capability of system monitoring, command override and report generation.
    - b. Maintenance Group upon completion of the project prior to close out.

- i. Maintenance group training shall include a site/building walk through indicating locations of equipment and their usage at up to six representative sites.
    - ii. Review of a-build documentation at each controller location.
    - iii. Troubleshooting techniques in hardware and software.
  - 4. The training shall cover the overall system, each individual system, each subsystem, and each component. The training shall also cover procedures for database management, normal operations, and failure modes with response procedures for each failure. Each procedural item shall be applied to each equipment level.
- C. Duration: Refer to the individual sections for the minimum time requirements.

### 3.2 Warranty

- A. Furnish and guarantee maintenance, repair and inspection service for the system using factory trained authorized representatives of the manufacturer of the equipment for a period of one year after final acceptance of the installation.
- B. Third Party Device warranties are transferred from the manufacturer to the Contractor, which may then transfer third party warranties to the Owner. Specific third party warranty details, terms and conditions, remedies and procedures, are either expressly stated on, or packaged with, or accompany such products. The warranty period may vary from product to product. These products include but are not limited to devices that are directly interconnected to the field hardware or computers and are purchased directly from the manufacturer.
- C. Purpose
  - 1. The Contractor shall repair any system malfunction or installation deficiency discovered by the Owner or their representatives during the burn in and warranty period.
  - 2. The Contractor shall correct any installation deficiencies found against the contract drawings and specifications discovered by the Owner or their representatives during the warranty period.

### 3.3 Examination of Site and Documents

- A. Bidder shall examine all documents, shall visit the site(s) prior to submitting bid, record their own investigations, and shall inform themselves of all conditions under which the Work is to be performed at the site(s) of the Work, including the structure of the ground, the obstacles that may be encountered, and all of the conditions of the documents, including superintendence of the Work, requirements of temporary environmental controls, the time of completion, list of Subcontractors, and all other relevant matters that may affect the Work or the bid process.
- B. Verify cable lengths comply with published standards.
- C. Notify Owner/Consultant of installation that would exceed maximum lengths prior to installation of cable.
- D. Contactor shall consult with Owner/Consultant regarding alternative routing or

location of cable.

- E. Do not proceed until unsatisfactory conditions have been corrected.
- F. Failure to make the examination shall not result in any Change Order requests.
- G. The Bidder shall base the bid on the site(s) examination, materials complying with the plans and specifications and shall list all materials where the bid form requires.
- H. The commencement of work by the Contractor shall indicate acceptance of existing conditions, unless a written notice of exceptions has been provided to the Owner/Consultant prior to commencement.
- I. If the Contractor observes, during preliminary examinations or subsequent work, existing violations of fire stopping, electrical wiring, grounding, or other safety- or code-related issues, the Contractor shall report these to the Owner/Consultant in a timely manner.

#### 3.4 Installation Requirements

- A. Refer to Section 27 00 00 for additional requirements.
- B. Contractor shall furnish and install all cables, connectors, and equipment as shown on Drawings and as specified herein.
- C. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified. This includes any modifications required to route and conceal horizontal distribution wiring.
- D. Beginning installation means Contractor accepts existing conditions.
- E. The Contractor shall be responsible for identifying and reporting to the General Contractor any existing damage to walls, flooring, tiles, and furnishings in the work area prior to start of work. All damage to interior spaces caused by the installation of cable, raceway, or other hardware shall be repaired by the Contractor.
- F. Repairs shall match preexisting color and finish of walls, floors, and ceilings. Any Contractor-damaged ceiling tiles, floor, and carpet shall to be replaced to match color, size, style, and texture.
- G. Where unacceptable conditions are found, the Contractor shall bring this to the attention of the construction supervisor immediately. A written resolution will follow to determine the appropriate action to be taken.
- H. All wiring shall be run "free-air," in conduit, in a secured plastic raceway or in modular furniture as designated on the Drawings. All cable shall be free of tension at both ends. PLENUM rated cable shall be used in areas used for air handling.
- I. Avoid abrasion and other damage to cables during installation.
- J. The cable system will be tested and documented upon completion of the installation as defined in the section below.
- K. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by manufacturers or as

indicated in their published literature, unless specifically noted herein to the contrary.

3.5 Cooperation

- A. The Contractor shall cooperate with Consultant's and Owner's personnel in locating work in a proper manner.
- B. Should it be necessary to raise, lower, or move longitudinally any part of the work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

3.6 Commissioning Submittals

- A. Provide the following to the Owner no later than 30 days prior to system commissioning/programming.
  - 1. Commissioning Test Plan and Check-Off List: Specified elsewhere in this document.
  - 2. Software: One set of fully functional software in manufacturer's original media packaging, temporarily licensed for a 30-day evaluation period.
  - 3. Web-based Training: Access to web-based training modules.

3.7 Commissioning

- A. Provide programming and commissioning for each system as described in individual sections below.
- B. This Contractor shall develop and submit a plan for coordination of settings and programming issues with the Consultant and Owner no later than 30 days prior to performing programming and commissioning.
- C. The security Contractor is required to place entire system into full and proper operation as designed and specified.
- D. Verify that all hardware components are properly installed, connected, communicating, and operating correctly.
- E. Verify that all system software is installed, configured, and complies with specified functional requirements.
- F. Perform final acceptance testing in the presence of Owner's representative, executing a point-by-point inspection against a documented test plan that demonstrates compliance with system requirements as designed and specified.
  - 1. Submit documented test plan to Owner at least 14 days in advance of acceptance test, inspection, and check-off.
  - 2. Conduct final acceptance tests in presence of Owner's representative, verifying that each device point and sequence is operating correctly and properly reporting back to control panel and control center.

3. Acceptance by Owner is contingent on successful completion of check-off; if check-off is not completed due to additional work required, re-schedule and perform complete check-off until complete in one pass, unless portions of system can be verified as not adversely affected by additional work.
4. The system shall not be considered accepted until all acceptance test items have been successfully checked-off. Beneficial use of part or all of the system shall not be considered as acceptance.

3.8 Operation and Maintenance Manuals

- A. Part One: Notwithstanding requirements specified elsewhere, submit the following labeled as the "Operating and Maintenance Manual" within thirty (30) days after Final Acceptance of the Installation:
  1. Record Drawings: Submit two (2) copies of revised versions of drawings as submitted in the "Shop and Field" and "Equipment Wiring Diagrams" Submittals showing actual device locations, conduit routing, wiring and relationships as they were constructed. Include nomenclature showing as-built wire designations and colors. Drawings shall include room numbers coinciding with Owner space planning numbering. Drawings shall be submitted in electronic editable AutoCAD 2010 files, in ".dwg" format, on CD or DVD disks.
  2. Manuals: Submit two (2) copies of each of the following materials in bound manuals, or electronic PDF copies, with labeled dividers:
    - a. A final Bill of Material for each system
    - b. Equipment Instruction Manuals: Complete, project specific comprehensive instructions for the operation of devices and equipment provided as part of this work.
    - c. Manufacturers Instruction Manuals: Specification sheets, brochures, Operation Manuals and service sheets published by the manufacturers of the components, devices and equipment provided.
    - d. Include information for testing, repair, troubleshooting, assembly, disassembly and recommended maintenance intervals.
    - e. Provide a replacement parts list with current prices. Include list of recommended spare parts, tools, and instruments for testing and maintenance purpose.
    - f. Performance, Test and Adjustment Data: Comprehensive documentation of performance verification according to parameters specified herein.
    - g. Warranties: Provide an executed copy of the Warranty Agreement and copies of all manufacturer's Warranty Registration papers as described herein.
- B. Part Two: Within fourteen (14) days of receipt of Consultant reviewed Operating and Maintenance Manual (Phase One), submit three (3) electronic copies in AutoCAD 2010 editable .dwg format of the reviewed Record Drawings and three (3) copies of the reviewed Operating and Maintenance Manuals to the Owner, on CD or DVD disks.

1. Within each equipment enclosure and/or terminal cabinet, the Contractor shall place a Single Line drawing of the system(s) and the respective Terminal Cabinet Wiring Diagram in a clear plastic sleeve permanently attached to the inside cover of the terminal cabinet.
  2. In each equipment enclosure the Contractor shall place a drawing providing device locations served by the equipment within the enclosure with identification that is identical to the wiring tags and with the software description of each point.
  3. The Contractor shall provide to the Owner one (1) copy of new administration and user software, including required graphical maps, on CD or DVD disks.
- C. Sufficient information, (detailed schematics of subsystems, assemblies and subassemblies to component level) clearly presented, shall be included to determine compliance with drawings and specifications.

### 3.9 Closeout Procedures

- A. Notification: Contractor shall provide written notification to Architect/Consultant and Owner when Contractor is satisfied that the work has been completed and is ready for inspection.
- B. Closeout Submittals: Contractor shall provide closeout documentation to the Architect/Consultant. The Architect/Consultant shall receive the closeout submittals no less than 72 hours prior to the scheduled inspection time.
- C. Inspection: Contractor shall be present for the inspection by the Architect/Consultant. Contractor shall supply all testing equipment needed to verify compliance with the specifications found in Bid package.
- D. Punch List: Work or materials found to be incomplete, of unsatisfactory quality, failing to meet the specifications in the Bid package, and/or unacceptable to the Architect/Consultant shall be documented by the Architect/Consultant and provided to Contractor to rectify.
- E. Re-Inspection: If a re-inspection is necessary, the costs of the Architect/Consultant's additional travel, hours, and expenses may be deducted by the Owner from the contract amount due Contractor.
- F. Punch List Approval: The punch list shall be considered complete only after having been signed by the Owner and Architect/Consultant.
- G. The system has successfully completed a 30-day performance period.
- H. Payment Authorization: Final payment will be authorized only after all closeout procedures and requirements have been followed and fulfilled by Contractor and approved in writing by the Owner and Architect/Consultant, including punch list(s) and/or re-inspection(s).

### 3.10 Service Contract

- A. The service contract shall cover equipment and software related to this contract, and shall provide for the following parts and services, without additional cost to the Owner:

1. Bi-yearly inspections, preventative maintenance and testing of equipment and components in Year One of the warranty period.
  2. Annual inspections, preventive maintenance, and testing of equipment and components in Years Two and above of the warranty period.
  3. Regular Service, Emergency Service, and Call-Back Service
  4. Labor and Repairs
  5. Equipment, and Materials and transportation cost.
- B. Response Time: Response time for service calls.
1. Emergency service calls where system is not responding to staff directed commands through the computer systems shall be within 2 hours to the project site.
  2. Emergency service calls where controllers are not reporting shall be within 2 hours to the project site.
  3. Normal service calls for device malfunctions shall be within 24 hours during normal working hours to the site.
- C. Repair Time: Contractor shall stock parts in sufficient quantities such that repair or replacement shall be guaranteed within 12-hours. Temporary replacements within this time period shall be acceptable, provided temporary replacements do not compromise system functionality, and provided permanent replacement is achieved within 72 hours. Contractor may contact Owner representative for use of Owner supplied spare parts where delay of system repair will have negative impact on system performance.
- D. Commencement: The warranty begins at the time of issuance of the statement of "Final Acceptance of the Installation" by the Owner.
- E. Transferability: The warranty shall be transferable to any person or persons at the discretion of the Owner.
- F. Transmittal: A copy of this Warranty shall be delivered to, and signed for by the Owner's representative whose primary responsibility is the operation and care of these systems. A copy of the signed Warranty document shall be delivered for review as part of the Final Submittals.
- G. Registration: Register Warranty papers for all equipment and software in the name of the Owner. Furnish reproductions of all equipment Warranty papers to the Owner with the Final Submittals.
- H. Subcontracting: Warranty service work may not be subcontracted except with specific permission and approval by the Owner.
- I. Resolution of Conflicts
1. The Owner retains the right to resolve unsatisfactory warranty service performance at any time by declaring the work unsatisfactory, stating specific areas of dissatisfaction in writing.

2. If the Contractor or his approved Subcontractor does not resolve such stated areas of dissatisfaction within thirty (30) days, the Owner may appoint any alternative service agency or person to fulfill the terms of the Warranty; the cost of which shall be borne by the Contractor. This action may be taken repeatedly until the Owner is satisfied that Warranty service performance is satisfactory. Satisfactory resolution of a malfunction shall be considered adequate when the device, equipment, system or component which is chronically malfunctioning is brought into compliance with the standards of performance as contained herein and published by the manufacturers of the equipment installed.

**End of Section**

## Section 27 62 00 – Electronic Access Control System

### Part 1 - General

#### 1.1 Scope

- A. Refer to Section 27 00 00 for additional project scope information.
- B. This specification section covers the furnishing and installation of a new and complete enterprise-wide, low-voltage, Electronic Access Control System (EACS).
- C. Contractor shall furnish and install access control hardware devices, mounting brackets, power supplies, switches, controls, consoles, and other components of the system as shown and specified.
- D. Contractor shall furnish and install access control related software to allow this system expansion. Software includes required license addition for access control readers and electrified portals, workstations and required physical security system Integration.
- E. Furnish and install outlets, junction boxes, conduit, connectors, wiring, and other accessories necessary to complete the system installation. Requirements shall be in accordance with Division 26 00 00, Electrical.

#### 1.2 Precedence

- A. Obtain, read, and comply with General Conditions and applicable sub-sections of the contract specifications. Where a discrepancy may exist between any applicable sub-section and directions as contained herein, this section shall govern.

#### 1.3 Related Work

- A. Division 08 - Door Hardware
- B. Section 27 00 00 – General Technology Requirements
- C. Section 27 05 00 – Communications General Requirements
- D. Section 27 05 23 – Pathways for Technology Systems
- E. Section 27 05 26 – Grounding and Bonding for Technology Systems
- F. Section 27 11 00 – Communications Equipment Rooms
- G. Section 27 13 00 – Communications Backbone Cabling
- H. Section 27 15 00 – Communications Horizontal Cabling
- I. Section 27 16 00 – Communications Connecting Cords
- J. Section 27 18 00 – Communications Labeling and Identification
- K. Section 27 21 00 – Network Electronics and UPS Systems

- L. Section 27 60 00 – Physical Security General Requirements
- M. Section 27 66 00 – Video Surveillance System

**Part 2 - Products**

2.1 Electronic Access Control Hardware

- A. The Access Control Panel (ACP) is used as the subcomponent to the security management system for the purpose of initiating all decision-making criteria as it relates to the cardholders, readers, and associated hardware connected. Decisions are made by the ACP and uploaded to the host computer as historical events.
- B. The ACP shall be listed for Underwriters Laboratory (UL):
  - 1. UL294 (Access Control System)
- C. Provide an access control system based off of Mercury Security open platform hardware and interface modules. The panels shall:
  - 1. Operate without the need for the host to be on-line. No decisions shall be dependent on the host.
  - 2. Support on-board 10/100 Ethernet communications to the host as primary communication.
  - 3. Include a request-to-exit and door status contact input for each reader without the need for additional modules for future use.
  - 4. Detect “forced entry” and “door left open.” A separate action is required for each.
  - 5. Allow mapping of readers to any output address within the same controller.
  - 6. Support at least 50 user-selected holidays.
  - 7. Allow all unused door logic, such as door strike relays, request-to-exit inputs, and door status inputs to be assigned as general-purpose points.
  - 8. Support optional modules for additional customization of inputs and outputs.
  - 9. Wireless reader support.
  - 10. Elevator support.
  - 11. Support a minimum of 5,060 alarm input points.
  - 12. Support a minimum of 5,060 relay output points.
  - 13. Maintain historical information for a minimum of three (3) months without AC power.
  - 14. Automatically adjust for daylight savings time and leap year.
  - 15. Support a variety of reader technologies.

16. Support for OSDP and OSDP SC (Secure Channel).
  17. Support the following card/reader technologies as a minimum:
    - a. Magnetic Stripe
    - b. 125KHz Proximity cards
    - c. 13.56Mhz Smart Cards and technologies
    - d. Biometrics
    - e. Wiegand
    - f. Vehicle Identification
    - g. Support multiple technologies simultaneously.
    - h. Support for HID 37-bit card formats.
    - i. Support for HID iClass SE and Seos technologies.
    - j. Support for NXP MiFare DESFire EV1
  18. Maintain the expiration date for each cardholder. Once the date is reached, the card will automatically be disabled. No access shall be authorized.
  19. Maintain three (3) access times for each door location: Standard, Long, and Egress.
  20. Have the ability to maintain an automatic door unlock during specific hours and days.
  21. Support a minimum of (2) “levels” of Anti-Passback: Global and Area.
- D. Panels shall use Mercury Security EP controller with MR interface panels. Contractor shall provide adequate number of access control panels, controllers, door interface panels and I/O panels for a complete turnkey system to support all components as indicated on project drawings. Basis of design is EP1502 controllers, MR52 interface panels and MR16IN/OUT I/O panels. Single door controllers shall only be used when specifically specified or approved by the Consultant.

## 2.2 System Software

- A. Manufacture:
  1. Genetec Security Center Synergis Professional
- B. Operating System Requirements: Shall operate in conjunction with and be compatible with Microsoft Windows Server 2022 operating systems.
- C. Support for Microsoft Active Directory (LDAP).
  1. Provide all licenses and integration required for LDAP integration.
  2. Provide (1) **GSC-1AD-USCH**, Active Directory Integration.

- D. Support for virtualization.
- E. Software shall include:
  - 1. Graphical user interface to show pull-down menus and a menu tree format.
  - 2. Password-protected operator login and access.
- F. Integration with video management system. Assume 2 cameras per door. All access control alarms shall be associated to video clips.
- G. Access Control Application Software: Shall provide interface between the ACS Host Workstation, IP based Reader-Controllers, inputs, and outputs in order to monitor sensors operate displays, report alarms, generate reports and provide all other system functions as follows:
  - 1. Overall Access Control System Parameters:
    - a. Number of access control readers per system: Unlimited
    - b. Number of client work stations per system: Unlimited
    - c. Number of cardholders: 64,000 per reader stand-alone mode, unlimited in network mode.
    - d. Number of credentials per cardholders: Unlimited
    - e. Number of cardholder groups: Unlimited
    - f. Number of system inputs: Unlimited
    - g. Number of system outputs: Unlimited
    - h. Reader Inputs: Door sense, request to exit, auxiliary, optical tamper, RS-232
    - i. Reader Outputs: (2) outputs; TTL1 and TTL2
  - 2. Access Control Software Functions: The system software shall provide for the following features and functions:
    - a. Door Programming Functions
      - i. Extended open alarms Individual Extended open timers per door.
      - ii. Personal Identification Number (PIN) Codes – Up to 9 digits.
      - iii. Device Support: Supports selected serial RS-232 and Wiegand devices.
      - iv. Number of Door Groups: Unlimited
    - b. Shifts
      - i. Number of shifts: Unlimited
      - ii. Interval assignments: Any day of the week.
    - c. Permissions
      - i. Number of Permissions: Unlimited

- d. Holidays: The software shall provide for an unlimited number of holidays.
- e. Door Control: The software shall provide the following types of area control functions:
  - i. Door control based on dual-authentication rules.
  - ii. Support requiring credentials belonging to two people
  - iii. Support requiring two credentials belong to same person
  - iv. Cardholder use limits
  - v. Elapsed Time based
  - vi. Number of usage based
  - vii. Configurable individual door strike times.
  - viii. Configurable extended individual door hold open times.
- f. Elevator Control: The software shall provide elevator control for an unlimited number of floors.
- g. System Graphical Tree: The software shall provide for graphical tree displays of the configured field hardware.
- h. Alarm and Event Logging: The software shall provide for logging of all system alarms and events chronologically including time and date stamp.
- i. System Scheduling: The system shall provide for scheduling of events including:
  - i. Open Door, Open Door Group
  - ii. Deactivate Badges
- j. Help Documentation: The software shall include complete documentation on CD.
- k. Alarm attributes: The software shall provide for programming of the following alarm and monitoring attributes:
  - i. Display of alarm events at the ACS Host workstation, or support networked workstation.
  - ii. Require the reader-controller, which generated the alarm to be restored to its normal state before the alarm is cleared.
  - iii. Require acknowledgment of an alarm to clear the alarm.
  - iv. Support auto-clearing of network related communication alarms.
  - v. Trigger a programmed system actions(s) when the alarm is acknowledged.
  - vi. Require a User Logon for Acknowledgment.

- I. Programming Downloads: The software shall provide for downloading of programming from the ACS Host to the Reader-controller-controllers as follows:
  - i. Credential holders and authorized time zones
  - ii. Time zones.
  - iii. Alarm configurations.
  - iv. Latch intervals.
  - v. TTL output on REX, Tamper, Unauthorized.
  - vi. Beep on events (REX, Tamper, Reject)
  - vii. Complete database download of 10,000 cardholder records in less than 15 minutes with system continuing to operate normally during this time.
- m. Reader-controller Programming Options: Provide the following minimum reader-controller programming functions:
  - i. Request to exit and door position switch: Provide programming for independent supervision of request to exit and door position switch.
  - ii. Manual activation of outputs: Provide for configurable activation of outputs from a credential presentation.
  - iii. User definable door strike time: Provide user definable/ programmable door strike functionality for each reader-controller.
  - iv. In/ out Reader-controller configuration: Reader-controller programmed as either an in reader or out reader for recording of time in and time out data.
  - v. Program use Limits: Limiting the number of times that cardholders may use their credential to gain access at the Reader-controller.
  - vi. Input/output linking: Provide programming for linking of reader outputs with inputs.
3. ACS Host Software Functions: The system ACS Host software shall provide for the following features and functions:
  - a. Device Status Monitoring
    - i. Alarm Status Indication: Provide real time status display that indicates the current status of all devices in the device tree.
    - ii. Reader-controller status: Provide display of Reader-controllers that are off line.
  - b. Device Group Programming
    - i. Reader-controller Groups: Provide for programming of Reader-controller groups.
    - ii. Input Groups: Provide for programming of input groups.

- iii. Output Groups: Provide for programming of output groups.
- c. Trace
  - i. Historical Trace: Provide for historical trace on any Reader-controller or cardholder.
- d. Test Utilities: Provide system test utilities to allow for testing of the following functions:
  - i. Alarm inputs status.
  - ii. Output operations.
  - iii. Credential Presentations.
  - iv. LED and buzzer operations
- e. Real-Time Graphical Maps: Provide graphical maps that display reader-controller status and allow for manual operation of the reader-controller.
  - i. Map Device Icons: Icons shall dynamically change to reflect the current state of the devices.
- f. Map Formats: Support import of maps to include the following file formats:
  - i. JPEG (.jpg)
  - ii. Windows Metafile (.wmf)
  - iii. Windows Bitmap (.bmp)
- g. Web- Browser Support
  - i. Support commonly used ACS functions from a standard workstation internet browser
  - ii. Support commonly used ACS functions from a standard mobile phone internet browser
- 4. Credential Management Software Functions: The system credential management software shall provide for the following features and functions:
  - a. Modification of cardholder records: Add, Modify and Delete records based upon permissions.
  - b. Access and Credential Management: Provide for the following credential management functions:
    - i. Assignment of single or multiple active badges.
    - ii. Programming personnel groups.
    - iii. Programming of group access permissions.
    - iv. Programming of individual access permissions
  - c. Badge Design: Provide badge design software that is integral to the access control source code with the following badge layout tools:

- i. Complete Badge design and Layout.
- ii. Image Import.

ID Printers: Provide support for industry standard printers and Microsoft Certified Windows 7 printer drivers and the following badge print formats:

- iii. Double-sided full color printing.
- iv. Edge to edge printing.

**2.3 Software Maintenance**

- A. The system shall be provided with a 5-year software maintenance agreement. The Owner shall be able to receive all major and minor software updates at no additional cost for the duration of the project. At the completion of the project the Owner shall have the option to receive a final software upgrade to the latest version (including all devices) before the project is paid in full.

**2.4 Mapping Software**

- A. The ACS software shall be provided with native integrated mapping software.
- B. The mapping software shall be compatible with JPEG and PNG.
- C. The Contractor shall provide a satellite level screen shot map showing exterior devices. These maps shall include drill down links to access the building floor plans where all interior and exterior devices are shown. The overview satellite map shall show alarms signifying there is an alarm in the building to draw attention quickly.
- D. The Contractor shall be responsible to provide all the labor to setup these maps and place all the devices.
- E. The Contractor shall get sign-off from the Owner and Consultant on the finished maps.
- F. The Contractor shall obtain the building plans from the Consultant for their use.

**2.5 Electronic Access Control Server**

- A. Provide one (1) directory server located in the customer's equipment rack located at the Fire Department HQ building.

**2.6 Mobile Access Contactless Smart Card Readers**

- A. 125Khz and 13.56Mhz MultiClass readers
  - 1. Credentials:
    - a. Operating Frequency: 13.56 MHz (ISO 15693, 14443A & 14443B)
    - b. Contactless smart card reader shall implement the following high security 13.56 MHz applications out-of-box.
      - i. Secure Identity Object on HID iCLASS SE
    - c. Able to read 37-bit card format.



2. Operating voltage range: 5-16 VDC
3. Current draw: 65mA average and 200mA peak @ 12VDC.
4. Color: Black
5. IP 55 exterior rated.
6. With attached pigtail
7. Typical read range for model R15 of 3.6” with card and 1.6” with fob
8. Typical read range for model R40 of 5.2” with card and 2.8” with fob
9. Provide adapter plate to mount on a single-gang mud ring as required.
10. Firmware upgradable via pre-programmed cards.
11. Provide the ability to transmit an alarm signal via an integrated optical tamper switch if an attempt is made to remove the reader.
12. An audio beeper and RGB light bar shall provide various tone and light sequences to signify: access granted, access denied, power up, and diagnostics.
13. Card readers shall be HID Signo Reader 40 (**40NKS-00-000000**) for standard applications and HID Signo Reader 20 (**20NKS-00-000000**) for mullion applications.

2.7 Access Control Credentials

A. Furnish the following

1. Quantity of (100) **SY-MID-SUB-T100**, T100 Mobile Access Subscription – Mobile Identities - 1-year user license for HID Origo Mobile Identities.
2. Quantity of (100) **3250PNNMN**, iCLASS SE Keyfob, 2K/2, Programmed iCLASS, Black W/Blue HID Logo, Matching iClass internal/external numbers.

2.8 Unified Managed Power Supplies

- A. Provide a power supply/chargers and sub-assemblies to power various access controller boards, locking hardware and other access control or security system components. The Contractor shall select the appropriate enclosure, power supply and sub-assemblies for each application. The Contractor shall include network monitoring modules for all power supplies.
- B. The power supplies shall house the access control boards within a single enclosure.
- C. Manufacturer:
  1. LifeSafety Power
  2. Or approved equal
- D. Enclosures
  1. Shall be capable of accommodating power supplies, sub-assemblies and other manufactures access control controller boards when required.

2. Wall mountable.
  3. Include a cam-lock and tamper switch.
  4. LifeSafety Power FPO150-B100D8PM8NL4E4M, fire stations (basis of design).
  5. LifeSafety Power FPO250/250-3D8P3M8NLXE12M, headquarters (basis of design).
- E. Power Supplies
1. 115 VAC input
  2. 12VDC or 24VDC selectable outputs at:
    - a. 2 amp continuous power @ 12VDC or 24VDC.
    - b. 4 amp continuous power @ 12VDC or 24VDC.
    - c. 6 amp continuous power @ 12VDC or 24VDC.
  3. High capacity battery charging circuit.
    - a. Provide adequate battery backup as required by Authority Having Jurisdiction (AHJ) or a minimum of 4-hours.
  4. Form “C” supervision contacts for AC Low, AC Fail, and battery presence.
  5. Supervised Fire Disconnect.
  6. Low power Disconnect.
  7. Class 2 aux. output.
  8. UL 294 listed sub-assembly for access control.
- F. Sub-Assemblies
1. The Contractor shall provide all sub-assemblies to meet the project requirements
  2. Access Control Module
    - a. Independently controlled fused protected outputs:
      - i. Fail-Safe and/or Fail-Secure power outputs.
      - ii. Dry form “C” 5 amp rated relay outputs (fused).
      - iii. Any combination of the above
  3. Access Control System trigger inputs:
    - a. Normally open (NO) inputs.
    - b. Open collector sink inputs.
    - c. Any combination of the above.
  4. Fire Alarm Disconnect:
    - a. Individually selectable for any or all outputs.

- b. Latching or non-latch input FACP disconnect.

- c. Normally open (NO), normally closed (NC) dry contact or polarity reversal from FACP signaling circuit trigger input.
  - d. LED indicates that the Fire Alarm Disconnect has been activated.
  - e. Form “C” relay output for auxiliary reporting.
5. Multi-Output Power Distribution Module
- a. Single input distributed over four (4), eight (8) or sixteen (16) outputs.
  - b. Fused protected outputs.
  - c. Output terminals shall accommodate up to 12AWG wires.
6. Multi-Output Power Distribution Module with Dual Inputs
- a. Two (2) inputs distributed over eight (8) outputs.
  - b. Outputs shall be configurable by input.
  - c. Fused protected outputs.
  - d. Output terminals shall accommodate up to 12AWG wires.
7. Network Communication Modules
- a. Power Supply Network Interface
    - i. Interface for up to two (2) power supply/chargers.
    - ii. Two (2) Network controlled From “C” relays.
    - iii. Event timers.
  - b. Network Power Distribution Module
    - i. Two (2) inputs distributed over eight (8) outputs.
    - ii. Outputs shall be configurable by input.
    - iii. Fused protected outputs.
    - iv. Emergency disconnect interface by output.
    - v. Selectable battery back-up by output.
    - vi. Output terminals shall accommodate up to 12AWG wires.
  - c. Common monitoring features
    - i. Network interface via LAN/WAN.
    - ii. Remote reporting of status via email and/or SNMP trap messaging.
    - iii. AC, low battery and battery presence monitoring.
    - iv. Alert messages of System Service required.
    - v. System log.
    - vi. On demand determination of system status.

- vii. Reset of individual outputs as required for remote diagnostics.
- viii. Monitor enclosure temperature.
- ix. Static or DHCP IP address configuration.
- x. SSL Secure Sockets Layer encryption.

8. Voltage Regulator

- a. The Contractor shall provide a voltage regulator to provide constant 5VDC or 12VDC outputs for access control boards, modules or other applicable components as well as a voltage regulator for door hardwiring requiring 12VDC.
- b. 24vdc Input.
- c. 5 or 12VDC output.
- d. Output rating of 6amp max.
- e. Stackable with both Networkable and dual input power distribution modules for space savings.

9. Power supplies and sub-assemblies shall be manufactured by LifeSafety Power or approved equal:

2.9 High Current Power Supplies for Electric Latch Retraction

- A. 115 VAC input, 6.3A.
- B. (2) 20VDC to 26.4VDC individually controlled lock outputs.
- C. Provides up to 15 amps for up to 300ms for high inrush applications and up to .75 amps continuous holding current.
- D. Auxiliary 12VDC always on output up to .75A.
- E. High capacity battery charging circuit.
  - 1. Provide adequate battery backup as required by Authority Having Jurisdiction (AHJ) or a minimum of 1-hour when power supply is not connected to a UPS circuit.
- F. (2) Normally Open trigger inputs.
- G. Normally closed FACP trigger input.
- H. Trouble relay output indicating low DC output voltage.
- I. UL 294 listed sub-assembly for access control.
- J. Include with lockable enclosure.
- K. Provide with appropriate gauge wire to allow for remote mounting according to manufacturer's recommendations.
- L. Manufacturer:

1. Altronix Striket1
2. Or approved equal

**2.10 Cables**

- A. Provide cabling per manufacturer's recommendations and code requirements for riser rated, plenum, and non-plenum cable types.
- B. UTP data cabling required will be provided, installed, terminated and tested by the Division 27 structured cabling Contractor.
- C. UTP patch cables will be provided and installed by the Contractor in the IDF and provided and installed by Contractor at the door.
- D. Cables for electronic access controlled doors shall be bundled and include the followings conductor counts:
  1. Card reader – 6 conductor, 22 awg shielded.
  2. Lock power – 4 conductor, 18 awg unshielded.
  3. Door contact – 2 conductor, 22 awg unshielded
  4. Request to exit and/or latch detection/spare – 4 conductor, 22 awg unshielded
- E. Cables for RS-485 shall be 24-AWG, 2-pair with 100% coverage aluminum foil shield and 90% coverage outer tinned copper braid shield.
  1. Manufacturer:
    - a. Belden #9843
    - b. Or approved equal
- F. Manufacturer:
  1. Belden #658AFS
  2. Convergent#725116
  3. General Cable #4EPL1S
  4. Or approved equal

**2.11 Door Contacts/Door Position Switches (DC)**

- A. The Security Contractor shall be responsible for the connection of all door position devices to the access control system. Door position devices shall be integral to the door hardware whenever possible. The Contractor shall refer to the door hardware schedule and coordinate with the door hardware Contractor on locations and requirements.
- B. Sealed and potted magnetic reed switch in contact housing.
- C. Provide DPDT for applications with multiple security systems utilizing a single door contact.

- D. Provide color that matches door as close as possible.
- E. Provide recessed switch whenever possible.
- F. Armored whip for surface mount contacts.
- G. Provide UTC Interlogix 1078 Series for recessed applications.
  - 1. Or approved equal.
- H. Provide UTC Interlogix 2500 Series for surface mount applications.
  - 1. Or approved equal.
- I. Provide UTC Interlogix 2200 Series for overhead door applications.
  - 1. Or approved equal.

**2.12 Request to Exit (REX) Devices**

- A. The Security Contractor shall be responsible for the connection of all request to exit devices integral to the door, motion based or other to the access control system. Request to Exit devices shall be integral to the door hardware whenever possible. The Contractor shall refer to the door hardware schedule and coordinate with the door hardware Contractor on locations and requirements. Motion based Request to Exit devices shall only be used when not available in the door hardware.
- B. The motion based REX shall be a dual technology device with Passive Infrared (PIR) and Range-Controlled Radar (RCR) motion detector.
- C. Reduces false alarms by sensing both heat and physical motion.
- D. Independent adjustable beam pattern and radar depth.
- E. Provide with mounting plate or wall mounting plate to mount over a single-gang backbox when required.
- F. Provide color that matches door as close as possible.
- G. DPDT output.
- H. DC Power draw: 28mA max @ 12 VDC, 17mA max @ 24 VDC.
- I. AC Power draw: 38mA max @ 12 VAC, 29mA max @ 24 VAC.
- J. Dimensions: 1.76”H x 7.395”W x 1.85”D.
- K. Utilize contact closure REX hardware built into the handle or crashbar whenever possible.
- L. Provide UTC Interlogix RCR-REX.
  - 1. Or approved dual technology equal.

**2.13 Electrified Hardware (EH)**

- A. The Security Contractor shall be responsible for the connection of all electrified

hardware to the access control system. This shall include providing centralized power supplies located next to or integral to the access control panels. The Contractor shall coordinate with the door hardware specifications and schedules for additional information.

**2.14 Workstations**

- A. Refer to 27 66 00 for workstation requirements. Both the ACS and VMS system shall share a single workstation.
- B. The EACS Contractor shall be responsible for installing and configuring client software the workstations.

**2.15 Wiegand Extenders**

- A. The Contractor shall provide an extender for any card reader location within an elevator. Coordinate connection to the travel cable, travel cable requirements and installation within the elevator cab and equipment room with the elevator contractor.
- B. Additionally, the Contractor shall provide an extender for any card reader located more than 500' from the access control panel.
- C. When not connecting to an elevator travel cable provide 18-AWG, shielded 2-conductor cable between near and far end units utilizing Belden 8760 or equal.
- D. Extends up to 4,000 feet on 22 awg cable and 10,000 on 18 awg cable.
- E. Devices shall be fully supervised.
- F. Rugged aluminum housing.
- G. Operating temp rating from -40 F to +176 F.
- H. Provide with near end and far end units.
- I. Provide with power supplies as necessary. Access control power supply may be utilized so long as the correct voltage is utilized.
- J. Manufacturer:
  - 1. CypressSPX-1300
  - 2. Or approved equal

**2.16 Surge Protection for Wiegand Communication**

- A. The Contractor shall provide a surge protector for all exterior card readers not directly attached to a building which would include any pedestal mounted reader, gate reader or any other exposed reader potentially prone to surges.
- B. Mount unit outside of the access control/power supply panels. Provide with appropriate mounting and enclosures as required.
- C. There shall be a minimum of a 36" shielded cable from the surge protector to the device to allow for adequate clamping time.

D. When protector is mounted in interior, dry or weather sealed enclosure:

1. Nominal voltage rating of 12V AC/DC. Provide correct module per required voltage level if different from 12V.
2. 20,000A surge current rating.
3. Protects 2-pair per module.
4. Accepts up to 10AWG cable
5. Connect directly to ground.
6. UL 497B listed
7. Provide quantity of modules as required for the application.
8. Provide base mounting plate as required for the application.
9. Manufacturer:
  - a. Ditek DTK-2MB Mounting Base
  - b. (2) Ditek DTK-2MHL12B Surge Modules
  - c. Or approved equal

2.17 Surge Protection for Low Voltage AC/DC power

- A. The Contractor shall provide a surge protector for all exterior devices being supplied by low voltage power. This does not include devices directly connected to a building where the risks of surges are negligible.
- B. There shall be a minimum of a 36" shielded cable from the surge protector to the device to allow for adequate clamping time.
- C. When protector is mounted in interior, dry or weather sealed enclosure:
  1. Nominal voltage rating of 24V AC/DC. Provide correct module per required voltage level if different from 24V.
  2. 20,000A surge current rating.
  3. Protects 2-pair per module.
  4. Accepts up to 10AWG cable
  5. Connect directly to ground.
  6. UL 497B listed
  7. Provide quantity of modules as required for the application.
  8. Provide base mounting plate as required for the application.
  9. Manufacturer:
    - a. Ditek DTK-2MB Mounting Base
    - b. Ditek DTK-2MHL24B Surge Module

- c. Or approved equal

**Part 3 - Execution**

**3.1 Testing**

- A. Refer to Section 27 00 00 for additional requirements.
- B. Prior to energizing or testing the system, ensure the following:
  - 1. All products are installed in a proper and safe manner per the manufacturer's instructions.
  - 2. Dust, debris, solder, splatter, etc., is removed.
  - 3. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
  - 4. All products are neat, clean, and unmarred, and parts are securely attached.
- C. Contractor shall ensure that each device in the security system is functioning normally and in such a manner as to meet the functional and performance requirements in this specification.

**3.2 Training**

- A. Refer to Section 27 00 00 for additional requirements.
- B. Provide system operations, administration, and maintenance training by factory-trained personnel qualified to instruct.
  - 1. Contractor shall provide up to 6 hours of scheduled and dedicated training time in three (3) four (2) hour sessions for administration and investigation.
  - 2. The Contractor shall provide up to 2 hours of dedicated training time for badge creation, printing and printer maintenance.
  - 3. Provide printed training materials for each trainee, including product manuals, course outline, workbook or student guides, and written examinations for certification.
  - 4. Provide hands-on training with operational equipment.
  - 5. Training shall be oriented to the specific system being installed under this contract as designed and specified.
  - 6. Contractor shall provide all necessary documentation of system operating parameters prior to scheduled training sessions.

**3.3 Warranty**

- A. Refer to Section 27 00 00 for additional requirements.

**3.4 Installation Practices**

- A. All services provided shall be professional and conform to the highest standards for industry practices. The Owner reserves the right to halt any installation due to poor

workmanship. All work shall be defect free, and the installer shall replace, at their expense, any work found to be defective.

- B. The Owner reserves the right to halt any installation due to failure of Contractor to observe installation-free periods due to instructional or administrative requirements. To the maximum extent possible, the Owner will provide advance notice of such periods.
- C. Contractor is responsible for providing a complete and system.
- D. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers, or as indicated in their published literature, unless specifically noted herein to the contrary.
- E. Contractor shall follow these standards and approved submittals for locations of power supplies. The Owner intends to limit the number and location of power supplies to facilitate more effective long-term support and maintenance of the system.

3.5 Coordination

- A. Contractor shall provide up to 8 hours (up to four, 2-hour sessions) of scheduled and dedicated coordination time to assist Owner with sequence of operation, rule creation and coordination as requested by Owner or Consultant.

3.6 Aesthetics

- A. All cables and equipment terminating at panels frames shall be vertically straight, with no cables crossing each other, from twelve inches inside the ceiling area to the termination block.
- B. All cable bundles shall be combed and bundled to accommodate individual termination block rows and panels.
- C. For any given telecom room, a horizontal and vertical alignment for all mounting hardware will be maintained to provide a symmetrical and uniform appearance to the distribution frame.
- D. All surface-mounted devices shall be firmly secured level and plumb
- E. All rack mount equipment shall be securely installed.

3.7 Hardware Layout

- A. Hardware positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.8 Server Installation Practices

- A. Verify that the manufacturer approved server hardware, OS meets the Owner's IT standards prior to ordering.
- B. Coordinate server power, cooling, and mounting requirements with Owner prior to

installation.

- C. Coordinate virus scan/security software requirements with Owner and manufacturer prior to installation.

3.9 Device Cabling/Wiring Installation Practices

- A. All external wire and cables shall be supported at least every five feet from the structure or as required to maintain not more than 12" cable sag between supports and without over tensioning the cables. Provide j-hooks as needed where cable tray or raceway is not available.
- B. This Contractor shall coordinate installation with Division 27 cabling Contractor to ensure there is at least 2-inches of physical separation between security cabling and voice/data cabling throughout cable path. Voice/data cabling Contractor has first claim to cable tray.
- C. All cables, regardless of length, shall be labeled within 18" of both ends with an identifier that is keyed to the door, room, or corridor number as identified.
- D. All cables shall have 6-foot service loops neatly coiled in the equipment room. During initial cable rough-in, this Contractor shall have sufficient slack to route anywhere within the equipment room.
- E. Cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame. Cables shall be dressed in a neat and orderly fashion. Any cabling or equipment installation that is deemed unacceptable by the Owner or Consultant shall be replaced or corrected by the Contractor at no additional cost. Plastic zip ties are not allowed.
- F. All cables are to run at right angles to the structure, placed above the ceiling in halls or corridors.
- G. Cables shall not run above red iron joist.
- H. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests.
- I. Ties and straps shall be installed snugly without deforming cable insulation. Ties shall be spaced at uneven intervals not to exceed four feet. No sharp burrs shall remain where excess length of the cable tie has been cut.
- J. Contractor shall notify Owner immediately if obstruction or hazard is discovered in a pathway provided by others.
- K. Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the manufacturer's rating.
- L. No splices shall be installed in any cable.

3.10 Cable Termination

- A. Termination hardware (blocks and patch panels) positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

**3.11 Physical Security Systems Integration**

- A. The electronic access control system shall be integrated with the video surveillance system.
  - 1. The access control/video surveillance integration shall be via a native IP interface.
- B. The Contractor shall provide any and all licensing to integrate the systems together including any additional items to be added to the yearly maintenance agreement.
- C. The following minimum features shall be included in the integration; the following list is not all inclusive or exhaustive. The integration shall be a turnkey solution:
  - 1. Call up live and/or recorded video from an alarm or event.
  - 2. Graphical maps showing camera icons.
  - 3. “Mouse over” camera viewing through the DVR/NVR browser and graphical maps.
  - 4. Playback controls for recorded video.
  - 5. Camera names brought in from the VMS.
  - 6. Alarm pop-ups and events shall include instructions and a sequence of operation to deal with events on the Video Management System and Electronic Access Control System.
  - 7. Intercom pop-ups when call button is pressed with the ability to unlock the door.
  - 8. Time syncing via common NTP server.
- D. The Contractor shall set up a meeting between the Owner, Consultant and manufacturer to determine the exact functionality of the integration before the integration starts.

**3.12 Elevator Interface**

- A. The Contractor shall furnish and install an elevator interface box outside of the elevator equipment room.
  - 1. The Contractor shall provide an elevator security junction box located outside of the Elevator Machine Room, for interface of security devices to be located within the elevator cab(s). This requirement complies with ANSI A17.1 code which prevents work within the Elevator Machine Room, other than specific elevator work.
  - 2. Security J-box shall include a keyed lockable door. Additionally, security J-box shall have proper terminal strips suitable for terminating all cables and mounting electronics within the J-box.

3. The Electrical Contractor shall provide 120VAC power to this enclosure as required to power the electronics.
  4. The Contractor shall provide any data cables to this enclosure as required.
  5. Electronics for video surveillance such as coax to IP converters may be placed within this enclosure.
  6. Coordinate exact location of elevator security junction box with the Elevator Contractor, Architect, and Consultant, prior to installation.
  7. Provide all cabling as required between the security system and elevator security J-box for all elevator interfaces.
  8. Provide all required interface points for connecting to elevator relays and travel cables.
  9. Cables entering the elevator security J-box and elevator equipment room shall be appropriately labeled by the Contractor, so that the Elevator Contractor can connect the appropriate wires to the elevator controllers. Wires should be individually labeled to separate them from other elevator functions and to assist the Elevator Contractor in making proper connection points.
  10. The Contractor shall assume all floors and all doors shall have the ability to be controlled and cable the system appropriately.
  11. The Contractor shall coordinate with the Elevator Contractor to ensure the appropriate cable is located within the elevator travel cable.
  12. Software level integration via IP is acceptable.
- B. Provide for Access Control System Interface and Programming, as follows:
1. Elevator Alarm Button shall be interfaced to alarm input on the access control interface panel, in addition to interface with the Elevator Status panels.
  2. When elevator is operating on “Override” modes (i.e. either from Elevator Control Room or in “Fireman’s Service Override Mode”), all card reader and other controls shall be overridden.

**3.13 ADA Power Assist Door Operator Interface**

- A. Certain electric locking mechanisms with card access shall be connected (hardwired) to the ADA Power Assist Door Operator pushbutton. In this scenario, card reader shall be interfaced to the ADA Door Operator pushbutton to approve activation of door motor based on card authorization or pre-programmed security schedule.
- B. Door motor shall not be energized until authorized by the security system to prevent operation and eventual burn-out of the motor from hitting the button with the security system activated.
- C. Contractor shall provide all necessary hardware, interfaces, and system programming.

**3.14 Fire Alarm Interface**

- A. Certain electric locking mechanisms shall be connected (hardwired) to the building

fire alarm system for fail safe release upon any fire alarm. A single low voltage/low current normally closed dry contact from the fire alarm system shall be provided by others in each room with Security Control Panels. This contact shall open on any fire alarm condition.

- B. The Contractor shall provide all additional UL listed failsafe relays and power supplies as necessary to interface to this contact and unlock all of these doors.
- C. The Contractor shall verify fail safe and fail secure locking requirements with the Architect, door hardware contractor/provider and the AHJ. Refer to fire alarm contractor shop drawing for fire alarm interface requirements.

**3.15 Fire Stopping**

- A. Fire stopping of openings between floors, fire-rated walls, and smoke-rated walls, created by others for This Contractor to pass cable through, shall be the responsibility of the This Contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.
- B. Any openings created by or for This Contractor and left unused shall be sealed up by This Contractor.
- C. This Contractor shall be responsible for creating a waterproof seal in and around any openings that This Contractor creates from the structure to the outside environment.

**3.16 System Inspection**

- A. Contractor shall coordinate with project representative for inspection after Contractor has completed testing of entire system.
- B. Contractor shall have trained Contractor representative and testing equipment on site during inspection to assist with spot verification of tests.
- C. Contractor shall verify with Project Representative the precise positioning of camera aim and shall make fine adjustments as requested.

**3.17 Labeling**

- A. Contractor shall neatly label all security devices and cabling at both ends. All labels shall be on Project as-built drawings.

**3.18 Documentation**

- A. Upon completion of the installation, Contractor shall provide full documentation sets to the Consultant for approval as described in section 27 60 00. All documentation shall become the property of the Owner.
- B. Documentation shall include the additional specific items detailed in the subsections below:
  - 1. Contractor shall provide hard copy and electronic forms of the final test results.
  - 2. Contractor shall provide a document including the following:

- a. Door label/identifier
- b. Location of each drop by orientation/permanent landmark in the room
- c. Contractor shall provide accurate as-built Construction Drawings. The drawings are to include cable routes and device locations.

3.19 Pre-Check out

- A. The Contractor shall demonstrate the following to Owner during system demonstration.
  1. The card readers are fully installed and functional.

3.20 Final Acceptance

- A. In addition to closeout requirements in section 27 60 00, This Contractor shall demonstrate the following before final approval.
  1. Owner training is complete.
  2. Punch list items are complete.
  3. As-built documentation is complete and submitted to Owner/Consultant.

3.21 Final Procedures

- A. Perform final procedures in accordance with section 27 60 00.

3.2 Qualifications

- A. The system programmer shall have attended manufacturer training and obtained certification in system(s) provided.
- B. The system programmer shall have attended manufacturer training and obtained certification in system provided.
- C. The system programmer shall be a certified partner of solution provided.

**Part 3 - Execution**

2.1 Warranty

- A. The product shall perform in all material respects in accordance with the accompanying user manual, and the media on which the Software Product resides will be free from defects in materials and workmanship under normal use. Software defects are covered through Service Releases and Cumulative Updates which are available for a period of 1 year from the date of the software purchase.
- B. Provide a 5 year Genetec Advantage support service which includes the following additional services over the standard warranty:
  1. Access to phone support and online chat for technical assistance

2. Online case management
3. Online system availability monitor
4. Access to Major and Minor Release Upgrades
5. Available 24/7 pager support and dedicated support specialist

2.2 Deployment Services and System Commissioning

A. General Requirements:

1. The contractor shall engage the services of the USP vendor to assist in the management of the deployment of the USP at the end-user site on projects that involve:
  - a. Multiple contractors or subcontractors that will be responsible for deploying the USP at multiple client sites in different geographical regions.
  - b. Complex enterprise installations involving advanced functionality (for example The Federation feature, failover, plugins) and/or multiple systems (for example access control, video, ALPR) and/or third party integrations.
  - c. Extensive use of customized solutions/plugins developed by the vendor that will be integrated into the USP.
2. The USP vendor services shall include Deployment Management and System Configuration and Commissioning.

B. Deployment Management Service:

1. The Deployment Management service from the vendor shall include a Project Manager acting as the single point of contact for all communications between the contractor and the vendor organization and who will be responsible for:
  - a. Conducting a Risk Assessment of the impact of potential risk factors on the operation of the vendor's USP.
  - b. Providing a project plan for the deployment of the vendor's USP.
  - c. Managing the development and deployment of the custom solution components that will be integrated into the vendor's USP (if applicable).
  - d. Providing a scope of work detailing the services to be provided by the vendor to assist in the deployment of the vendor's USP.
  - e. Coordinating and scheduling the vendor field services with the contractor to assist with the deployment of the vendor's USP.
  - f. Providing regular project status updates to the contractor regarding the development of custom solutions (if applicable) and the deployment of the vendor's USP.

C. Solution Architect Service:

1. The Solution Architect service from the vendor shall include a Solutions Architect Engineer acting as a single technical point of contact throughout the deployment of the USP, and who will be responsible for:
  - a. Assisting the contractor/subcontractor with the design and architecture of the vendor's USP.
  - b. Conducting technical consultation activities that may include fit/gap analysis, system design reviews, device compatibility assessments, functional and technical design reviews, as well as performance reviews of the vendor's USP.
  - c. Conducting a system assessment and ensuring best practices of the vendor's USP are followed.
  - d. Providing upgrade and migration strategy for the vendor's USP where applicable.
  - e. Providing documentation regarding the system architecture, system design, hardware specifications and compatibility requirements, camera bandwidth calculations, and best practices as they relate to the vendor's USP.

D. System Configuration and Commissioning Service:

1. The System Configuration and Commissioning service from the vendor shall include a Field Engineer who will be responsible for:
  - a. Assisting the contractor's or subcontractor's onsite/remote technicians with the configuration and commissioning of the vendor's USP at the client site.
  - b. Conducting a test of the USP following the deployment of the system using real- world operator scenarios to ensure optimal system performance.
  - c. Providing the contractor with a Service Report detailing the tasks completed during the deployment of the USP at the client site, as well as any recommendations for improving the performance of the USP that must be implemented by the contractor.
  - d. Providing a knowledge transfer of the vendor's USP to the contractor following the deployment of the USP at the client site.

2.3 Manufacturer End User Operator Training

The contractor shall engage the services of the USP vendor to assist in the end user training of the USP at the end-user site

**End of Section**



## Section 27 66 00 – Video Surveillance System

### Part 1 - General

#### 1.1 Scope

- A. Refer to Section 27 00 00 for additional project scope information.

#### 1.2 Precedence

- A. Obtain, read and comply with General Conditions and applicable sub-sections of the contract specifications. Where a discrepancy may exist between any applicable sub-section and directions as contained herein, this section shall govern.

#### 1.3 Related Work

- A. Section 27 00 00 – General Technology Requirements
- B. Section 27 05 00 – Communications General Requirements
- C. Section 27 05 23 – Pathways for Technology Systems
- D. Section 27 05 26 – Grounding and Bonding for Technology Systems
- E. Section 27 11 00 – Communications Equipment Rooms
- F. Section 27 13 00 – Communications Backbone Cabling
- G. Section 27 15 00 – Communications Horizontal Cabling
- H. Section 27 16 00 – Communications Connecting Cords
- I. Section 27 18 00 – Communications Labeling and Identification
- J. Section 27 21 00 – Network Electronics and UPS Systems
- K. Section 27 60 00 – Physical Security General Requirements
- L. Section 27 62 00 – Electronic Access Control System

#### 1.4 General Summary

- A. System shall include IP cameras connecting to the VMS as specified.
- B. The Category 6 cabling to each camera shall be provided by this Contractor. Patch cords for the IP cameras to the network switches shall be furnished and installed by this Contractor. Patch cords from the IP Camera to the data jack shall be furnished by this Contractor and installed by this Contractor.
- C. System installation shall include, but not be limited to, installation, programming, and configuration of system components as well as all associated software upgrades, patches, and maintenance for the first year.

- D. Contractor is responsible for meeting with Owner’s representative at time of camera installation to verify exact placement and view of each camera to ensure coverage area is as intended.

1.5 Drawing Sheets

- A. All security cameras are designated with a C symbol on the project drawings.

1.6 Mounting and Installation

- A. Contractor shall provide the appropriate mounting hardware for all ceiling types and wall types where cameras shall be located.
- B. Wall mounted 180/360 degree or multi-sensor cameras shall be mounted horizontally on a gooseneck, parapet, pendant or other similar method.
- C. Exterior cameras shall be mounted on a gooseneck.
- D. Cameras mounted in droptile shall have a tile support bridge with a steel support cable connected to structure to prevent tile sagging, theft and vandalism.

1.7 Code and Standard Requirements

- A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association and any other codes as required by the AHJ.
- B. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.
- C. Cameras shall meet the following standards:
  - 1. MPEG-4:
    - a. ISO/IEC 14496-10 AVC (H.264)
  - 2. Networking:
    - a. IEEE 802.3af (Power over Ethernet)
  - 3. Network Video:
    - a. ONVIF Profile S or better

**Part 2 - Products**

2.1 VMS General Requirements

- A. Manufacturer:
  - 1. Genetec Security Center Omnicast Enterprise

2. Contractor shall update to the latest software revision

2.2 Software Maintenance

- A. The system shall be provided with a **5-year software maintenance agreement**. The Owner shall be able to receive all major and minor software updates at no additional cost for the duration of the project. At the completion of the project the Owner shall have the option to receive a final software upgrade to the latest version (including all devices) before the project is paid in full.

2.3 Mapping Software

- A. The ACS software shall be provided with native integrated mapping software.
- B. The mapping software shall be compatible with PDF, JPEG and PNG.
- C. The Contractor shall provide a satellite level screen shot map showing exterior devices. This maps shall include drill down links to access the building floor plans where all interior and exterior devices are shown. The overview satellite map shall show alarms signifying there is an alarm in the building to draw attention quickly.
- D. The Contractor shall be responsible to provide all the labor to setup these maps and place all the devices.
- E. The Contractor shall get sign-off from the Owner and Consultant on the finished maps.
- F. The Contractor shall obtain the building plans from the Consultant for their use.
- G. Provide licensing for Genetec Plan Manager for up to 50 entities, part number **GSC-PM-STD-50**.

2.4 Directory and Archiving Server Hardware

- A. VMS Directory Management Server
  1. Provide one (1) Genetec StreamVault model **SV-2011E-R6S-D480-236**.
  2. The directory server will be centrally located at the F.D. Fire Headquarters.
  3. Install server in customer's equipment rack.
  4. Coordinate with City of Wheeling's IT department.
- B. VMS Archivers Fire Stations
  1. Provide six (6) Genetec StreamVault model **SV-2020E-R4-12T-4-236**.
  2. One (1) video archiver will be located remotely at each of the six fire stations.
  3. Coordinate with City of Wheeling's IT department.
- C. VMS Archiver F.D. Fire Headquarters.
  1. Provide one (1) Genetec StreamVault model **SV-2020E-R4-48T-12-236**.
  2. Install server in customer's equipment rack.
  3. Coordinate with City of Wheeling's IT department.

2.5 VMSClient Workstations

- A. The Contractor shall provide and install workstations at the following locations:
  - 1. One (1) at the F.D. Fire Headquarters (exact location T.B.D.)
- B. The workstation shall meet the minimum following specifications:
  - 1. Desktop mounted.
  - 2. Intel Core i7 -10700K, or newer generation.
  - 3. A minimum of 16 GB of Registered ECC DDR4 2133MHz ram.
  - 4. (1) 10/100/1000 NIC cards each connected to a different switch.
  - 5. Dedicated NVIDIA Quadro P2200 video graphics card.
  - 6. (1) 256GB M.2 SSD and (1) 1TB 3.5" SATA HDD
  - 7. (1) 24" (minimum) desktop 1920x1080 LED monitor
    - a. Provide adapters as required to connect to monitors.
    - b. Provide quantity of video cards as required to connect to quantity of monitors.
  - 8. Sound card or integrated to motherboard with inputs and outputs.
  - 9. Windows 10 Professional x64.
  - 10. The Contractor shall coordinate with the Owner to install anti-virus and other required software before the Contractor connects the workstation to the network. The Contractor shall provide the Owner with a list of anti-virus exclusions required for smooth performance of the workstation.
  - 11. The workstation dimensions shall not exceed 18" tall by 8" wide by 20" deep.
  - 12. Provide with 5-year Next Business Day hardware replacement with keep your hard drive.
  - 13. Manufacturer:
    - a. BCD Video
    - b. Provide one (1) **SVW-303E-T3-S2000-I7**

2.6 Cameras and Devices

- A. General:
  - 1. The Contractor shall select the appropriate mounting hardware for the situation.
  - 2. All cameras shall be equipped with remote autofocus or autoback focus.
  - 3. Multi-sensor 180 and 360 cameras shall have each sensor optimally calibrated independently to the conditions.

4. All cameras shall be vandal proof and appropriate for the environment it is being installed in.
5. All cameras shall have the latest VMS recommended firmware installed and all cameras of the same model shall have matching firmware versions.
6. The contractor shall coordinate with the owner for IP addressing, network configuration and multicast network configuration.
7. All cameras regardless of manufacturer/model shall have a consistent user name and non-standard password set. This shall be documented and provided to the owner and consultant prior to inspections.
8. The camera requirements below represent general performance criteria. Approved equals will have slight differences in specifications. The Owner and Consultant have complete discretion to reject approved equals that stray too far from the minimum requirements.

**B. Camera Type**

1. See “Camera Schedule” and “Camera Type” details on the Schedule Drawings for specific camera manufactures and model numbers used for the Bases of Design.
2. The Camera Schedule may not be an exact representation of the quantity of cameras to be furnished. Confirm quantity and location on the contract drawings.

**2.7 Ethernet with Power over Ethernet (PoE) UTP Surge Suppressor**

- A. The Contractor shall provide and install a surge protector for all exterior mounted cameras. Cameras that are not attached to the building or reach above the building roof line shall have a surge protector at the camera side and interior termination side.
- B. There shall be a minimum of a shielded cable from the surge protector to the device to allow for adequate clamping time.
- C. When protector is mounted in interior, dry or weather sealed enclosure:
  1. Shielded RJ-45 jacks and ground stud
    - a. Connect ground directly to ground bar (TMGB/TGB) or ground.
    - b. Do not use shielded cable on the output.
  2. Maximum supported data rate: 10,000Mb/s (10 Gigabit)
  3. Supports IEEE 802.3af (PoE)
  4. Max current rating of 30A per pair.
  5. UL 497B listed
  6. 110 punch down in and 110 punch down out.
    - a. 110 punch down in and RJ-45 out may be used when output is connected directly to a switch only when approved in specific situations.
  7. Manufacturer:

- a. Ditek VM45POE module w/ VM12RM racking kit.
- b. Or approved equal

D. When protector is exposed to weather or moisture:

1. Shielded RJ-45 jacks and ground connection.
  - a. Connected ground connection directly to ground.
  - b. Do not use shielded cable on the output.
2. Outdoor-rated NEMA 4X enclosure
3. Maximum supported data rate: 1,000Mb/s (1 Gigabit)
4. Supports IEEE 802.3af, 802.3at (PoE) and PoE+ up to 144 watts per port.
5. Max current rating of 20,000A per pair.
6. UL 497B listed
7. RG-45 in and RJ-45 out.
8. Provide with appropriate mounting kit.
9. Manufacturer:
  - a. DitekDTK-MRJPOEX
  - b. Or approved equal

2.8 Ethernet UTP Surge Suppressor (No PoE)

- A. The Contractor shall provide and install a surge protector for all exterior mounted cameras. Cameras that are not attached to the building or reach above the building roof line shall have a surge protector at the camera side and interior termination side.
- B. There shall be a minimum of a 36" shielded patch cable from the surge protector to the device to allow for adequate clamping time.
- C. When protector is mounted in interior, dry or weather sealed enclosure:
  1. Shielded RJ-45 jacks and ground stud
    - a. Connect ground directly to ground bar (TMGB/TGB) or ground.
    - b. Do not use shielded cable on the output.
  2. Maximum supported data rate: 10,000Mb/s (10 Gigabit)
  3. Max current rating of 100A per pair.
  4. UL 497B listed
  5. 110 punch down in and 110 punch down out.
    - a. 110 punch down in and RJ-45 out may be used when output is connected directly to a switch only when approved in specific situations.

6. Manufacturer:
  - a. Ditek DTK-110C6A
  - b. Or approved equal

2.9 Ethernet with PoE Over 75 Ohm Coaxial Cable

- A. The contractor shall provide an Ethernet over coaxial cable converter for each camera mounted within an elevator and other locations as required.
- B. Each camera shall receive its own dedicated transmitter and receiver unit. Splitting multiple cameras through a single Tx/Rx pair is not allowed.
- C. The Contractor shall coordinate with the Elevator Contractor for installation.
- D. Shall support multi-cast networks.
- E. Provide full duplex 10/100Base-T.
- F. Shall support IEEE 802.3af (PoE) and IEEE 802.3at (PoE+) on input and output.
- G. Can support 802.3at at 20 watts at a minimum of 1,000 feet of 20awg RG-59.
- H. Provide with optional power supply when PoE switch is not available.
- I. Provide with wall mount or rack mount bracket as required.
- J. Manufacturer:
  1. Veracity Highwire Powerstar
    - a. Provide with dedicated power supply as required.
  2. Or approved equal

2.10 Surge Protection for Low Voltage AC/DC power

- A. The Contractor shall provide a surge protector for all exterior devices being supplied by low voltage power. This does not include devices directly connected to a building where the risks of surges are negligible.
- B. There shall be a minimum of a 36" shielded cable from the surge protector to the device to allow for adequate clamping time.
- C. When protector is mounted in interior, dry or weather sealed enclosure:
  1. Nominal voltage rating of 24V AC/DC. Provide correct module per required voltage level if different from 24V.
  2. 20,000A surge current rating.
  3. Protects 2-pair per module.
  4. Accepts up to 10AWG cable
  5. Connect directly to ground.
  6. UL 497B listed

7. Provide quantity of modules as required for the application.
8. Provide base mounting plate as required for the application.
9. Manufacturer:
  - a. Ditek DTK-2MB Mounting Base
  - b. Ditek DTK-2MHLP24B Surge Module
  - c. Or approved equal

**Part 3 - Execution**

**3.1 Testing**

- A. Prior to energizing or testing the system, ensure the following:
  1. All products are installed in a proper and safe manner per the manufacturer's instructions.
  2. Dust, debris, solder, splatter, etc., is removed.
  3. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
  4. All products are neat, clean, and unmarred, and parts are securely attached.
- B. Contractor shall ensure that each device in the security system is functioning normally and in such a manner as to meet the functional and performance requirements in this specification.

**3.2 Training**

- A. Provide system operations, administration, and maintenance training by factory-trained personnel qualified to instruct.
  1. Contractor shall provide up to 12 hours of scheduled and dedicated training time in three (3) four (4) hour sessions for administration and investigation.
  2. Contractor shall provide up to 2 hours of scheduled and dedicated training time for maintenance including lens and dome cleaning, focusing and positioning.
  3. Provide printed training materials for each trainee, including product manuals, course outline, workbook or student guides, and written examinations for certification.
  4. Provide hands-on training with operational equipment.
  5. Training shall be oriented to the specific system being installed under this contract as designed and specified.
  6. Contractor shall provide all necessary documentation of system operating parameters prior to scheduled training sessions.

**3.3 Warranty**

- A. Refer to Section 27 00 00 for additional requirements.

**3.4 Installation Practices**

- A. All services provided shall be professional and conform to the highest standards for industry practices. The Owner reserves the right to halt any installation due to poor workmanship. All work shall be defect free, and the installer shall replace, at their expense, any work found to be defective.
- B. The Owner reserves the right to halt any installation due to failure of Contractor to observe installation-free periods due to instructional or administrative requirements. To the maximum extent possible, the Owner will provide advance notice of such periods.
- C. Contractor is responsible for providing a complete and functional video surveillance system.
- D. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers, or as indicated in their published literature, unless specifically noted herein to the contrary.
- E. Contractor shall follow these standards and approved submittals for locations of power supplies. The Owner intends to limit the number and location of power supplies to facilitate more effective long-term support and maintenance of the system.

**3.5 Coordination**

- A. Contractor shall provide up to 8 hours (up to four, 2-hour sessions) of scheduled and dedicated coordination time to assist Owner with camera positioning and coordination as requested by Owner or Consultant.

**3.6 Aesthetics**

- A. All cables and equipment terminating at panels frames shall be vertically straight, with no cables crossing each other, from twelve inches inside the ceiling area to the termination block.
- B. All cable bundles shall be combed and bundled to accommodate individual termination block rows and panels.
- C. For any given telecom room, a horizontal and vertical alignment for all mounting hardware will be maintained to provide a symmetrical and uniform appearance to the distribution frame.
- D. All surface-mounted devices shall be firmly secured level and plumb
- E. All rack mount equipment shall be securely installed.

**3.7 Hardware Layout**

- A. Hardware positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.8 VMS Installation Practices

- A. Verify that the manufacturer approved server hardware, OS meets the Owner's IT standards prior to ordering.
- B. Coordinate server power, cooling, and mounting requirements with Owner prior to installation.
- C. Coordinate virus scan/security software requirements with Owner and manufacturer prior to installation.

3.9 Device Cabling/Wiring Installation Practices

- A. All external wire and cables shall be supported at least every five feet from the structure or as required to maintain not more than 12" cable sag between supports and without over tensioning the cables. Provide j-hooks as needed where cable tray or raceway is not available.
- B. This Contractor shall coordinate installation with Division 27 05 00 cabling Contractor to ensure there is at least 2-inches of physical separation between security cabling and voice/data cabling throughout cable path. Voice/data cabling Contractor has first claim to cable tray.
- C. All cables, regardless of length, shall be labeled within 18" of both ends with an identifier that is keyed to the door, room, or corridor number as identified.
- D. All cables shall have 6-foot service loops neatly coiled in the equipment room. During initial cable rough-in, this Contractor shall have sufficient slack to route anywhere within the equipment room.
- E. Cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame. Cables shall be dressed in a neat and orderly fashion. Any cabling or equipment installation that is deemed unacceptable by the Owner or Consultant shall be replaced or corrected by the Contractor at no additional cost. Plastic zip ties are not allowed.
- F. All cables are to run at right angles to the structure, placed above the ceiling in halls or corridors.
- G. Cables shall not run above red iron joist.
- H. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests.
- I. Ties and straps shall be installed snugly without deforming cable insulation. Ties shall be spaced at uneven intervals not to exceed four feet. No sharp burrs shall remain where excess length of the cable tie has been cut.
- J. Contractor shall notify Owner immediately if obstruction or hazard is discovered in a pathway provided by others.
- K. Cable shall be stored and handled to assure that it is not stretched, kinked, crushed,

or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the manufacturer's rating.

- L. No splices shall be installed in any cable.

**3.10 Cable Termination**

- A. Termination hardware (blocks and patch panels) positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

**3.11 Elevator Interface**

- A. The Contractor shall furnish and install an elevator interface box outside of the elevator equipment room.
  1. The Contractor shall provide an elevator security junction box located outside of the Elevator Machine Room, for interface of security devices to be located within the elevator cab(s). This requirement complies with ANSI A17.1 code which prevents work within the Elevator Machine Room, other than specific elevator work.
  2. Security J-box shall include a keyed lockable door. Additionally, security J-box shall have proper terminal strips suitable for terminating all cables and mounting electronics within the J-box.
  3. The Electrical Contractor shall provide 120VAC power to this enclosure as required to power the electronics.
  4. The Contractor shall provide any data cables to this enclosure as required.
  5. Electronics for access control may be placed within this enclosure.
  6. Coordinate exact location of elevator security junction box with the Elevator Contractor, Architect, and Consultant, prior to installation.
  7. Provide all cabling as required between the security system and elevator security J-box for all elevator interfaces.
  8. Provide all required interface points for connecting to elevator travel cables.
  9. Cables entering the elevator security J-box and elevator equipment room shall be appropriately labeled by the Contractor, so that the Elevator Contractor can connect the appropriate wires to travel cables. Wires should be individually labeled to separate them from other elevator functions and to assist the Elevator Contractor in making proper connection points.
  10. The Contractor shall coordinate with the Elevator Contractor to ensure the appropriate cable is located within the elevator travel cable.

**3.12 Fire Stopping**

- A. Fire stopping of openings between floors, fire-rated walls, and smoke-rated walls, created by others for This Contractor to pass cable through, shall be the responsibility of the This Contractor. Sealing material and application of this

material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

- B. Any openings created by or for This Contractor and left unused shall be sealed up by This Contractor.
- C. This Contractor shall be responsible for creating a waterproof seal in and around any openings that This Contractor creates from the structure to the outside environment.

**3.13 System Inspection**

- A. Contractor shall coordinate with project representative for inspection after Contractor has completed testing of entire system.
- B. Contractor shall have trained Contractor representative and testing equipment on site during inspection to assist with spot verification of tests.
- C. Contractor shall verify with Project Representative the precise positioning of camera aim and shall make fine adjustments as requested.

**3.14 Labeling**

- A. Contractor shall neatly label all security devices and cabling at both ends. All labels shall be on Project as-built drawings.

**3.15 Camera Installation**

- A. Contractor shall field verify all camera locations and positioning with Owner prior to installation.

**3.16 Documentation**

- A. Upon completion of the installation, Contractor shall provide full documentation sets to the Consultant for approval as described in section 27 60 00. All documentation shall become the property of the Owner.
- B. Documentation shall include the additional specific items detailed in the subsections below:
  - 1. Contractor shall provide hard copy and electronic forms of the final test results.
  - 2. Contractor shall provide a document including the following:
    - a. Camera label/identifier
    - b. Location of each drop by orientation/permanent landmark in the room
    - c. Contractor shall provide accurate as-built Construction Drawings. The drawings are to include cable routes and device locations.

**3.17 Pre-Checkout**

- A. The Contractor shall demonstrate the following to Owner during system demonstration.
  - 1. The cameras are fully installed and functional.

2. Camera adjustments are complete to the Owner's satisfaction including.
  - a. Aim/Zoom
  - b. Focus/Back Focus
  - c. Masking Zones
  - d. Motion Detection Zones
  - e. Pre-Sets/Tours

**3.18 Final Acceptance**

- A. In addition to closeout requirements in section 27 60 00, This Contractor shall demonstrate the following before final approval.
  1. Owner training is complete.
  2. Punch list items are complete.
  3. As-built documentation is complete and submitted to Owner/Consultant.

**3.3 Qualifications**

- A. The system programmer shall have attended manufacturer training and obtained certification in Genetec Security Center - Omnicast™ Technical Certification.
- B. Optionally, the system programmer shall have attended manufacturer training and obtained certification in Genetec Security Center - Enterprise Technical Certification.
- C. The system programmer shall be a Genetec certified partner with the following level of qualification:
  - Certified Reseller or up
  - Elite Reseller or up
  - Unified Elite Reseller
- D. The system programmer shall submit proof of certifications.

**Part 3 - Execution**

**1.0 Warranty**

- A. The product shall perform in all material respects in accordance with the accompanying user manual, and the media on which the Software Product resides will be free from defects in materials and workmanship under normal use. Software defects are covered through Service Releases and Cumulative Updates which are available for a period of 1 year from the date of the software purchase.
- B. Provide 5 year Genetec Advantage support service which includes the following additional services over the standard warranty:
  1. Access to phone support and online chat for technical assistance

2. Online case management
3. Online system availability monitor
4. Access to Major and Minor Release Upgrades
5. 24/7 pager support and dedicated support specialist

2.2 Deployment Services and System Commissioning

A. General Requirements:

1. The contractor shall engage the services of the USP vendor to assist in the management of the deployment of the USP at the end-user site on projects that involve:
  - a. Multiple contractors or subcontractors that will be responsible for deploying the USP at multiple client sites in different geographical regions.
  - b. Complex enterprise installations involving advanced functionality (for example The Federation feature, failover, plugins) and/or multiple systems (for example access control, video, ALPR) and/or third party integrations.
  - c. Extensive use of customized solutions/plugins developed by the vendor that will be integrated into the USP.
2. The USP vendor services shall include Deployment Management and System Configuration and Commissioning.

B. Deployment Management Service:

1. The Deployment Management service from the vendor shall include a Project Manager acting as the single point of contact for all communications between the contractor and the vendor organization and who will be responsible for:
  - a. Conducting a Risk Assessment of the impact of potential risk factors on the operation of the vendor's USP.
  - b. Providing a project plan for the deployment of the vendor's USP.
  - c. Managing the development and deployment of the custom solution components that will be integrated into the vendor's USP (if applicable).
  - d. Providing a scope of work detailing the services to be provided by the vendor to assist in the deployment of the vendor's USP.
  - e. Coordinating and scheduling the vendor field services with the contractor to assist with the deployment of the vendor's USP.
  - f. Providing regular project status updates to the contractor regarding the development of custom solutions (if applicable) and the deployment of the vendor's USP.

C. Solution Architect Service:

1. The Solution Architect service from the vendor shall include a Solutions Architect Engineer acting as a single technical point of contact throughout the

deployment of the USP, and who will be responsible for:

- a. Assisting the contractor/subcontractor with the design and architecture of the vendor's USP.
- b. Conducting technical consultation activities that may include fit/gap analysis, system design reviews, device compatibility assessments, functional and technical design reviews, as well as performance reviews of the vendor's USP.
- c. Conducting a system assessment and ensuring best practices of the vendor's USP are followed.
- d. Providing upgrade and migration strategy for the vendor's USP where applicable.
- e. Providing documentation regarding the system architecture, system design, hardware specifications and compatibility requirements, camera bandwidth calculations, and best practices as they relate to the vendor's USP.

**D. System Configuration and Commissioning Service:**

1. The System Configuration and Commissioning service from the vendor shall include a Field Engineer who will be responsible for:
  - a. Assisting the contractor's or subcontractor's onsite/remote technicians with the configuration and commissioning of the vendor's USP at the client site.
  - b. Conducting a test of the USP following the deployment of the system using real- world operator scenarios to ensure optimal system performance.
  - c. Providing the contractor with a Service Report detailing the tasks completed during the deployment of the USP at the client site, as well as any recommendations for improving the performance of the USP that must be implemented by the contractor.
  - d. Providing a knowledge transfer of the vendor's USP to the contractor following the deployment of the USP at the client site.

**2.3 Manufacturer End User Operator Training**

The contractor shall engage the services of the USP vendor to assist in the end user training of the USP at the end-user site

**End of Section**

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