

2. Assumes all responsibility for miscellaneous items furnished by the Mechanical Contractor that require wiring but are not shown on the electrical drawings or specified in the Electrical Specification. If items such as relays, flow switches, or interlocks are required to make the mechanical system function correctly or are required by the manufacturer, they are the responsibility of the Mechanical Contractor.
3. Assumes all responsibility for Temperature Control wiring, if the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Temperature Control Contractor's or Subcontractor's Responsibility:

1. Wiring of all devices needed to make the Temperature Control System functional.
2. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor or Subcontractor.
3. Coordinating equipment locations (such as PE's, EP's, relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

F. Electrical Contractor's Responsibility:

1. Furnishes and installs all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor in the Mechanical Drawings or Specifications.
2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Furnishes and installs motor control and temperature control wiring, when noted on the drawings.
4. Furnishes, installs, and connects all relays, etc., for automatic shutdown of certain mechanical equipment (supply fans, exhaust fans, etc.) upon actuation of the Fire Alarm System.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

G. General (Electrical/Technology):

1. The purpose of these Specifications is to outline the Electrical and Technology Contractor's work responsibilities as related to Telecommunications Rough-in, conduit, cable tray, power wiring and Low Voltage Technology Wiring.

2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals approved. Therefore, only known wiring, conduits, raceways and electrical power related to such items is shown on the Technology drawings. Other wiring, conduits, raceways, junction boxes and electrical power not shown on the Technology Drawings but required for operation of the systems is the responsibility of the Technology Contractor and included in said Contractor's bid.
3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Technology systems, the final installation shall not be until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
4. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Technology Wiring, installation shall not begin prior to a coordination review of the cable tray shop drawings by the Technology Contractor.

H. Technology Contractor's Responsibility:

1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being furnished and installed by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility".
3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the telecommunications ground bar.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.07 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.

- b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
 - 2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
 - a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.
 - 3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.
- B. Participation:
- 1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
 - 2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.

6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign-off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.08 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.

2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Architect/Engineer will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer are acceptable.
2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Insert San Bernardino Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all published standards of San Bernardino.
3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
4. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
5. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
7. If there are no local codes having jurisdiction, the current issue of the National Electrical Code shall be followed.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.

8. Pay all telephone company charges related to the service or change in service.

E. Examination of Drawings:

1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, switchboards, switchgear and unit substations, shall be determined by the Contractor unless noted in the contract documents.
3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.
7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
9. Any item listed as furnished shall also be installed unless otherwise noted.
10. Any item listed as installed shall also be furnished unless otherwise noted.

F. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.

5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

1.09 WEB-BASED PROJECT SOFTWARE

- A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.
- B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.
- C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.
- D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

1.10 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item	Coordination Drawing
26 05 03	Through Penetration Firestopping	
26 05 13	Wire and Cable	
26 05 33	Conduit and Boxes	+> 1.5"
26 05 53	Electrical Identification	
26 27 26	Wiring Devices	Ceiling mount
26 28 16	Disconnect Switches	Yes
26 43 00	Surge Protection Devices	

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

- a. Date
- b. Project title and number
- c. Contractor's name and address
- d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
- e. Description of items submitted and relevant specification number
- f. Notations of deviations from the contract documents
- g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- a. Date
- b. Project title and number
- c. Architect/Engineer
- d. Contractor and subcontractors' names and addresses
- e. Supplier and manufacturer's names and addresses
- f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
- g. Description of item submitted (using project nomenclature) and relevant specification number
- h. Notations of deviations from the contract documents
- i. Other pertinent data
- j. Provide space for Contractor's review stamps

3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.

- e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
- a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
- a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal, excluding mailing.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 26 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 26 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.11 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.

B. Format:

1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
2. Submit in Excel format.
3. Support values given with substantiating data.

C. Preparation:

1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.

3. Itemize the cost for each of the following:
 - a. Overhead and profit.
 - b. Bonds.
 - c. Insurance.
 - d. General Requirements: Itemize all requirements.
4. For each line item having an installed cost of more than \$5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:
 - a. Each piece of equipment requiring shop drawings. Use the equipment nomenclature (SB-1, PANEL P-1, etc.) on the Schedule of Values.
 - b. Each type of small unitary equipment (e.g., FDS, FCS, CS, etc.). Multiple units of the same type can be listed together provided quantities are also listed so unit costs can be determined.
 - c. Each conduit system (medium voltage, normal, emergency, low voltage systems, etc.). In addition, for larger projects breakdown the material and labor for each conduit system based on geography (building, floor, and/or wing).
 - d. Fire alarm broken down into material and labor for the following:
 - 1) Engineering
 - 2) Controllers, devices, sensors, etc.
 - 3) Conduit
 - 4) Wiring
 - 5) Programming
 - 6) Commissioning
 - e. Site utilities (5' beyond building)
 - f. Seismic design
 - g. Testing
 - h. Commissioning
 - i. Record drawings
 - j. Punchlist and closeout

D. Update Schedule of Values when:

1. Indicated by Architect/Engineer.
2. Change of subcontractor or supplier occurs.
3. Change of product or equipment occurs.

1.12 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

1.13 PRODUCT DELIVERY, STORAGE, HANDLING and MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.
- B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:
 - 1. Distribution equipment - branch panels, distribution panels, switchboards, motor control centers, etc.
 - 2. Variable frequency drives.
 - 3. Transformers, ventilated.
 - 4. Electronic equipment, UPS, harmonic filters, power factor correction.
 - 5. Lighting luminaires and lighting control systems.
- C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.
- D. Keep all materials clean, dry and free from damaging environments.
- E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.14 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.
- B. The following network connected equipment shall be equipped with restricted access protocols:
 - 1. EMS

1.15 WARRANTY

- A. Provide one-year warranty for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.16 INSURANCE

- A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.17 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality.

- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.
- D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on the Contractors part or on the part of other Contractors whose work is affected.
- E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All items of material having a similar function (e.g., safety switches, panelboards, switchboards, contactors, motor starters, dry type transformers) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

PART 3 - EXECUTION

3.01 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.02 ARCHITECT/ENGINEER OBSERVATION OF WORK

- A. The contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
1. Placing fill over underground and underslab utilities.
 2. Covering exterior walls, interior partitions and chases.
 3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will review the installation and provide a written report noting deficiencies requiring correction. The contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation:
1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. All junction boxes are closed and identified in accordance with Section 26 0553 Electrical Identification.
 - b. Luminaires, including ceiling-mounted exit and emergency lights, are installed and operational.
 - c. Luminaire whips are supported above the ceiling.
 - d. Conduit identification is installed in accordance with Section 26 0553 Electrical Identification.
 - e. Luminaires are suspended independently of the ceiling system when required by these contract documents.
 - f. All wall penetrations have been sealed.

2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Architect/Engineer may not recommend further payments to the contractor until full access has been provided.

3.03 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. IDPH Pre-Occupancy Requirements:
 1. Each Contractor must submit all forms and certifications required by IDPH relating to their work at 85% completion of the project or when directed by the Owner/Architect/Engineer.
- C. Final Jobsite Observation:
 1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.
 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 3. It is understood that if the Architect/Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Architect/Engineer will be deducted from the Contractor's final payment.
 4. Contractor shall notify Architect/Engineer 48 hours prior to installation of ceilings or lay-in ceiling tiles.
- D. The following must be submitted before Architect/Engineer recommends final payment:
 1. Operation and maintenance manuals with copies of approved shop drawings.
 2. Record documents including marked-up drawings and specifications.
 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.
 4. Inspection and testing report by the fire alarm system manufacturer.
 5. Start-up reports on all equipment requiring a factory installation or start-up.

E. Circuit Directories:

1. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.04 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div26.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div26.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.

7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copies of all factory inspections and/or equipment startup reports.
5. Copies of warranties.
6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
7. Dimensional drawings of equipment.
8. Detailed parts lists with lists of suppliers.
9. Operating procedures for each system.
10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
11. Repair procedures for major components.
12. Replacement parts and service material requirements for each system and the frequency of service required.
13. Instruction books, cards, and manuals furnished with the equipment.
14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.
15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

3.05 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

- C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.
- D. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- E. The instructions shall include:
 - 1. Maintenance of equipment.
 - 2. Start-up procedures for all major equipment.
 - 3. Description of emergency system operation.
- F. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.
- G. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.
- H. Operating Instructions:
 - 1. Contractor is responsible for all instructions to the Owner's representatives for the electrical and specialized systems.
 - 2. If the Contractor does not have staff that can adequately provide the required instructions, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.06 RECORD DOCUMENTS

- A. The following paragraphs supplement Division 1 requirements.
- B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete Record Documents as required by this contract, this Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

- E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.
- F. Record actual routing of conduits exceeding 2 inches.

3.07 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.
- C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.08 SPECIAL REQUIREMENTS

- A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.
- B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.
- D. Raceway and Cable Routing Restrictions: Raceways and cable are restricted from being routed in the following locations, unless serving the space or permitted by the authority having jurisdiction.
 - 1. Elevator machine rooms and hoistways.
 - 2. Exit enclosures.
 - 3. Other areas restricted by code.
 - 4. Technology, data, server rooms.
 - 5. Fire pump and sprinkler rooms.
 - 6. Normal power in emergency power equipment rooms: Limited to feeders and branch circuits serving the emergency power equipment located in the room.
 - 7. Emergency power in normal power equipment rooms: Limited to feeders and branch circuits serving the normal power equipment located in the room.
- E. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:
 - 1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.

2. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
3. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

3.09 INDOOR AIR QUALITY (IAQ) MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

- A. Within the Limits of Construction:
 1. The Electrical Contractor shall coordinate all work with the contractor responsible for IAQ.
 2. The means, methods and materials used by the Electrical Contractor shall be coordinated with the contractor responsible for IAQ and shall comply with the IAQ requirements set forth in Division 1 and Division 21/22/23 of these specifications.
- B. Outside the Limits of Construction:
 1. IAQ shall be the responsibility of the electrical contractor for work that is required outside the limits of construction.
 2. The Electrical Contractor is responsible for the IAQ set forth in Division 1 and Division 21/22/23 of these specifications.
 3. The Electrical Contractor shall review and coordinate all IAQ plans and procedures with the owner's IAQ representative.
- C. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:
 1. General Contractor shall erect and maintain dust barriers throughout the construction work. These barriers shall be reasonably airtight and shall prevent entry into the construction zone by unauthorized persons. Reasonably airtight means construction equivalent to full-height temporary or permanent walls with joints taped or sealed, and shafts and other penetrations sealed as well as possible. Fire resistant polyethylene is acceptable; if flame spread/smoke developed ratings are demonstrated to conform to the applicable building codes and licensing acts.
 2. The Contractor shall continuously maintain the construction zone under a negative pressure of at least 0.01" w.g. minimum relative to all adjacent areas of the building.

- a. Exhaust fans used for this purpose shall filter air and discharge it outdoors or to the least populated area adjacent to the construction work using negative air machines designed specifically for this purpose. All filtration for air recirculated back into the building shall be HEPA (99.97% DOP efficiency) for work adjacent to healthcare or elderly facilities. If no work is adjacent to these areas, 95% filtration is acceptable. Filtering air discharged to outdoors shall be accomplished with 30% filters.
 - b. If air is discharged outdoors, maintain all required distances to doors, windows, air intakes, etc.
 - c. If high levels of Volatile Organic Compounds (VOC's) or odors are released, activated carbon or equivalent filtration shall also be employed. Exhaust shall not discharge near doors, air intakes, pedestrians, gathering areas, or operable windows.
 - d. Adjusting existing air handling equipment to assist in pressure control is acceptable, if approved by the Owner and the authority having jurisdiction.
 - e. Seal return, exhaust, and supply air openings in or near the construction zone that serve existing air handling systems, and rebalance the systems for proper operation. If this is impractical, add filters at the intakes of sufficient cross sectional area to minimize the pressure drop and avoid the need for rebalancing.
 - f. Maintain pressure control one hour before and after all construction periods, and 24 hours per day in healthcare or elderly facilities.
3. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
 - a. Minimizing the amount of dust generated.
 - b. Reducing solvent fumes and VOC emissions.
 - c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
4. Request that the Owner designate an IAQ representative.
5. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
6. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
7. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
8. Request copies of and follow all Owner's IAQ and infection control policies.
9. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
10. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
11. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings under Construction".

3.10 SYSTEM STARTING AND ADJUSTING

- A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.
- C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.
- D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.11 FIELD QUALITY CONTROL

- A. General:
 - 1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester's name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.
 - 2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.
 - 3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.
 - 4. Any wiring device, electrical apparatus or luminaire, if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
 - 5. Test cable insulation of service and panel feeder conductors for proper insulation values. Tests shall include the cable, all splices, and all terminations. Each conductor shall be tested and shall test free of short circuits and grounds and have an insulation value not less than Electrical Code Standards. Take readings between conductors, and between conductors and ground.

6. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Architect/Engineer or authority having jurisdiction deems necessary.

B. Ground Resistance:

1. Conduct service ground resistance tests using an approved manufactured ground resistance meter. Submit to the Architect/Engineer a proposed test procedure including type of equipment to be used. (The conventional ohmmeter is not an acceptable device.)
2. Make ground resistance measurements during normal dry weather and not less than 48 hours after a rain. Ground resistance values shall be verified by the /Engineer at the time the readings are taken.
3. If the ground resistance value obtained is more than the value set forth in Section 26 0526, the following shall be done to obtain the value given:
 - a. Verify that all connections in the service ground system are secure.
 - b. Increase the depth to which ground rods are driven by adding section lengths to the rods and retest. If the resistance is still excessive increase the depth by adding an additional rod section and retest.
 - c. If the resistance is still excessive, furnish and install additional ground rods, spaced not less than 20 feet from other ground rods unless otherwise noted on plans, and connect into the ground electrode system. Retest.
 - d. Review results with the Architect/Engineer.
4. Before final payment is made to the Contractor submit a written report to the Architect/Engineer including the following:
 - a. Date of test.
 - b. Number of hours since the last rain.
 - c. Soil condition at the time of the test in the ground electrode location. That is: dry, wet, moist, sand, clay, etc.
 - d. Diagram of the test set-up showing distances between test equipment, ground electrode, auxiliary electrodes, etc.
 - e. Make, model, and calibration date of test equipment.
 - f. Tabulation of measurements taken and calculations made.

C. Ground-Fault Equipment Performance Testing:

1. Test: Perform ground-fault performance testing when system is installed. The test process shall use primary current injection per manufacturer instruction and procedures. Perform test for the following:
 - a. Service disconnects
 - b. Solid state molded case circuit breakers and solid-state insulated case circuit breakers equipped with ground fault protection.

- c. Fusible switches with ground fault relay protection.
 - d. Outside branch circuits and feeders.
 - e. Code required.
- 2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.
- D. Arc Energy Reduction Equipment Performance Testing:
 - 1. Test: Perform arc energy protection performance testing when system is installed. The test process shall use primary current injection or approved method per manufacturer instructions and procedures. Perform test for the following:
 - a. All arc energy reduction systems installed.
 - 2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.
- E. Other Equipment:
 - 1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.
- F. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Architect/Engineer or authority having jurisdiction deem necessary.
- G. Contractor shall thermographic study all electrical gear, switchboard, panelboards, etc. at the end of construction to identify any unusual conditions/heating within the equipment. Coordinate with Owner/Architect/Engineer to have an Owner/Architect/Engineer representative present during testing.
- H. Report shall include color printouts, in binder, of pictures taken to use as a baseline reading after building is occupied.
- I. Upon completion of the project, the Contractor shall provide amperage readings for all panelboards and switchboards and turn the results over to the Owner for "benchmark" amperages.

3.12 UTILITY REBATE

- A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.
- B. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations of fire-rated construction fire sealed in accordance with specifications.
2. Electrical panels have typed circuit identification.
4. Per Section 26 0500, cable insulation test results have been submitted.
6. Per Section 26 0500, ground resistance test results have been submitted.
7. Operation and Maintenance manuals have been submitted as per Section 26 0500.
8. Bound copies of approved shop drawings have been submitted as per Section 26 0500.
9. Report of instruction of Owner's representative has been submitted as per Section 26 0500.
11. Start-up reports from factory representative have been submitted as per Section 26 0500.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION

SECTION 26 0503 - THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.01 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.02 REFERENCES

- A. UL 263 - Fire Tests of Building Construction and Materials
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. CBC California Building Code

1.03 SUBMITTALS

- A. Submit under provisions of Section 26 0500.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
 4. F ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

1.05 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 2. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq.ft. at both ambient temperature and 400°F.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.
- F. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:
 - 1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
 - 2. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
 - 3. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

1.06 MEETINGS

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
 - 1. Review foreseeable methods related to firestopping work.
 - 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.07 WARRANTY

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division

Penetrating Item	UL System No.
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999
*Alternate method of firestopping is patching opening to match original rated construction.	

Penetrating Item	UL System No.
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999
*Alternate method of firestopping is patching opening to match original rated construction.	

Penetrating Item	UL System No.
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999

Penetrating Item	UL System No.
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999
*Alternate method of firestopping is patching opening to match original rated construction.	

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.02 CLEANING AND PROTECTING

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.03 IDENTIFICATION

- A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:
 - 1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

3.04 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the contractor's expense.

END OF SECTION

SECTION 26 0505 - ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Electrical demolition

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work shall be as specified in individual Sections.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. THE DRAWINGS ARE INTENDED TO INDICATE THE SCOPE OF WORK REQUIRED AND DO NOT INDICATE EVERY BOX, CONDUIT, OR WIRE THAT MUST BE REMOVED. THE CONTRACTOR SHALL VISIT THE SITE PRIOR TO SUBMITTING A BID AND VERIFY EXISTING CONDITIONS.
- B. Where walls, ceilings, structures, etc., are indicated as being removed on general or electrical drawings, the Contractor shall be responsible for the removal of all electrical equipment, devices, fixtures, raceways, wiring, systems, etc., from the removed area.
- C. Where ceilings, walls, structures, etc., are temporarily removed and replaced by others, this Contractor shall be responsible for the removal, storage, and replacement of equipment, devices, fixtures, raceways, wiring, systems, etc.
- D. Where mechanical or technology equipment is indicated as being removed on electrical, mechanical, or technology drawings, the Contractor shall be responsible for disconnecting the equipment and removing all starters, VFD, controllers, electrical equipment, raceways, wiring, etc. associated with the device.
- E. Verify that abandoned wiring and equipment serve only abandoned equipment or facilities. Extend conduit and wire to facilities and equipment that will remain in operation following demolition. Extension of conduit and wire to equipment shall be compatible with the surrounding area. Extended conduit and conductors to match existing size and material.

- F. Coordinate scope of work with all other Contractors and the Owner at the project site. Schedule removal of equipment and electrical service to avoid conflicts.
- G. Bid submittal shall mean the Contractor has visited the project site and has verified existing conditions and scope of work.

3.02 PREPARATION

- A. The Contractor shall obtain approval from the Owner before turning off power to circuits, feeders, panels, etc. Coordinate all outages with Owner.
- B. Coordinate utility service outages with Utility Company.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations. Assume all equipment and systems must remain operational unless specifically noted otherwise on drawings.
- D. Disconnect electrical systems in walls, floors, structures, and ceilings scheduled for removal.
- E. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Service changeover shall be completed on an overtime basis.
- F. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Provide a watchman to make required premise observations during all outages, requirements as dictated by codes and Owner's insurance carrier.
- G. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. System changeover shall be completed on an overtime basis.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Demolish and extend existing electrical work under provisions of Division 1 of Specifications and this Section.

- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring and raceway to source of supply. Existing conduit in good condition may be reused in place by including an equipment ground conductor in reused conduit. Reused conduit and boxes shall have supports revised to meet current codes. Relocating conduit shall not be allowed.
- D. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces. Remove all associated clamps, hangers, supports, etc. associated with raceway removal.
- E. Disconnect and remove outlets and devices that are to be demolished. Remove outlet or devices' associated back box, supports, and conduit and conductors back to source. Patch opening created from removal of device to match surrounding finishes.
- F. Disconnect and remove abandoned panelboards and distribution equipment.
- G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories. Ballasts in light fixtures installed prior to 1980 shall be incinerated in EPA approved incinerator or disposed of in EPA certified containers and deposited in an EPA landfill certified for PCB disposal or recycled by permitted ballast recycler. Punctured or leaking ballasts must be disposed of according to Federal Regulations under the Toxic Substance Control Act. Provide Owner and Architect/Engineer with a Certificate of Destruction to verify proper disposal.
- I. Repair adjacent construction and finishes damaged during demolition and extension work. Patch openings to match existing surrounding finishes.
- J. Maintain access to existing electrical installations that remain active. Modify installation or provide junction boxes and access panel as appropriate.
- K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified. Extended conduit and conductors to match existing size and material.
- L. HID and fluorescent lamps, determined by the Toxicity Characteristic Leachate procedure (TCLP), to be hazardous waste shall be disposed of in an EPA-permitted hazardous waste disposal facility or by a permitted lamp recycler.
- M. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

- N. This Contractor is responsible for all costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

3.04 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment that remain or are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- C. ELECTRICAL ITEMS (E.G., LIGHTING FIXTURES, RECEPTACLES, SWITCHES, CONDUIT, WIRE, ETC.) REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE OWNER. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE OWNER IN A LOCATION COORDINATED WITH THE OWNER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DISPOSAL OF MATERIAL THE OWNER DOES NOT WANT.

3.05 INSTALLATION

- A. Install relocated materials and equipment under the provisions of Division 1 of Specifications.

END OF SECTION

SECTION 26 0513 - WIRE AND CABLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Building wire
- B. Cabling for remote control, signal, and power limited circuits

1.02 RELATED WORK

- A. Section 26 0553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.03 REFERENCES

- A. ASTM B800-05 - Standard Specification for 8000 Series Aluminum Alloy Wire Electrical Purposes-Annealed and Intermediate Tempered.
- B. ASTM B801-07 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation
- C. NEMA WC 70 - Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy
- D. NFPA 70 - National Electrical Code (NEC)
- E. CEC California Electrical Code
- F. UL 44 - Thermoset-Insulated Wires and Cables
- G. UL 83 - Thermoplastic-Insulated Wires and Cables
- H. UL 854 - Service-Entrance Cables
- I. UL 1581 - Standard for Electrical Wires, Cables, and Flexible Cords
- J. UL 2196 - Fire Resistive, Fire Resistant and Circuit Integrity Cables
- K. California Division of State Architect (DSA) Interpretation of Regulations

1.04 SUBMITTALS

- A. Submit shop drawings and product data under the provisions of Section 26 0500.

- B. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 BUILDING WIRE

- A. Feeders and Branch Circuits 8 AWG and larger: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.
- B. Feeders and Branch Circuits 10 AWG and Smaller: Copper, solid or stranded conductor, 600-volt insulation, THHN/THWN, unless otherwise noted on the drawings.
- C. Control Circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN.
- D. Aluminum conductors are not to be used.
- E. Each 120 and 277-volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

2.02 CABLING FOR REMOTE CONTROL, SIGNAL, AND POWER LIMITED CIRCUITS

- A. Wire for the following specialized systems shall be as designated on the drawings, or elsewhere in these specifications. If not designated on the drawings or specifications, the system manufacturer's recommendations shall be followed.
 - 1. Electronic control
 - 2. Other specialized cabling, signal, and power limited cabling. Refer to the appropriate Division 23, requirements; including, but not limited, to the following:
 - a. Building Automation Systems and Controls, Division 23.
- B. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket.
- C. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.
- D. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

2.03 METAL-CLAD CABLE (MC)

- A. Conductors shall be copper, 600-volt insulation, THHN. Metal clad cable shall be constructed in strict accordance with Underwriters Laboratories, Inc. Standard for Metal-Clad Cables, UL 15694, exterior of metal interlocked armor.
- B. Minimum conductor size for branch circuit wiring shall be 12 AWG, with larger wires used where specified.
- C. Metal-clad cables may be used for branch circuit wiring as defined in the Electrical Code, subject to acceptance by State and local codes.

PART 3 - EXECUTION

3.01 WIRE AND CABLE INSTALLATION SCHEDULE

- A. Above Accessible Ceilings:
 - 1. Building wire shall be installed in raceway.
 - 2. Metal clad cable, Type MC, 1/2" size with minimum #12 conductors and ground, shall be allowed for flexible whips to individual luminaires on non-essential circuits. The flexible whips shall be between 18" to 72" in length per Electrical Code.
- B. All Other Locations: Building wire in raceway.
- C. Above Grade: All conductors installed above grade shall be type "THHN".
- D. Underground or In Slab: All conductors shall be type "THWN".
- E. Low Voltage Cable (less than 100 volts): Low voltage cables in ducts, plenums, and other air handling spaces shall be plenum listed. Low voltage cables in non-accessible areas shall be installed in conduit. Low voltage cable may be installed without conduit in accessible areas using the following types of cable supports. Cable support types/systems shall comply with the warranty requirements of the low voltage cable manufacturer.
 - 1. J-hooks
 - 2. Bridle rings with saddle supports
- F. Low Voltage Cable (less than 100 volts): Low voltage cable shall be installed in raceway.
- G. Fire-Rated 2-Hour Feeders and Circuit Requiring Continuous Operation (CI): Refer to Part 2 of this section for acceptable products and assemblies. Installation shall meet UL 2196.

3.02 CONTRACTOR CHANGES

- A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, CEC California Electrical Code edition Table 310.15(B)(16). Service entrance conductors are based on copper conductor installed in underground electrical ducts, CEC California Electrical Code Table B310.15(B)(2)(7).
- B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.
- C. Conductor length(s) listed on plans and schedules. The drawings are diagrammatic with intent to convey the components of the electrical distribution system. Conductor length(s) when listed on plans and schedules are for engineering calculation purposes. Conductor length(s) shall NOT be used for bidding purposes.
- D. Record drawing shall include the calculations and sketches.

3.03 GENERAL WIRING METHODS

- A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
- B. Use no wire smaller than 18 AWG for low voltage control wiring below 100 volts.
- C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277-volt branch circuit home runs longer than 200 feet.
- D. Use no wire smaller than 8 AWG for outdoor lighting circuits.
- E. The ampacity of multiple conductors in one conduit shall be derated per the Electrical Code. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.
- F. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.
- G. Splice only in junction or outlet boxes.
- H. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- I. Make conductor lengths for parallel circuits equal.
- J. All conductors shall be continuous in conduit from last outlet to their termination.
- K. Terminate all spare conductors on terminal blocks, and label the spare conductors.

- L. Cables or wires shall not be laid out on the ground before pulling.
- M. Cables or wires shall not be dragged over earth or paving.
- N. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.
- O. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.
- P. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

3.04 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.
- D. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.
- E. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.
- F. Only nylon rope shall be permitted to pull cables into conduit and ducts.
- G. Completely and thoroughly swab raceway system before installing conductors.
- H. Conductor Supports in Vertical Raceways:
 - 1. Support conductors in vertical raceways in accordance with the Electrical Code Spacing of Conductors Supports.
 - 2. Supports shall be of insulated wedge type (OZ Gedney Type S, or equal) and installed in a tapered insulated bushing fitting or a metal woven mesh with a support ring that fits inside conduit fitting installed in an accessible junction box (Hubbell Kellems support grip or equal).

3.05 CABLE INSTALLATION

- A. Provide protection for exposed cables where subject to damage.
- B. Use suitable cable fittings and connectors.
- C. Run all open cable parallel or perpendicular to walls, ceilings, and exposed structural members. Follow the routing as illustrated on the drawings as closely as possible. Cable routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatical, unless noted otherwise. The correct routing, when shown diagrammatically, shall be chosen by the Contractor based on information in the contract documents; in accordance with the manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", recognized industry standards; and coordinated with other contractors.
- D. Open cable shall be supported by the appropriate size J-hooks or other means if called for on the drawings. Wire and cable from different systems shall not be installed in the same J-hook. J-hooks shall be sized with 20% spare capacity. J-hooks shall provide proper bend radius support for data cable and fiber cables.
- E. Open cable installed above suspended ceilings shall not rest on the suspended ceiling construction, nor utilize the ceiling support system for wire and cable support.
- F. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet. All J-hooks shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc. J-hooks shall be independently rigidly attached to a structural element. J-hooks shall be installed to provide 2" horizontal separation and 6" vertical separation between systems.
- G. Open cable shall only be installed where specifically shown on the drawings, or permitted in these specifications.

3.06 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice and tap only in accessible junction boxes.
- B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.
- C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.
- D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

- E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.
- F. Thoroughly clean wires before installing lugs and connectors.
- G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.
- I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:
 - 1. Facing the front and operating side of the equipment, the phase identification shall be:
 - a. Left to Right - A-B-C
 - b. Top to Bottom - A-B-C
- J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.
- K. Use antioxidant joint compound on all aluminum conductor terminations. Apply antioxidant joint compound per manufacturer's recommendations.

3.07 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Building Wire and Power Cable Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a "Megger". The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.
- C. Inspect wire and cable for physical damage and proper connection.
- D. Torque test conductor connections and terminations to manufacturer's recommended values.
- E. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

- F. Documentation indicating that the torque wrench has been calibrated not more than 30 days prior to tightening of lugs shall be provided.
- G. Protection of wire and cable from foreign materials:
 - 1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.
- H. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

END OF SECTION

SECTION 26 0527 - SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Conduit and Equipment Supports
- B. Fastening Hardware

1.02 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Allied Support Systems
- B. Cooper B-Line
- C. Erico, Inc.
- D. Hilti
- E. Power Fasteners
- F. Orbit Industries

2.02 MATERIAL

- A. Support Channel: stainless steel; painted steel for interior/dry locations. All field cut ends shall be touched up with matching finish to inhibit rusting.
- B. Hardware: Corrosion resistant.
- C. Anchorage and Structural Attachment Components:
 - 1. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to Authorities Having Jurisdiction.

- a. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
 2. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
 3. Welding Lugs: Comply with MSS-SP-69, Type 57.
 4. Beam clamps for Steel Beams and Joists: Double sided or concentric open web joist hangars. Single-sided type is not acceptable.
 5. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
 6. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.
 7. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-05. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.
 8. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.
- D. Conduit Sleeves and Lintels:
1. Each Contractor shall provide, to the General Contractor for installation, lintels for all openings required for the Contractor's work in masonry walls and conduit sleeves for floors, unless specifically shown as being by others.
 2. Refer to Structural General Notes for lintel requirements in masonry construction.
 3. Refer to Structural plans and specifications for lintel requirements and sizes.
 4. Lintels:
 - a. Lintels in non-bearing masonry wall openings can be sized in accordance with the note below. Lintels that occur in existing bearing walls are to be sized according to similar conditions and spans in the new construction and lintel schedule. Bottom plate size shall be a minimum of 3/8" thick. The width of the plate shall be 3/4" less than the field verified wall thickness. The plate shall be the full length of the lintel member. Lintels are not required over openings that are 12" wide or less and at least 1 course below the top of the wall.
 - b. All lintels shall have a minimum of 8" end bearing.
 - c. All lintels in exterior wall construction shall be hot-dip galvanized.
 - d. For all openings not otherwise detailed or scheduled, minimum lintels shall be for each 4 inch of masonry width:

- 1) 0 to 2'-0" span: 5/16" plate (3/4" less than wall width)
 - 2) 2'-0" to 4'-0" span: L 3 1/2 x 3 1/2 x 1/4
 - 3) 4'-0" to 6'-0" span: L4 x 3 1/2 x 5/16 (llv)
 - 4) 6'-0" to 8'-0" span: L5 x 3 1/2 x 5/16 (llv)
- e. All angles that are back to back shall be welded top and bottom 3" at 12" minimum.
5. Fabricate all lintels from structural steel shapes or as indicated on the drawings. All lintels and grouped wall openings shall be approved by the Architect or Structural Engineer.
 6. Fabricate all sleeves from standard weight black steel pipe. Provide continuous sleeve. Cut or split sleeves are not acceptable. Sleeves through concrete walls may be high density polyethylene pipe penetration sleeve with a water stop collar, suitable for use with Link-Seal mechanical seals. Century-Line Model CS.
 7. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.
 8. Sleeves shall not penetrate structural members without approval from the Structural Engineer.
 9. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
 10. Install all sleeves concentric with conduits. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
 11. Where conduits rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
 12. Size sleeves large enough to allow expansion and contraction movement.
- E. Rooftop Support System:
1. Provide pre-fabricated roof supports for all conduit and equipment installed above the roof. Support all conduit and equipment a minimum of 4" above roof.
 2. Support system shall be compatible with single ply, bituminous, metal, and spray foam roof systems. The base shall be rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.
 3. All metal components shall be hot dipped galvanized. Mounting hardware shall be stainless steel or hot dipped galvanized. Support shall be UV, corrosion, and freeze/thaw resistant. Support shall include orange paint, reflective safety orange accents, or similar markings for increased visibility.
 4. Products: