

rearrangement of furnishings or equipment, such changes shall be made without extra cost.

4. Verify dimensions and the correct location of Owner-Furnished equipment before proceeding with the roughing-in of connections.
5. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with work carefully check and verify dimensions and sizes with the drawings to see that the equipment will fit into the spaces provided without violation of applicable Codes.
6. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the Engineer.
7. Be responsible for coordination of coordinated drawings.
8. Replace or repair, without additional compensation, any work which does not comply with these requirements.

K. Installation General: For special requirements, refer to specific equipment under these requirements.

1. Unless otherwise specified elsewhere in the specifications, do all excavating necessary for the proper installation of the electrical work.
2. Locations of Openings: Locate chases, shafts and openings required for the installation of the electrical work during framing of the structure. Do any additional cutting and patching required. Cutting or drilling in any structural member is prohibited without approval of the Engineer. Furnish access panels as required.
3. Location of Sleeves: Where conduits pass through concrete walls, suspended slabs or metal deck floors, install sleeves of adequate size to permit installation of conduit. Sleeves shall be installed prior to pouring of concrete and shall have ends flush with the wall or extend 2 inches above floor surfaces. Verify locations.
4. Type of Sleeves: Sleeves shall be steel pipe or galvanized sheet steel.
5. Finish Around Sleeves: Rough edges shall be finished smooth. Space between conduit and sleeves where conduit passes through exterior walls shall be sealed to permit movement of conduit, but prevent entrance of water. Space between conduit and sleeves where conduit passes through fire rated interior walls and slabs shall be sealed with approved materials to provide a fire barrier conforming to the requirements of the governing authorities having jurisdiction, using UL Approved Firestopping Systems.

6. Wherever conduit extends through roof, install flashings in accordance with drawings and details.
7. Be responsible for cutting and patching which may be required for the proper installation of the electrical work.
8. Protect work, materials and equipment cause whatever and provide adequate and proper storage facilities during the progress of the work.
9. Storage outdoors shall be weather protected and shall include space heaters to prevent condensation. Provide for the safety and good condition of all work until final acceptance of the work. Replace all damaged or defective work, materials and equipment before requesting final acceptance.
10. Conduit and Equipment to be Installed: Clean thoroughly to remove plaster, spattered paint, cement and dirt on both exterior and interior
11. Conduit and Equipment to be Painted: Clean conduit exposed to view in completed structure by removing plaster and dirt. Remove grease, oil and similar material from conduit and equipment by wiping with clean rags and suitable solvents in preparation for paint.
12. Items with Factory Finish: Remove cement, plaster, grease and oil, and leave surfaces, including cracks and corners, clean and polished. Touch up scratched or bare spots to match finish.
13. Site Cleaning: Remove from site all packing cartons, scrap materials and other rubbish.
14. Electrical equipment and materials exposed to public and in finished areas shall be finish-painted after installation in accordance with the Painting Section. All exposed screw-type fasteners, exterior, or interior in restrooms, shall be vandal-resistant spanner type; include tool.

L. Tests:

1. Equipment and systems for which the National Electrical Testing Association (NETA) has an approved or recommended procedure, shall be tested in accordance with that procedure. Test values shall equal values recommended by NETA. Copies of test reports shall be submitted as required under shop drawing submittals.
2. Resistance to ground tests shall be accomplished by a qualified independent testing firm to measure resistance to ground at grounding electrodes. Make tests before slabs or affected areas are poured in order that corrective measures, if required, may be taken. Submit a report showing the results of these measurements. If the resistances exceed values specified elsewhere or NETA test procedure recommendations, perform corrective measures required to reduce resistance to acceptable values.

3. Prior to energizing any motor, measure the service voltage for phase balance and report if unbalance exceeds 1% from mean.
  4. Upon completion of the work and adjustment of all equipment, conduct an operating test. Conduct the test in the presence of an authorized representative of the Engineer. Demonstrate system and equipment to operate in accordance with requirements of the Contract Documents and to be free from electrical and mechanical defects. Provide systems free from short circuits and grounds and show an insulation resistance between phase conductors and ground not less than the requirements of the governing electric code. Test circuits for proper neutral connection.
  5. Complete tests prior to final inspection of project, including corrective work based on the results of the tests.
  6. Perform special tests on systems and equipment as specified herein using personnel qualified to perform such tests.
  7. Submit a report showing test voltage of line to neutral on the secondaries of transformers.
  8. Measure voltage on secondary side of transformers with full load connected and adjust taps to provide rated secondary voltage.
  9. Refer to Section 01 40 00 – Quality Requirements for other testing requirements.
- M. Protection: Protect finish parts of the materials and equipment against damage during the progress of the work and until final completion and acceptance. Cover materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred. Keep moving parts clean, dry and lubricated.
- N. Cleaning Up:
1. Upon completion of the work and at various time during the progress of the work, remove from the building all surplus materials, rubbish and debris resulting from the work of this Division.
  2. Thoroughly clean switchgear including busses, apparatus, exposed conduit, metal work including the exterior and interior, and accessories for the work of this Division, of cement, plaster and other deleterious materials; remove grease and oil spots with cleaning solvent; carefully wipe surfaces and scrape cracks and corners clean.
  3. Thoroughly polish chromium or plated work. Remove dirt and stains from lighting fixtures.
  4. Leave the entire installation in a clean condition.
- O. Completion:

1. The work will not be reviewed for final acceptance until operating and maintenance data, manufacturer's literature, panel directories and nameplates specified herein have been approved and properly posted or installed and final cleaning of equipment and premises has been completed.
  2. When the installation is complete and adjustments have been made, operate the system for a period of one week, during which time demonstrate that systems are completed and operating in conformance with the specifications.
  3. Refer to Section 01 70 00 – Execution and Closeout Requirements for other system starting requirements.
- P. Operating and Maintenance Data: Submit complete and at one time, prior to acceptance of the installation, 4 copies of manufacturer's instructions for operation and maintenance of electrical equipment, including replacement parts lists. As specified in Section 01 70 00 – Execution and Closeout Requirements.
- Q. Inspection and Acceptance Procedures: The Architect will submit observation reports periodically during the construction phase detailing Contract deficiencies. The Contractor is responsible for making corrections immediately. Notice of Completion of the project will not be made until all items have been corrected.
- R. Substantial Completion of Electrical Systems:
1. Prior to Substantial Completion of operating electrical systems, the Contractor shall:
    - a. Provide materials of the type and quality specified and as necessary for proper operation, tested and ready for use.
    - b. Deliver to the Engineer, the Record Drawings.
    - c. Furnish the required Operating and Maintenance Data/Manuals.
    - d. Clean up of the project pertaining to this Division of the work.
    - e. After installation has been completed and adjustments made, operate the system for a period of one week, during which time, demonstrate to the Engineer that systems are complete and operating in conformance with Contract Documents.
    - f. Conduct tests required and as specified in this Division and submit test reports and corrective actions taken.
    - g. Submission of warranties and guarantees.
  2. Substantial Completion of Work Shall be Contingent On:
    - a. Contractor replacing defective materials and workmanship.

- b. Upon completion of work and adjustments made, Contractor shall conduct an operating test for each system for approval at such time as Engineer directs. Conduct test in presence of authorized representative of Architect and demonstrate that systems and equipment do operate in accordance with requirements of the Contract Documents and are free from electrical and mechanical defects.
  - c. Contractor shall provide the necessary training programs and instructions to the Owner's representative. Number of hours or days as required under separate Sections of these Specifications.
  - d. Submit copies of manufacturer's instructions and maintenance of electrical equipment including replacement parts lists. Each set shall include one set of shop drawings of equipment installed.
- S. Submittals for Change Orders: When changes are made during the construction phase, deletions and additions shall be presented in a manner that will indicate the cost of each item of material and corresponding labor. Markup shall be then added in accordance with the requirements of the General Conditions as modified by the Supplementary Conditions.
  - 1. Unit pricing shall apply in event of changes, additions and deletions to the base Contract, as follows:
    - a. Submit a unit cost, covering one hour of labor, including all applicable supervision, nonproductive labor, burdens, benefits, insurance's, taxes, direct and indirect job expenses including drawings, engineering temporary power, warehouse, tools, equipment, clean-up, bonds, overhead and profit, charged for labor. Unit cost of labor shall be applicable for duration through completion of the project.
    - b. Material unit costs shall be based on the latest edition of "Electrical Trade Book," published by Trade Service Publications, Inc., Unit cost shall be taken from extreme right-hand column.
  - 2. Labor unit quantities, for specific items as required by unit pricing and for equipment not covered by unit pricing shall be those listed in the third column from the National Electrical Contractors' Association, Inc., "NECA Manual of Labor Units."
  - 3. For material not covered by the Unit Pricing, use the latest edition of "Electrical Trade Book, extreme right hand column. This materials cost shall remain for the duration of the contract and shall apply to all phases of construction.
- T. The Contractor at a time convenient to the Owner shall provide instruction to the Owner's operating personnel in the proper operation and maintenance of the equipment and systems. The instructors shall have received factory training and shall be thoroughly familiar with the equipment installed. The operating

personnel shall receive the number of days instruction as indicated in other sections.

U. General Commissioning Requirements:

1. Attend Commissioning pre-construction meeting and other required meetings to facilitate coordination and execution of the commissioning scope.
2. Provide the services of specialized technicians when required for certain tests and/or validation efforts. These services may come from the vendors of the equipment to be tested or from qualified independent testing services.
3. Systems that will be commissioned are:
  - a. Fire detection and alarm system.

V. Commissioning Work in Cooperation with Other Trades:

1. Coordinate with the various vendors of products provided to obtain the extra descriptive data, submittal data, O&M manuals, documentation and other information required for submittal for commissioning purposes. Provide this information timely to the commissioning schedule outlined and/or as required by the commissioning provider.
2. Arrange and pay for focused training materials and services provided by the various equipment vendors of products provided and installed for this project.
3. For each of the systems categories outlined above, inform the vendors and subcontractors of the commissioning responsibilities incumbent on them to provide so they can offer their assistance and experience related to their products.
4. Cooperate with and assist the Owner for functional testing of HVAC, fire protection/suppression systems, iron door systems upon testing of fire detection and alarm system.

**PART 2: PRODUCTS – NOT USED**

**PART 3: EXECUTION – NOT USED**

**END OF SECTION**

**SECTION 26 05 03**  
**EQUIPMENT WIRING CONNECTIONS**

**PART 1: GENERAL**

**1.1 SUMMARY**

- A. Section includes electrical connections to equipment.
- B. Related Sections:
  - 1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
  - 2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

**1.2 REFERENCES**

- A. National Electrical Manufacturers Association:
  - 1. NEMA WD 1 - General Requirements for Wiring Devices.
  - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

**1.3 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's installation instructions.

**1.4 CLOSEOUT SUBMITTALS**

- A. Section 01 70 00 - Execution and Closeout Requirements: Submittal procedures.
- B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

**1.5 COORDINATION**

- A. Section 01 31 00 – Project Management and Coordination.
- B. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- C. Determine connection locations and requirements.
- D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

- E. Sequence electrical connections to coordinate with start-up of equipment.

**PART 2: PRODUCTS**

**2.1 CORD AND PLUGS**

- A. Manufacturers:
  - 1. Hubbell.
  - 2. Pass & Seymour.
  - 3. Arrow-Hart.
  - 4. Substitutions: Section 01 25 00 – Substitution procedures.
- B. Attachment Plug Construction: Conform to NEMA WD 1.
- C. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.
- D. Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- E. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

**PART 3: EXECUTION**

**3.1 EXAMINATION**

- A. Section 01 31 00 – Project Management and Coordination.
- B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

**3.2 INSTALLATION**

- A. Make electrical connections.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Install receptacle outlet to accommodate connection with attachment plug.
- E. Install cord and cap for field-supplied attachment plug.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.



- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
- J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

### 3.3 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

**END OF SECTION**

## SECTION 26 05 19

### LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

#### PART 1: GENERAL

##### 1.1 SUMMARY

- A. Section includes building wire and cable; nonmetallic-sheathed cable; direct burial cable; service entrance cable; armored cable; metal clad cable; and wiring connectors and connections.
- B. Related Sections:
  - 1. Section 26 05 53 - Identification for Electrical Systems: Product requirements for wire identification.

##### 1.2 REFERENCES

- A. International Electrical Testing Association:
  - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Fire Protection Association:
  - 1. NFPA 70 - National Electrical Code.
  - 2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
- C. Underwriters Laboratories, Inc.:
  - 1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

##### 1.3 SYSTEM DESCRIPTION

- A. Product Requirements: Provide products as follows:
  - 1. Solid conductor for feeders and branch circuits 10 AWG and smaller.
  - 2. Stranded conductors for feeders and branch circuits 8 AWG and larger.
  - 3. Stranded conductors for control circuits.
  - 4. Conductor not smaller than 12 AWG for power and lighting circuits.
  - 5. Conductor not smaller than 16 AWG for control circuits.

6. 10 AWG conductors for 20 ampere, 120 volt branch circuits larger than 75 feet.
7. 10 AWG conductors for 20 ampere, 277 volt branch circuits larger than 200 feet.

B. Wiring Methods: Provide the following wiring methods:

1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
3. Above Accessible Ceilings: Use only building wire, Type THHN/THWN insulation, in raceway.
4. Wet or Damp Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
5. Exterior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
6. Underground Locations: Use only building wire, Type THHN/THWN insulation, in raceway.

1.4 DESIGN REQUIREMENTS

- A. Conductor sizes are based on copper type THHN/THWN 600V insulation rated 75 degrees C.

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit for building wire and each cable assembly type.
- C. Test Reports: Indicate procedures and values obtained.

1.6 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of components and circuits.

1.7 QUALITY ASSURANCE

- A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

- B. Perform Work in accordance with State of California Public Work's standard.
- C. Maintain two copies of each document on site.

1.8 QUALIFICATIONS

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

1.9 FIELD MEASUREMENTS

- A. Verify field measurements are as indicated on Drawings.

1.10 COORDINATION

- A. Section 01 31 00 – Project Management and Coordination.
- B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

**PART 2: PRODUCTS**

2.1 BUILDING WIRE

- A. Manufacturers:
  - 1. General Cable Co.
  - 2. Rome Cable.
  - 3. Southwire.
  - 4. Superior Essex.
  - 5. Substitutions: Section 01 25 00 – Substitution procedure.
- B. Product Description: Single conductor insulated wire.
- C. Conductor: Copper.

2.2 ARMORED CABLE

- A. Manufacturers:
  - 1. Diamond Wire & Cable Co.
  - 2. Essex Group Inc.
  - 3. General Cable Co.
  - 4. Substitutions: Section 01 25 00 – Substitution procedure.

- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation Temperature Rating: 60 degrees C.
- E. Insulation Material: Thermoplastic.
- F. Armor Material: Steel
- G. Armor Design: Interlocked metal tape.

### 2.3 METAL CLAD CABLE

- A. Manufacturers:
  - 1. Diamond Wire & Cable Co.
  - 2. Essex Group Inc.
  - 3. General Cable Co.
  - 4. Substitutions: Section 01 25 00 – Substitution procedure.
- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation Temperature Rating: 60 degrees C.
- E. Insulation Material: Thermoplastic.
- F. Armor Material: Steel.
- G. Armor Design: Interlocked metal tape.
- H. Jacket: PVC.

### 2.4 WIRING CONNECTORS

- A. Split Bolt Connectors:
  - 1. ILSCO, Model SK.
  - 2. Blackburn, Model HPS.
  - 3. Burndy, Model KSU.
  - 4. Substitutions: Section 01 25 00 – Substitution procedure.
- B. Solderless Pressure Connectors:

1. ILSCO, Model SLUH.
  2. Burndy, Model KA-U.
  3. Panduit, Model LAM.
  4. Substitutions: Section 01 25 00 – Substitution procedure.
- C. Compression Connectors:
1. ILSCO, Model CRL.
  2. Blackburn, Model ATL.
  3. Burndy, Model HYLUG/HYLINK.
  4. Substitutions: Section 01 25 00 – Substitution procedure.

## 2.5 TERMINATIONS

- A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.
- B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

## **PART 3: EXECUTION**

### 3.1 EXAMINATION

- A. Section 01 31 00 – Project Management and Coordination.
- B. Verify interior of building has been protected from weather.
- C. Verify mechanical work likely to damage wire and cable has been completed.
- D. Verify raceway installation is complete and supported.

### 3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

### 3.3 INSTALLATION

- A. Route wire and cable to meet Project conditions.
- B. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- C. Identify wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.
- D. Special Techniques--Building Wire in Raceway:

1. Pull conductors into raceway at same time.
  2. Install building wire 4 AWG and larger with pulling equipment.
- E. Special Techniques - Cable:
1. Protect exposed cable from damage.
  2. Support cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
  3. Use suitable cable fittings and connectors.
- F. Special Techniques - Wiring Connections:
1. Clean conductor surfaces before installing lugs and connectors.
  2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
  3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
  4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
  5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- G. Install stranded conductors for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, then install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.
- H. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.
- I. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

### 3.4 WIRE COLOR

- A. General:
1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
    - a. Black and red for single phase circuits at 120/240 volts.

- b. Black, red, and blue for circuits at 120/208 volts single or three phase.
    - c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
  - 2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
    - a. Black and red for single phase circuits at 120/240 volts.
    - b. Black, red, and blue for circuits at 120/208 volts single or three phase.
    - c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
- B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.
- C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.
- D. Feeder Circuit Conductors: Uniquely color code each phase.
- E. Ground Conductors:
  - 1. For 6 AWG and smaller: Green.
  - 2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

### 3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements, 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

**END OF SECTION**



## SECTION 26 05 29

### HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

#### PART 1: GENERAL

##### 1.1 SUMMARY

###### A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Firestopping relating to electrical work.
6. Firestopping accessories.
7. Equipment bases and supports.

###### B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Section 28 05 29 - Hangers and Supports for Electronic Safety and Security.

##### 1.2 REFERENCES

###### A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

###### B. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. California Electrical Code

1. CEC – California Electrical Code.

D. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

### 1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

### 1.4 SYSTEM DESCRIPTION

- A. Firestopping Materials: ASTM E119, UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.
- B. Firestopping Materials ASTM E119, UL 1479 to achieve fire ratings of adjacent construction in accordance with UL Design Numbers noted on Drawings.
- C. Firestop interruptions to fire rated assemblies, materials, and components.

### 1.5 PERFORMANCE REQUIREMENTS

- A. Firestopping: Conform to CSFM and UL for fire resistance ratings and surface burning characteristics.
- B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

### 1.6 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

- C. Product Data:
  - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
  - 2. Firestopping: Submit data on product characteristics, performance and limitation criteria.
- D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.
- F. Manufacturer's Installation Instructions:
  - 1. Hangers and Supports: Submit special procedures and assembly of components.
  - 2. Firestopping: Submit preparation and installation instructions.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- H. Engineering Judgements: For conditions not covered by UL listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

#### 1.7 QUALITY ASSURANCE

- A. Through Penetration Firestopping of Fire Rated Assemblies: ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
  - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
  - 2. Floor Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
    - a. Floor Penetrations Within Wall Cavities: T-Rating is not required.
- B. Through Penetration Firestopping of Non-Fire Rated Floor Assemblies: Materials to resist free passage of flame and products of combustion.
  - 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.

- 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Perform Work in accordance with State of California Public Work's standard.
- G. Maintain two copies of each document on site.

#### 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

#### 1.9 PRE-INSTALLATION MEETINGS

- A. Section 01 31 00 – Project Management and Coordination.
- B. Convene minimum one week prior to commencing work of this section.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

#### 1.11 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

**PART 2: PRODUCTS**

**2.1 CONDUIT SUPPORTS**

- A. Manufacturers:
  - 1. Cooper B-Line Systems
  - 2. Panduit Corp.
  - 3. Unistrut Corp.
  - 4. Substitutions: Section 01 25 00 – Substitution procedure.
- B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
- D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.
- F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

**2.2 FORMED STEEL CHANNEL**

- A. Manufacturers:
  - 1. Cooper B-Line Systems.
  - 2. Panduit Corp.
  - 3. Unistrut Corp.
  - 4. Substitutions: Section 01 25 00 – Substitution procedure.
- B. Product Description: Galvanized (12 gage) thick steel. With holes 1-1/2 inches on center.

**2.3 SPRING STEEL CLIPS**

- A. Manufacturers:
  - 1. Cooper B-Line Systems
  - 2. Substitutions: Section 01 25 00 – Substitution procedure.

- B. Product Description: Mounting hole and screw closure.

## 2.4 SLEEVES

- A. Furnish materials in accordance State of California Public Work's standard.
- B. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- C. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- D. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

## 2.5 FIRESTOPPING

- A. Manufacturers:
  - 1. Dow Corning Corp.
  - 2. Fire Trak Corp.
  - 3. Hilti Corp.
  - 4. International Protective Coating Corp.
  - 5. 3M Fire Protection Products.
  - 6. Specified Technology, Inc.
  - 7. Substitutions: Section 01 25 00 – Substitution procedure.
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
  - 1. Silicone Firestopping Elastomeric Firestopping: Silicone elastomeric compound and compatible silicone sealant.
  - 2. Foam Firestopping Compounds: Foam compound.
  - 3. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
  - 4. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
  - 5. Firestop Pillows: Formed mineral fiber pillows.
- C. Color: As selected from manufacturer's full range of colors.

## 2.6 FIRESTOPPING ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Dam Material: Permanent:
  - 1. Mineral fiberboard.
  - 2. Sheet metal.
- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- D. General:
  - 1. Furnish UL listed products or products tested by nationally recognized independent testing laboratory.
  - 2. Select products with rating not less than rating of wall or floor being penetrated.
- E. Non-Rated Surfaces:
  - 1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
  - 2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

## **PART 3: EXECUTION**

### 3.1 EXAMINATION

- A. Section 01 31 00 – Project Management and Coordination: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive firestopping.

### 3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

- B. Remove incompatible materials affecting bond.
- C. Install backing or damming materials to arrest liquid material leakage.
- D. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

### 3.3 INSTALLATION - HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
  - 1. Concrete Structural Elements: Provide expansion anchors.
  - 2. Steel Structural Elements: Provide beam clamps.
  - 3. Concrete Surfaces: Provide expansion anchors.
  - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
  - 5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
  - 6. Sheet Metal: Provide sheet metal screws.
  - 7. Wood Elements: Provide wood screws.
- B. Inserts:
  - 1. Install inserts for placement in concrete forms.
  - 2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
  - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
  - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- C. Install conduit and raceway support and spacing in accordance with CEC.
- D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- E. Install multiple conduit runs on common hangers.
- F. Supports:



1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface mounted cabinets and panelboards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
4. Support vertical conduit at every floor.

### 3.4 INSTALLATION - FIRESTOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.
- B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.
- D. Dam material to remain.
- E. Fire Rated Surface:
  1. Seal opening at wall, ceiling, and roof as follows:
    - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
    - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
    - c. Pack void with backing material.
    - d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
  2. Where cable tray, conduit, or wireway penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.
- F. Non-Rated Surfaces:
  1. Seal opening through non-fire rated wall, floor, ceiling, and roof opening as follows:

- a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
  - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
  - c. Install type of firestopping material recommended by manufacturer.
2. Install escutcheons, floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
  3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
  4. Interior partitions: Seal pipe penetrations at telecommunication rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

### 3.5 INSTALLATION - SLEEVES

- A. Exterior entries: Seal with adjustable interlocking rubber links.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 2 inches above finished floor level. Caulk sleeves.
- E. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install stainless steel escutcheons at finished surfaces.

### 3.6 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect installed firestopping for compliance with specifications and submitted schedule.

### 3.7 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.8 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

**END OF SECTION**

## SECTION 26 05 33

### RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

#### PART 1: GENERAL

##### 1.1 SUMMARY

- A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.
- B. Related Sections:
  - 1. Section 26 05 03 - Equipment Wiring Connections.
  - 2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
  - 3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
  - 4. Section 26 05 53 - Identification for Electrical Systems.
  - 5. Section 26 27 16 - Electrical Cabinets and Enclosures.
  - 6. Section 26 27 26 - Wiring Devices.
  - 7. Section 28 05 33 - Conduits and Backboxes for Electronic Safety and Security.
  - 8. Section 28 05 36 - Cable Trays for Electronic Safety and Security.

##### 1.2 REFERENCES

- A. American National Standards Institute:
  - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
  - 2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
  - 3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).
- B. National Electrical Manufacturers Association:
  - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
  - 2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
  - 3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

### 1.3 SYSTEM DESCRIPTION

- A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- B. Underground More than 5 feet outside Foundation Wall: Provide thickwall nonmetallic conduit. Provide cast metal boxes.
- C. Under Slab on Grade: Provide rigid steel conduit. Provide cast metal boxes.
- D. Outdoor Locations, Above Grade: Provide PVC coated rigid steel conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.
- E. Wet and Damp Locations: Provide rigid steel conduit. Provide cast metal outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.
- F. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
- G. Exposed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

### 1.4 DESIGN REQUIREMENTS

- A. Minimum Raceway Size: 3/4 inch above grade and once unless otherwise specified.

### 1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit for the following:
  1. Flexible metal conduit.
  2. Liquidtight flexible metal conduit.
  3. Nonmetallic conduit.

4. Flexible nonmetallic conduit.
5. Nonmetallic tubing.
6. Raceway fittings.
7. Conduit bodies.
8. Surface raceway.
9. Wireway.
10. Pull and junction boxes.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents:
  1. Record actual routing of conduits larger than 2 inches.
  2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- B. Protect PVC conduit from sunlight.

#### 1.8 COORDINATION

- A. Section 01 31 00 -- Project Management and Coordination.
- B. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.
- C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

### **PART 2: PRODUCTS**

#### 2.1 METAL CONDUIT

- A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices .
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co..
6. Substitutions: Section 01 25 00 – Substitution procedure.

- B. Rigid Steel Conduit: ANSI C80.1.
- C. Intermediate Metal Conduit (IMC): Rigid steel.
- D. Fittings and Conduit Bodies: NEMA FB 1.

## 2.2 PVC COATED METAL CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices .
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co..
6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 20 mil thick.

C. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

## 2.3 FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices .
3. Thomas & Betts Corp.
4. Walker Systems Inc.

5. The Wiremold Co..
6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: Interlocked steel construction.

C. Fittings: NEMA FB 1.

#### 2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices .
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co..
6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: Interlocked steel construction with PVC jacket.

C. Fittings: NEMA FB 1.

#### 2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices .
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co..
6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: NEMA FB 1; steel , compression type.

#### 2.6 NONMETALLIC CONDUIT

A. Manufacturers:



1. Allied Tube.
  2. Hubbell Wiring Devices .
  3. Thomas & Betts Corp.
  4. Walker Systems Inc.
  5. The Wiremold Co..
  6. Substitutions: Section 01 25 00 – Substitution procedure.
- B. Product Description: NEMA TC 2; Schedule 40 PVC.
- C. Fittings and Conduit Bodies: NEMA TC 3.

## 2.7 SURFACE METAL RACEWAY

- A. Manufacturers:
1. Hubbell Wiring Devices .
  2. Panduit Corp.
  3. Walker Systems Inc.
  4. The Wiremold Co..
  5. Substitutions: Section 01 25 00 – Substitution procedure.
- B. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
- C. Size: As noted on drawings.
- D. Finish: As noted on drawings.
- E. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway.

## 2.8 SURFACE NONMETAL RACEWAY

- A. Manufacturers:
1. Carlon Electrical Products.
  2. Hubbell Wiring Devices .
  3. Thomas & Betts Corp.
  4. Walker Systems Inc.

5. The Wiremold Co..
  6. Substitutions: Section 01 25 00 – Substitution procedure.
- B. Product Description: Plastic channel with fitted cover, suitable for use as surface raceway.
  - C. Size: As noted on drawings.
  - D. Finish: As noted on drawings.
  - E. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories, finish to match raceway.

## 2.9 WIREWAY

- A. Manufacturers:
  1. Carlon Electrical Products.
  2. Hubbell Wiring Devices .
  3. Thomas & Betts Corp.
  4. Walker Systems Inc.
  5. The Wiremold Co..
  6. Substitutions: Section 01 25 00 – Substitution procedure.
- B. Product Description: General purpose type wireway.
- C. Knockouts: Manufacturer's standard.
- D. Size: As indicated on Drawings.
- E. Cover: Screw cover.
- F. Connector: Slip-in.
- G. Fittings: Lay-in type with removable top, bottom, and side; captive screws.
- H. Finish: Rust inhibiting primer coating with gray enamel finish.

## 2.10 OUTLET BOXES

- A. Manufacturers:
  1. Carlon Electrical Products.
  2. Hubbell Wiring Devices .

3. Thomas & Betts Corp.
  4. Walker Systems Inc.
  5. The Wiremold Co..
  6. Substitutions: Section 01 25 00 – Substitution procedure.
- B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
  2. Concrete Ceiling Boxes: Concrete type.
- C. Nonmetallic Outlet Boxes: NEMA OS 2.
- D. Cast Boxes: NEMA FB 1, Type FD, cast ferrous alloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.
- E. Wall Plates for Finished Areas: As specified in Section 26 27 26.
- F. Wall Plates for Unfinished Areas: Furnish gasketed cover.

#### 2.11 PULL AND JUNCTION BOXES

- A. Manufacturers:
1. Carlon Electrical Products.
  2. Hubbell Wiring Devices .
  3. Thomas & Betts Corp.
  4. Walker Systems Inc.
  5. The Wiremold Co..
  6. Substitutions: Section 01 25 00 – Substitution procedure.
- B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- C. Hinged Enclosures: As specified in Section 26 27 16.
- D. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
1. Material: Cast aluminum.
  2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

**PART 3: EXECUTION**

**3.1 EXAMINATION**

- A. Section 01 31 00 – Project Management and Coordination.
- B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

**3.2 INSTALLATION**

- A. Ground and bond raceway and boxes in accordance with Section 26 05 26.
- B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.
- C. Identify raceway and boxes in accordance with Section 26 05 53.
- D. Arrange raceway and boxes to maintain headroom and present neat appearance.

**3.3 INSTALLATION - RACEWAY**

- A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
- B. Arrange raceway supports to prevent misalignment during wiring installation.
- C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.
- E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports
- F. Do not attach raceway to ceiling support wires or other piping systems.
- G. Construct wireway supports from steel channel specified in Section 26 05 29.
- H. Route exposed raceway parallel and perpendicular to walls.
- I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.
- J. Route conduit under slab from point-to-point.
- K. Maintain clearance between raceway and piping for maintenance purposes.

- L. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
- M. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- N. Bring conduit to shoulder of fittings; fasten securely.
- O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.
- P. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- Q. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch size.
- R. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
- S. Install fittings to accommodate expansion and deflection where raceway crosses seismic and expansion joints.
- T. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- U. Install suitable caps to protect installed conduit against entrance of dirt and moisture.
- V. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.
- W. Close ends and unused openings in wireway.

#### 3.4 INSTALLATION - BOXES

- A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.
- B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.
- C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

- F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.
- H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- I. Install stamped steel bridges to fasten flush mounting outlet box between studs.
- J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- K. Install adjustable steel channel fasteners for hung ceiling outlet box.
- L. Do not fasten boxes to ceiling support wires or other piping systems.
- M. Support boxes independently of conduit.
- N. Install gang box where more than one device is mounted together. Do not use sectional box.
- O. Install gang box with plaster ring for single device outlets.

### 3.5 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods described in other sections.
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.
- C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.
- D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

### 3.6 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused openings in boxes.

### 3.7 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

**END OF SECTION**

## SECTION 26 05 48

### SEISMIC CONTROLS FOR ELECTRICAL WORK

#### PART 1: GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. This Section includes seismic restraints and other earthquake-damage-reduction measures for electrical components. It complements optional seismic construction requirements in the various electrical component Sections.

##### 1.3 DEFINITIONS

- A. BOCA: BOCA National Building Code.
- B. SBC: Standard Building Code.
- C. UBC: Uniform Building Code.
- D. Seismic Restraint: A fixed device (a seismic brace, an anchor bolt or stud, or a fastening assembly) used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component during an earthquake.
- E. Mobile Structural Element: A part of the building structure such as a slab, floor structure, or wall that may move independent of other mobile structural elements during an earthquake.

##### 1.4 SUBMITTALS

- A. Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of seismic restraint component used.
  - 1. Anchor Bolts and Studs: Tabulate types and sizes, complete with report numbers and rated strength in tension and shear as evaluated by ICBO Evaluation Service.
- B. Shop Drawings: For anchorage and bracing not defined by details and charts in Drawings. Indicate materials, and show designs and calculations signed and sealed by a professional engineer.
  - 1. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.



2. Details: Detail fabrication and arrangement. Detail attachment of restraints to both structural and restrained items. Show attachment locations, methods, and spacings, identifying components and listing their strengths. Indicate direction and value of forces transmitted to the structure during seismic events.
  3. Preapproval and Evaluation Documentation: By ICBO Evaluation Service, showing maximum ratings of restraints and the basis for approval (tests or calculations).
  4. Coordination Drawings: Plans and sections drawn to scale and coordinating seismic bracing for electrical components with other systems and equipment, including other seismic restraints, in the vicinity.
- C. Product Certificates: Signed by manufacturers of seismic restraints certifying that products furnished comply with requirements.
  - D. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
  - E. Material Test Reports: From a qualified testing agency indicating and interpreting test results of seismic control devices for compliance with requirements indicated.

#### 1.5 QUALITY ASSURANCE

- A. Comply with seismic restraint requirements in California Building Code, unless requirements in this Section are more stringent.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing seismic engineering services, including the design of seismic restraints, that are similar to those indicated for this Project.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.

#### 1.6 PROJECT CONDITIONS

- A. Project Seismic Zone and Zone Factor as Defined in UBC: Zone 4, Zone Factor 0.40.
- B. Occupancy Category as Defined in UBC: IV.

#### 1.7 PROJECT CONDITIONS

- A. Project Seismic Hazard Exposure Group as Defined in BOCA or SBC: III.

## 1.8 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural system and architectural features, and with mechanical, fire-protection, electrical, and other building features in the vicinity.
- B. Coordinate concrete bases with building structural system.

## **PART 2: PRODUCTS**

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Amber/Booth Company, Inc.
  - 2. B-Line Systems, Inc.
  - 3. Erico, Inc.
  - 4. GS Metals Corp.
  - 5. Loos & Company, Inc.
  - 6. Mason Industries, Inc,
  - 7. Powerstrut.
  - 8. Thomas & Betts Corp.
  - 9. Unistrut Corporation.

### 2.2 MATERIALS

- A. Use the following materials for restraints:
  - 1. Indoor Dry Locations: Steel, zinc plated.
  - 2. Outdoors and Damp Locations: Galvanized steel.
  - 3. Corrosive Locations: Stainless steel.

### 2.3 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

- A. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to authorities having jurisdiction.

1. 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.
- B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type.
1. Concrete Inserts: Steel-channel type.
- C. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
- D. Welding Lugs: Comply with MSS SP-69, Type 57.
- E. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- F. 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.
- G. 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.

#### 2.4 SEISMIC BRACING COMPONENTS

- A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.
1. Materials for Channel: ASTM A 570, GR 33.
  2. Materials for Fittings and Accessories: ASTM A 575, ASTM A 576, or ASTM A 36.
  3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
  4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
- B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.
- C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
1. Arrange units for attachment to the braced component at one end and to the structure at the other end.

2. Wire Rope Cable: Comply with ASTM 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.
- D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

### **PART 3: EXECUTION**

#### **3.1 APPLICATION**

- A. Generator Sets: Comply with Division 15 Section "Mechanical Vibration Controls and Seismic Restraints."

#### **3.2 INSTALLATION**

- A. Install seismic restraints according to applicable codes and regulations and as approved by authorities having jurisdiction, unless more stringent requirements are indicated.

#### **3.3 STRUCTURAL ATTACHMENTS**

- A. Use bolted connections with steel brackets, slotted channel, and slotted-channel fittings to spread structural loads and reduce stresses.
- B. Attachments to New Concrete: Bolt to channel-type concrete inserts or use expansion anchors.
- C. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.
- D. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.
- E. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.
- F. Attachments to Wood Structural Members: Install bolts through members.
- G. Attachments to Steel: Bolt to clamps on flanges of beams or on upper truss chords of bar joists.

#### **3.4 ELECTRICAL EQUIPMENT ANCHORAGE**

- A. Anchor rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.
- B. Anchor panelboards, motor-control centers, motor controls, switchboards, switchgear, transformers, unit substations, fused power-circuit devices, transfer switches, busways, battery racks, static uninterruptible power units, power conditioners, capacitor units, communication system components, and electronic signal processing, control, and distribution units as follows:

1. Size concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base.
2. Concrete Bases for Floor-Mounted Equipment: Use female expansion anchors and install studs and nuts after equipment is positioned.
3. Bushings for Floor-Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or stud and mounting hole in concrete.
4. Anchor Bolt Bushing Assemblies for Wall-Mounted Equipment: Install to allow for resilient media where equipment or equipment-mounting channels are attached to wall.
5. Torque bolts and nuts on studs to values recommended by equipment manufacturer.

### 3.5 SEISMIC BRACING INSTALLATION

- A. Install bracing according to spacings and strengths indicated by approved analysis.
- B. Expansion and Contraction: Install to allow for thermal movement of braced components.
- C. Cable Braces: Install with maximum cable slack recommended by manufacturer.
- D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to the structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

### 3.6 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Make flexible connections in raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate at electrical equipment anchored to a different mobile structural element from the one supporting them.

### 3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform the following field quality-control testing:
- B. Testing Agency: Engage a qualified testing agency to perform the following field quality-control testing:
- C. Testing: Test pull-out resistance of seismic anchorage devices.
  1. Provide necessary test equipment required for reliable testing.

2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
3. Schedule test with Owner, through Engineer, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
4. Obtain Architect's approval before transmitting test loads to the structure. Provide temporary load-spreading members.
5. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
6. Test to 90 percent of rated proof load of device.
7. If a device fails the test, modify all installations of same type and retest until satisfactory results are achieved.
8. Record test results.

**END OF SECTION**

## SECTION 26 05 53

### IDENTIFICATION FOR ELECTRICAL SYSTEMS

#### PART 1: GENERAL

##### 1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Labels.
3. Wire markers.
4. Conduit markers.
5. Stencils.
6. Lockout Devices.

B. Related Sections:

1. Section 27 05 53 - Identification for Communications Systems.
2. Section 28 05 53 - Identification for Electronic Safety and Security.

##### 1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:

1. Submit manufacturer's catalog literature for each product required.
2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

##### 1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

#### 1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept identification products on site in original containers. Inspect for damage.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

#### 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Install products only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

#### 1.7 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for extra materials.

### **PART 2: PRODUCTS**

#### 2.1 NAMEPLATES

- A. Furnish materials in accordance with County standards.
- B. Product Description: Laminated three-layer plastic with engraved black letters on white background color.
- C. Letter Size:
  - 1. 1/8 inch high letters for identifying individual equipment and loads.
  - 2. 1/4 inch high letters for identifying grouped equipment and loads.
- D. Minimum nameplate thickness: 1/8 inch.

#### 2.2 LABELS

- A. Furnish materials in accordance with County standards.
- B. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background.



## 2.3 WIRE MARKERS

- A. Furnish materials in accordance with County standards.
- B. Description: Split sleeve type wire markers.
- C. Legend:
  - 1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
  - 2. Low voltage and Control Circuits: Wire number as indicated on shop drawings.

## 2.4 CONDUIT AND RACEWAY MARKERS

- A. Furnish materials in accordance County standards.
- B. Description: Labels fastened with adhesive black lettering on white background.
- C. Legend:
  - 1. 480 Volt System: 480 VOLTS.
  - 2. 208 Volt System: 208 VOLTS.

## 2.5 STENCILS

- A. Furnish materials in accordance with County standards.
- B. Stencils: With clean cut symbols and letters of following size:
  - 1. Up to 2 inches Outside Diameter of Raceway: 1/2 inch high letters.
  - 2. 2-1/2 to 6 inches Outside Diameter of Raceway: 1 inch high letters.

## 2.6 LOCKOUT DEVICES

- A. Lockout Hasps:
  - 1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

## **PART 3: EXECUTION**

### 3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance for stencil painting.

### 3.2 INSTALLATION

- A. Install identifying devices after completion of painting.
- B. Nameplate Installation:
  - 1. Install nameplate parallel to equipment lines.
  - 2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
  - 3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
  - 4. Secure nameplate to equipment front using adhesive.
  - 5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
  - 6. Install nameplates for the following:
    - a. Switchboards.
    - b. Panelboards.
    - c. Transformers.
    - d. Service Disconnects.
- C. Label Installation:
  - 1. Install label parallel to equipment lines.
  - 2. Install label for identification of individual control device stations.
  - 3. Install labels for permanent adhesion and seal with clear lacquer.
- D. Wire Marker Installation:
  - 1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes and each load connection.
- E. Stencil Installation:
  - 1. Apply stencil painting in accordance with Industry standards.
- F. Underground Warning Tape Installation:

1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

**END OF SECTION**

## SECTION 26 05 72

### ACCEPTANCE TESTING

#### PART 1: GENERAL

##### 1.1 SCOPE OF WORK

It is the intent of these acceptance tests to assure that all Contractor supplied equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with designed specifications.

- A. The acceptance tests and inspections shall determine suitability for energization of switchgear and cables.
- B. Items that shall be checked, inspected, and tested include, but are not limited to, the following:
  - 1. Relays.
  - 2. Power/Lighting panel boards.
  - 3. 600V rated cable.
  - 4. Fire alarm system.

##### 1.2 APPLICABLE CODES

- A. All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.
  - 1. California Electrical Code - CEC 2010 Edition.
  - 2. National Electrical Manufacturer's Association - NEMA.
  - 3. American Society for Testing and Materials - ASTM.
  - 4. Institute of Electrical and Electronic Engineers - IEEE.
  - 5. National Electrical Testing Association - NET A.
  - 6. American National Standards Institute - ANSI:
    - a. C2, National Electrical Safety Code
    - b. Z244-1, American National Standard for Personnel Protection
  - 7. State Codes and Ordinances.
  - 8. Insulated Cable Engineers Association - ICEA.
  - 9. Association of Edison Illuminating Companies - AEIC.

10. Occupational Safety and Health Administration:
  - a. Part 1910, Subpart S, 1910.30S
  - b. Part 1926, Subpart V, 1926.950 through 1926.960
11. National Fire Protection Association - NFPA:
  - a. ANSI/CECB, Electrical Equipment Maintenance
  - b. CECE, Electrical Safety Requirements for Employee Workplaces
  - c. ANSI/CEC, National Electrical Code 2002 Edition
  - d. ANSI/NFPA 7S, Lightning Protection Code
  - e. ANSI/NFPA 101, Life Safety Code
12. All inspections and tests shall utilize the following references:
  - a. Project Design Specification.
  - b. Project Design Drawings.
  - c. Manufacturer's instruction manuals applicable to each particular apparatus.

### 1.3 QUALIFICATIONS OF TESTING AGENCY

- A. The testing firm shall be an independent testing organization, which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.
- B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
- C. The testing firm and all the testing personnel shall have been engaged in such practices for a minimum of ten years.
- D. The testing firm shall meet federal OSHA criteria for accreditation of testing laboratories, Title 29, Parts 1907, 1910, and 1936. Full membership in the National Electrical Testing Association constitutes proof of such criteria.
- E. The lead, on site, technical person shall be currently certified by the National Electrical Testing Associate (NETA) in Electrical Power Distribution System Testing.
- F. Testing firm shall utilize only full-time technicians who are regularly employed by the firm for testing services. Electrically unskilled employees are not permitted to perform testing or assistance of any kind. Electricians may assist, but may not perform testing and/or inspection services.

- G. The testing firm shall submit proof of the above qualifications.
- H. The testing firm shall be an independent organization as defined by OSHA Title 29, Part 1936 and the National Electrical Testing Association.
- I. All instruments used by the testing firm to evaluate electrical performance shall meet NETA's Specifications for Test Instruments. (See Section 1.7 of this specification).
- J. The terms used herewith such as Test Agency, Testing Laboratory, or Contractor Test Company, shall be construed to mean testing firm.

#### 1.4 RESPONSIBILITIES

- A. The Contractor shall notify the Owners Representative prior to commencement of any testing.
- B. Any system, material or workmanship, which is found defective on the basis of acceptance tests, shall be reported.
- C. The testing firm shall maintain a written record of all tests and upon completion of project, assemble and certify a final test report.
- D. A stable source of 60 hertz power shall be provided for testing purposes by the Contractor. Owners Representative shall witness all tests and a minimum of 14 days notice shall be provided.

#### 1.5 TEST EQUIPMENT

- A. Test Instrument Calibration
  - 1. The testing firm shall have a calibration program that assures that all applicable test instrumentation is maintained within rated accuracy.
  - 2. The accuracy shall be directly traceable to the National Bureau of Standards.
  - 3. Instruments shall be calibrated in accordance with the following frequency schedule:
    - a. Field instruments: Analog - 6 months maximum  
Digital - 12 months maximum
    - b. Laboratory Instruments - 2 months
    - c. Leased specialty equipment - 12 months (where accuracy is guaranteed by lessor)
  - 4. Dated calibration labels shall be visible on all test equipment.
  - 5. Records must be kept up-to-date which show date and results of instruments calibrated or tested.

6. An up-to-date instrument calibration instruction and procedure will be maintained for each test instrument.
7. Calibrating standard shall be of higher accuracy than that of the instrument tested.

#### 1.6 TEST REPORTS

- A. The test report shall include the following:
  1. Summary of project.
  2. Description of equipment/device tested.
  3. Description of test, including date, time, and duration of test.
  4. Test results.
  5. Conclusions and recommendations.
  6. Appendix, including appropriate test forms.
  7. Identification of test equipment used.
  8. Signature of responsible test organization authority.
  9. Signature of the person witnessing the tests.
  10. Furnish five copies of the complete report to the Owners Representative no later than thirty (30) days after completion of project unless otherwise directed.

#### 1.7 SAFETY AND PRECAUTIONS

- A. Safety practices shall include, but are not limited to, the following requirements:
  1. Occupational Safety and Health Act of 1970 - OSHA.
  2. Accident Prevention Manual for Industrial Operations, National Safety Council, Chapter 4.
  3. Applicable State safety operating procedures.
  4. NETA Safety/Accident Prevention Program.
  5. District's safety practices.
  6. National Fire Protection Association - CECE.
  7. ANSI Z244.1 American National Standards for Personnel Protection.

- B. All tests shall be performed with apparatus de-energized except where otherwise specifically required.
- C. The testing firm shall have a designated safety representative on the project to supervise operations with respect to safety.

**PART 2: PRODUCTS – NOT USED**

**PART 3: EXECUTION**

**3.1 EQUIPMENT VERIFICATIONS, TESTS AND CALIBRATIONS GENERAL**

- A. As part of the contract, the Contractor shall perform tests of installed work as herein specified and specified in other Sections of these Specifications.
- B. The Contractor shall provide all materials, equipment, labor and technical supervision to perform such tests and inspections.
- C. All tests shall be performed in compliance with the recommendations and requirements of the National Electrical Testing Association, Inc. (NETA), and applicable codes and standards.
- D. Upon completion of the tests and inspections noted in these Specifications, a label shall be attached to all serviced devices. These labels shall indicate date serviced and the service company responsible.
- E. The test and inspections shall determine suitability for continued reliable operation.
- F. All tests shall be conducted in the presence of the Owners Representative. Provide a minimum of two weeks notice to the Owners Representative.
- G. Furnish the necessary equipment and personnel to perform all required tests of all wiring and connections for continuity, short circuit, and improper grounds. Included, but not limited to, the following systems: substations, air interrupting switches, low voltage main and feeder circuit breakers, interlocking controls, panelboards, distribution transformers, branch circuits.

**3.2 BATTERY SYSTEM**

- A. Visual and mechanical inspection:
  - 1. Inspect for physical damage, anchorage, electrolyte leakage and level.
  - 2. Check intercell bus link and cable connection integrity for tightness and corrosion.
- B. Electrical tests:
  - 1. Measure system charging voltage and each individual cell voltage.
  - 2. Measure electrolyte specific gravity.



3. Perform infrared scan of the intracell links cable connections under current discharge conditions.

### 3.3 LOW VOLTAGE CIRCUIT BREAKERS

#### A. Visual and mechanical inspection:

1. Inspect for physical condition.
2. Inspect alignment and grounding.
3. Perform mechanical operator and contact alignment tests on the breaker and its operating mechanism in accordance with manufacturer's instructions.
4. Perform insulation resistance test on control wiring.
5. Clean mechanism, insulating surfaces and contacts.

#### B. Electrical tests:

1. Measure contact resistance.
2. Trip overcurrent protective device by operation of each protective device.
3. Perform an insulation resistance test phase-to-ground, phase-to-phase and across open contacts.
4. Perform insulation resistance test in accordance with Doble procedure.
5. Perform timing test with Travel Analyzer to insure proper contact overtravel and pressure.

### 3.4 CABLES, LOW VOLTAGE (600 VOLTS AND LESS)

#### A. Visual and mechanical inspections:

1. Inspect cables for physical damage and proper connection.
2. Torque test cable connection. Tighten connections in accordance with industry standards.
3. Perform infrared scan of all connections under loaded conditions.

#### B. Electrical tests: Perform insulation resistance test of each cable with respect to ground and adjacent cables.

### 3.5 GROUNDING SYSTEMS

#### A. Visual and mechanical inspection: Inspect ground system connections for completeness and adequacy.

- B. Electrical tests: Perform fall-of-the-potential test per IEEE No. 81, Section 9.03 to determine the ground resistance between the main grounding system and all major electrical equipment frames, system neutral and/or *derived* neutral points.

### 3.6 FIRE ALARM SYSTEM

- A. Refer to Section 28 31 00 for systems testing and certification requirements.

**END OF SECTION**

## SECTION 26 27 16

### ELECTRICAL CABINETS AND ENCLOSURES

#### **PART 1: GENERAL**

##### 1.1 SUMMARY

- A. Section Includes:
  - 1. Hinged cover enclosures.
  - 2. Cabinets.
  - 3. Terminal blocks.
  - 4. Accessories.
- B. Related Requirements:
  - 1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
  - 2. Section 26 05 29 - Hangers and Supports for Electrical Systems.
  - 3. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
  - 4. Section 27 05 33 - Conduits and Backboxes for Communications Systems.
  - 5. Section 28 05 33 - Conduits and Backboxes for Electronic Safety and Security.

##### 1.2 REFERENCE STANDARDS

- A. National Electrical Manufacturers Association:
  - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
  - 2. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.

##### 1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit manufacturer's standard data for enclosures, cabinets, and terminal blocks.
- C. Manufacturer's Instructions: Submit application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance materials.
- B. Extra Stock Materials:
  - 1. Furnish two of each key.

#### 1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

### **PART 2: PRODUCTS**

#### 2.1 HINGED COVER ENCLOSURES

- A. Manufacturers:
  - 1. Cooper B-Line.
  - 2. Hammond Stahlin.
  - 3. Hoffman Engineering Company
  - 4. Hubbell Wiring Devices
  - 5. Reliance Electric
  - 6. Substitutions: Section 01 25 00 – Substitution procedure.
- B. Description: NEMA 250, Type 1 or 3R galvanized steel enclosure.
  - 1. Covers: Continuous hinge, held closed by flush latch operable by key.
  - 2. Furnish interior plywood panel for mounting terminal blocks and electrical components; finish with white enamel.
  - 3. Enclosure Finish: Manufacturer's standard enamel.

#### 2.2 CABINETS

- A. Manufacturers:
  - 1. Cooper B-Line.
  - 2. Hammond Stahlin.
  - 3. Hoffman Engineering Company
  - 4. Hubbell Wiring Devices

5. Reliance Electric
6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Description:

1. Boxes: Galvanized steel.
2. Box Size: 24 inches wide x 30 inches high x 6 inches deep.
3. Backboard: Furnish 3/4 inch thick plywood backboard for mounting terminal blocks. Paint matte white.
4. Fronts: Steel, flush or surface type with door with concealed hinge, and flush lock.
5. Knockouts: None.

C. Fabrication

1. Furnish metal barriers to form separate compartments wiring of different systems and voltages.
2. Furnish accessory feet for free-standing equipment.

D. Finishes:

1. Finish with gray baked enamel.

## 2.3 TERMINAL BLOCKS

A. Manufacturer List:

1. Entrelec Inc.
2. Phoenix Contact.
3. Weidmuller.
4. Substitutions: Section 01 25 00 – Substitution procedure.

B. Description:

1. Terminal Blocks: NEMA ICS 4.
2. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
3. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.

4. Furnish ground bus terminal block, with each connector bonded to enclosure.

**PART 3: EXECUTION**

**3.1 INSTALLATION**

- A. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner in accordance with Section 26 05 29.
- B. Install cabinet fronts plumb.

**3.2 CLEANING**

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
- B. Clean electrical parts to remove conductive and harmful materials.
- C. Remove dirt and debris from enclosure.
- D. Clean finishes and touch up damage.

**END OF SECTION**

## SECTION 26 27 26

### WIRING DEVICES

#### **PART 1: GENERAL**

##### 1.1 SUMMARY

- A. Section includes wall receptacles; and device plates and decorative box covers.
- B. Related Sections:
  - 1. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.

##### 1.2 REFERENCES

- A. National Electrical Manufacturers Association:
  - 1. NEMA WD 1 - General Requirements for Wiring Devices.
  - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

##### 1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Samples: Submit two samples of each wiring device and wall plate illustrating materials, construction, color, and finish.

##### 1.4 QUALIFICATIONS

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

##### 1.5 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish 20 of each style, size, and finish wall plate.

#### **PART 2: PRODUCTS**

##### 2.1 RECEPTACLES

- A. Manufacturers:

1. Cooper Wiring Devices.
  2. Hubbell, Inc.
  3. Leviton Manufacturing Company.
  4. Pass and Seymour.
  5. Substitutions: Section 01 60 00 - Product Requirements.
- B. Product Description: NEMA WD 1, Heavy-duty general use receptacle.
- C. Device Body: Ivory plastic.
- D. Configuration: NEMA WD 6, type as indicated on Drawings.
- E. Convenience Receptacle: Type 5-20.
- F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

## 2.2 WALL PLATES

- A. Manufacturers:
1. Cooper Wiring Devices.
  2. Hubbell, Inc.
  3. Leviton Manufacturing Company.
  4. Pass and Seymour.
  5. Substitutions: Section 01 60 00 - Product Requirements.
- B. Cover Plate: 0.035 inch thick satin-finished.
- C. Jumbo Cover Plate: 0.035 inch thick satin-finished.
- D. Weatherproof Cover Plate: Gasketed cast galvanized metal plate with threaded and gasketed device cover.

## PART 3: EXECUTION

### 3.1 EXAMINATION

- A. Section 01 31 00 – Project Management and Coordination.
- B. Verify outlet boxes are installed at proper height.
- C. Verify wall openings are neatly cut and completely covered by wall plates.



- D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

### 3.2 PREPARATION

- A. Clean debris from outlet boxes.

### 3.3 EXISTING WORK

- A. Disconnect and remove abandoned wiring devices.
- B. Modify installation to maintain access to existing wiring devices to remain active.
- C. Clean and repair existing wiring devices to remain or to be reinstalled.

### 3.4 INSTALLATION

- A. Install devices plumb and level.
- B. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- C. Do not share neutral conductor on load side of dimmers.
- D. Install receptacles with grounding pole on top.
- E. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.
- F. Install wall plates on flush mounted switches, receptacles, and blank outlets.
- G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- H. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.
- I. Use jumbo size plates for outlets installed in masonry walls.
- J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

### 3.5 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights as specified or as indicated on drawings.
- B. Install wall switch 48 inches above finished floor.

- C. Install convenience receptacle 18 inches above finished floor.
- D. Install convenience receptacle 6 inches above counter or centered in back splash of counter.
- E. Install top of dimmer 48 inches above finished floor.

### 3.6 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements, 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect each wiring device for defects.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify each receptacle device is energized.
- E. Test each receptacle device for proper polarity.

### 3.7 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust devices and wall plates to be flush and level.

### 3.8 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
- B. Clean exposed surfaces to remove splatters and restore finish.

**END OF SECTION**

## SECTION 27 13 43

### COMMUNICATIONS SERVICES CABLING

#### PART 1: GENERAL

##### 1.1 SUMMARY

- A. Section includes termination devices, outlets, and premises wiring.
- B. Related Sections:
  - 1. Section 26 27 26 - Wiring Devices: Wall plates.

##### 1.2 REFERENCES

- A. International Electrical Testing Association:
  - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Fire Protection Association:
  - 1. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
- C. Telecommunications Industry Association/Electronic Industries Alliance:
  - 1. TIA/EIA 568 - Commercial Building Telecommunications Cabling Standard.
  - 2. TIA/EIA 569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
- D. Underwriters Laboratories, Inc.:
  - 1. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and their Accessories Installed in Air-Handling Spaces.

##### 1.3 SYSTEM DESCRIPTION

- A. Horizontal Pathway: Conform to TIA/EIA 569, using raceway, backboards, and cabinets as indicated on Drawings.
- B. Horizontal Wiring: By Owner. Complete from telecommunications closet to each outlet using shielded horizontal cables.

##### 1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

- B. Product Data: Submit catalog data for each termination device, cable, and outlet device.
- C. Test Reports: Indicate procedures and results for specified field testing and inspection.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations and sizes of pathways and outlets.

#### 1.6 QUALITY ASSURANCE

- A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.
- B. Provide combustible electrical equipment exposed within plenums with peak rate of heat release not greater than 100 kW, peak optical density not greater than 0.5, and average optical density not greater than 0.15 when tested in accordance with UL 2043.
- C. Perform Work in accordance with County standard.
- D. Maintain one copy of each document on site.

#### 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in installing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of project.
- C. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.

#### 1.8 PRE-INSTALLATION MEETINGS

- A. Section 01 31 00 – Project Management and Coordination.
- B. Convene minimum one week prior to commencing work of this section.

## 1.9 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two telephone outlet jacks.

## 1.10 COORDINATION

- A. Coordination with Utility and Owner for additional dedicated telephone lines required for the fire alarm system.
- B. Utility charges for service installation paid by Owner and are not part of this contract.

## **PART 2: PRODUCTS**

### 2.1 TELEPHONE OUTLET JACKS

- A. Product Description: Conform to TIA/EIA 568 requirements for cable connectors for specific cable types.

### 2.2 SHIELDED HORIZONTAL CABLE

- A. Product Description: TIA/EIA 568, 100-ohm, unshielded twisted pair CAT 6 plenum rated noncombustible cable with 24 AWG copper conductor.

## **PART 3: EXECUTION**

### 3.1 EXISTING WORK

- A. Remove exposed abandoned telecommunications cables and pathways, including abandoned cables and pathways above accessible ceiling finishes. Cut flush with walls and floors, and patch surfaces.
- B. Maintain access to existing telecommunications equipment, cabling, and terminations and other installations remaining active and requiring access. Modify installation or provide access panel.
- C. Extend existing telecommunications installations using materials and methods compatible with existing installations, or as specified.
- D. Clean and repair existing telecommunications equipment remaining or is to be reinstalled.

### 3.2 INSTALLATION

- A. Install pathways in accordance with TIA/EIA 569.
- B. Install wire and cable in accordance with TIA/EIA 568.

- C. Install termination cabinets plumb, and attach securely to building wall at each corner. Install cabinet trim plumb.
- D. Install pull wire in each empty telephone conduit over 10 feet in length or containing bends.
- E. Ground and bond pathways, cable shields, and equipment.

### 3.3 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test optical fiber cables in accordance with NETA ATS, except Section 4. Perform inspections and tests listed in NETA ATS, Section 7.25.
- C. Inspect and test copper cables and terminations in accordance with TIA/EIA 568.

**END OF SECTION**

## SECTION 28 05 29

### HANGERS AND SUPPORTS FOR ELECTRONIC SAFETY AND SECURITY

#### PART 1: GENERAL

##### 1.1 SUMMARY

###### A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Firestopping accessories.
8. Equipment bases and supports.

###### B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Section 26 05 29 - Hangers and Supports for Electrical Systems.

##### 1.2 REFERENCES

###### A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

###### B. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
- C. National Fire Protection Association:
  1. NFPA 70 - National Electrical Code.
- D. Underwriters Laboratories Inc.:
  1. UL 263 - Fire Tests of Building Construction and Materials.
  2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
  3. UL 1479 - Fire Tests of Through-Penetration Firestops.
  4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
  5. UL - Fire Resistance Directory.
- E. Intertek Testing Services (Warnock Hersey Listed):
  1. WH - Certification Listings.

### 1.3 DEFINITIONS

- A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

### 1.4 SYSTEM DESCRIPTION

- A. Firestopping Materials: ASTM E814 UL 263 UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.
  1. Ratings may be 3-hours for firestopping in through-penetrations of 4-hour fire rated assemblies unless otherwise required by applicable codes.
- B. Firestop interruptions to fire rated assemblies, materials, and components.

### 1.5 PERFORMANCE REQUIREMENTS

- A. Firestopping: Conform to applicable code FM UL WH for fire resistance ratings and surface burning characteristics.
- B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.



## 1.6 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- C. Product Data:
  - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
  - 2. Firestopping: Submit data on product characteristics, performance and limitation criteria.
- D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.
- F. Manufacturer's Installation Instructions:
  - 1. Hangers and Supports: Submit special procedures and assembly of components.
  - 2. Firestopping: Submit preparation and installation instructions.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- H. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

## 1.7 QUALITY ASSURANCE

- A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
  - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
  - 2. Floor [and Roof] Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
    - a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

- B. Through Penetration Firestopping of Non-Fire Rated Floor [and Roof] Assemblies: Materials to resist free passage of flame and products of combustion.
  - 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
  - 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Perform Work in accordance with County standard.
- G. Maintain one copy copies of each document on site.

#### 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum years documented experience approved by manufacturer.

#### 1.9 PRE-INSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing work of this section.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

#### 1.11 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

- B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.
- C. Provide ventilation in areas to receive solvent cured materials.

**PART 2: PRODUCTS**

**2.1 CONDUIT SUPPORTS**

- A. Manufacturers:
  - 1. Allied Tube & Conduit Corp.
  - 2. Electroline Manufacturing Company.
  - 3. O-Z Gedney Co.
  - 4. Substitutions: Section 01 25 00 – Substitution Procedures.
- B. Furnish materials in accordance with County standards.
- C. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- D. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
- E. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- F. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.
- G. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

**2.2 FORMED STEEL CHANNEL**

- A. Manufacturers:
  - 1. Allied Tube & Conduit Corp.
  - 2. B-Line Systems.
  - 3. Midland Ross Corporation, Electrical Products Division.
  - 4. Unistrut Corp.
  - 5. Substitutions: Section 01 25 00 – Substitution Procedures.
- B. Furnish materials in accordance with County standards.

- C. Product Description: Galvanized 12 gage) thick steel. With holes 1-1/2 inches on center.

### 2.3 SPRING STEEL CLIPS

- A. Furnish materials in accordance with County standards.
- B. Product Description: Mounting hole and screw closure.

### 2.4 SLEEVES

- A. Furnish materials in accordance with County standards.
- B. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- C. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- D. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.
- E. Fire-stopping Insulation: Glass fiber type, non-combustible.

### 2.5 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
  - 1. Thunderline Link-Seal, Inc.
  - 2. NMP Corporation.
  - 3. Substitutions: Section 01 25 00 – Substitution Procedure.
- B. Furnish materials in accordance with County standards.
- C. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

### 2.6 FIRESTOPPING

- A. Manufacturers:
  - 1. Dow Corning Corp.
  - 2. Fire Trak Corp.
  - 3. Hilti Corp.

4. International Protective Coating Corp.
  5. 3M fire Protection Products.
  6. Specified Technology, Inc.
  7. Substitutions: Not Permitted.
- B. Furnish materials in accordance with County standards.
- C. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
  2. Foam Firestopping Compounds: Single component foam compound.
  3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
  4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
  5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
  6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
  7. Firestop Pillows: Formed mineral fiber pillows.
- D. Color: Dark gray As selected from manufacturer's full range of colors.

## 2.7 FIRESTOPPING ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Dam Material: Permanent:
1. Mineral fiberboard.
  2. Mineral fiber matting.
  3. Sheet metal.

4. Plywood or particle board.
  5. Alumina silicate fire board.
- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- D. General:
1. Furnish UL listed products or products tested by independent testing laboratory.
  2. Select products with rating not less than rating of wall or floor being penetrated.
- E. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
  2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

### **PART 3: EXECUTION**

#### **3.1 EXAMINATION**

- A. Section 01 31 00 – Project Management and Coordination: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive firestopping.

#### **3.2 PREPARATION**

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Install backing damming materials to arrest liquid material leakage.
- D. Obtain permission from Engineer before using powder-actuated anchors.
- E. Obtain permission from Engineer before drilling or cutting structural members.

### 3.3 INSTALLATION - HANGERS AND SUPPORTS

#### A. Anchors and Fasteners:

1. Concrete Structural Elements: Provide expansion anchors.
2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
3. Concrete Surfaces: Provide expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
6. Sheet Metal: Provide sheet metal screws.
7. Wood Elements: Provide wood screws.

#### B. Inserts:

1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above flush with top of recessed into and grouted flush with slab.

#### C. Install conduit and raceway support and spacing in accordance with NEC.

#### D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

#### E. Install multiple conduit runs on common hangers.

#### F. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.

2. Install surface mounted cabinets and panelboards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
4. Support vertical conduit at every floor.

#### 3.4 INSTALLATION - FIRESTOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.
- B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.
- D. Compress fibered material to maximum 40 percent of its uncompressed size.
- E. Place intumescent coating in sufficient coats to achieve rating required.
- F. Remove dam material after firestopping material has cured.
- G. Fire Rated Surface:
  1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
    - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
    - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
    - c. Pack void with backing material.
    - d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
  2. Where conduit penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.
- H. Non-Rated Surfaces:
  1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:



- a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
  - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
  - c. Install type of firestopping material recommended by manufacturer.
- 2. Install escutcheons floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
  - 3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
  - 4. Interior partitions: Seal pipe penetrations at clean rooms, computer rooms, telecommunication rooms and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

### 3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

### 3.6 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with adjustable interlocking rubber links.
- B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
- C. Set sleeves in position in forms. Provide reinforcing around sleeves.
- D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- G. Install chrome plated steel escutcheons at finished surfaces.

3.7 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.8 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

**END OF SECTION**

## SECTION 28 05 33

### CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY

#### PART 1: GENERAL

##### 1.1 SUMMARY

- A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.
- B. Related Sections:
  - 1. Section 26 05 03 - Equipment Wiring Connections.
  - 2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
  - 3. Section 26 27 16 - Electrical Cabinets and Enclosures.
  - 4. Section 26 27 26 - Wiring Devices.
  - 5. Section 28 05 29 - Hangers and Supports for Electronic Safety and Security.
  - 6. Section 28 05 53 - Identification for Electronic Safety and Security.

##### 1.2 REFERENCES

- A. American National Standards Institute:
  - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
  - 2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
  - 3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).
- B. National Electrical Manufacturers Association:
  - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
  - 2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
  - 3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
  - 4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

### 1.3 SYSTEM DESCRIPTION

- A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- B. Wet and Damp Locations: Provide rigid steel and aluminum conduit. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.
- C. Concealed Dry Locations: Provide rigid steel and aluminum conduit, intermediate metal conduit and electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
- D. Exposed Dry Locations: Provide rigid steel and aluminum conduit, intermediate metal conduit. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

### 1.4 DESIGN REQUIREMENTS

- A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

### 1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit for the following:
  1. Flexible metal conduit.
  2. Liquidtight flexible metal conduit.
  3. Raceway fittings.
  4. Conduit bodies.
  5. Pull and junction boxes.
- C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory

Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents:
  - 1. Record actual routing of conduits larger than 2 inch.
  - 2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- B. Protect PVC conduit from sunlight.

#### 1.8 COORDINATION

- A. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.
- B. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

### **PART 2: PRODUCTS**

#### 2.1 METAL CONDUIT

- A. Manufacturers:
  - 1. Carlon Electrical Products.
  - 2. Hubbell Wiring Devices.
  - 3. Thomas & Betts Corp.
  - 4. Walker Systems Inc.
  - 5. The Wiremold Co.
  - 6. Substitutions: Section 01 25 00 – Substitution Procedures.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Rigid Aluminum Conduit: ANSI C80.5.

- D. Intermediate Metal Conduit (IMC): Rigid steel.
- E. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

## 2.2 FLEXIBLE METAL CONDUIT

- A. Manufacturers:
  - 1. Carlon Electrical Products.
  - 2. Hubbell Wiring Devices.
  - 3. Thomas & Betts Corp.
  - 4. Walker Systems Inc.
  - 5. The Wiremold Co.
  - 6. Substitutions: Section 01 25 00 – Substitution Procedures.
- B. Product Description: Interlocked steel construction.
- C. Fittings: NEMA FB 1.

## 2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Manufacturers:
  - 1. Carlon Electrical Products.
  - 2. Hubbell Wiring Devices.
  - 3. Thomas & Betts Corp.
  - 4. Walker Systems Inc.
  - 5. The Wiremold Co.
  - 6. Substitutions: Section 01 25 00 – Substitution Procedures.
- B. Product Description: Interlocked steel construction with PVC jacket.
- C. Fittings: NEMA FB 1.

## 2.4 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
  - 1. Carlon Electrical Products.

2. Hubbell Wiring Devices.
  3. Thomas & Betts Corp.
  4. Walker Systems Inc.
  5. The Wiremold Co.
  6. Substitutions: Section 01 25 00 – Substitution Procedures.
- B. Product Description: ANSI C80.3; galvanized tubing.
- C. Fittings and Conduit Bodies: NEMA FB 1; steel compression type.

## 2.5 OUTLET BOXES

- A. Manufacturers:
1. Carlon Electrical Products.
  2. Hubbell Wiring Devices.
  3. Thomas & Betts Corp.
  4. Walker Systems Inc.
  5. The Wiremold Co.
  6. Substitutions: Section 01 25 00 – Substitution Procedure.
- B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
  2. Concrete Ceiling Boxes: Concrete type.
- C. Nonmetallic Outlet Boxes: NEMA OS 2.
- D. Cast Boxes: NEMA FB 1, Type FD, aluminum. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.
- E. Wall Plates for Finished Areas: As specified in Section 26 27 26.
- F. Wall Plates for Unfinished Areas: Furnish gasketed cover.

## 2.6 PULL AND JUNCTION BOXES

- A. Manufacturers:

1. Carlon Electrical Products.
  2. Hubbell Wiring Devices.
  3. Thomas & Betts Corp.
  4. Walker Systems Inc.
  5. The Wiremold Co.
  6. Substitutions: Section 01 25 00 – Substitution Procedure.
- B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- C. Hinged Enclosures: As specified in Section 26 27 16.
- D. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
1. Material: Galvanized cast iron or Cast aluminum.
  2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

**PART 3: EXECUTION**

**3.1 EXAMINATION**

- A. Section 01 31 00 – Project Management and Coordination.
- B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

**3.2 EXISTING WORK**

- A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.
- B. Remove concealed abandoned raceway to its source.
- C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.
- D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.



- E. Extend existing raceway and box installations using materials and methods compatible with existing electrical installations, or as specified.
- F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

### 3.3 INSTALLATION

- A. Install Work in accordance with County standards.
- B. Ground and bond raceway and boxes in accordance with Section 26 05 26.
- C. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.
- D. Identify raceway and boxes in accordance with Section 26 05 53.
- E. Arrange raceway and boxes to maintain headroom and present neat appearance.

### 3.4 INSTALLATION - RACEWAY

- A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
- B. Arrange raceway supports to prevent misalignment during wiring installation.
- C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29 ; provide space on each for 25 percent additional raceways.
- E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports
- F. Do not attach raceway to ceiling support wires or other piping systems.
- G. Construct wireway supports from steel channel specified in Section 26 05 29.
- H. Route exposed raceway parallel and perpendicular to walls.
- I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.
- J. Route conduit in and under slab from point-to-point.
- K. Maintain clearance between raceway and piping for maintenance purposes.

- L. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
- M. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- N. Bring conduit to shoulder of fittings; fasten securely.
- O. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- P. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2 inch size.
- Q. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
- R. Install fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints.
- S. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- T. Install suitable caps to protect installed conduit against entrance of dirt and moisture.
- U. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.
- V. Close ends and unused openings in wireway.

### 3.5 INSTALLATION - BOXES

- A. Install wall mounted boxes at elevations to accommodate mounting heights specified in section for outlet device.
- B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.
- C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

- F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.
- H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- I. Install stamped steel bridges to fasten flush mounting outlet box between studs.
- J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- K. Install adjustable steel channel fasteners for hung ceiling outlet box.
- L. Do not fasten boxes to ceiling support wires or other piping systems.
- M. Support boxes independently of conduit.
- N. Install gang box where more than one device is mounted together. Do not use sectional box.
- O. Install gang box with plaster ring for single device outlets.

### 3.6 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 26 05 29.
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.
- C. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

### 3.7 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused openings in boxes.

### 3.8 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

**END OF SECTION**

## SECTION 28 05 53

### IDENTIFICATION FOR ELECTRONIC SAFETY AND SECURITY

#### PART 1: GENERAL

##### 1.1 SUMMARY

###### A. Section Includes:

1. Nameplates.
2. Labels.
3. Wire markers.
4. Conduit markers.
5. Stencils.
6. Lockout Devices.

###### B. Related Sections:

1. Section 26 05 53 - Identification for Electrical Systems.
2. Section 27 05 53 - Identification for Communications Systems.

##### 1.2 SUBMITTALS

###### A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

###### B. Product Data:

1. Submit manufacturer's catalog literature for each product required.
2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

###### C. Samples:

1. Submit two tags, actual size.
2. Submit two labels, actual size.

###### D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

### 1.3 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

### 1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with County standard.

### 1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept identification products on site in original containers. Inspect for damage.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

### 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Install labels or nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

### 1.8 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for extra materials.
- B. Furnish two containers of spray-on adhesive.

## **PART 2: PRODUCTS**

### 2.1 NAMEPLATES

- A. Furnish materials in accordance County standards.

- B. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.
- C. Letter Size:
  - 1. 1/8 inch high letters for identifying individual equipment and loads.
  - 2. 1/4 inch high letters for identifying grouped equipment and loads.
- D. Minimum nameplate thickness: 1/8 inch.

## 2.2 LABELS

- A. Furnish materials in accordance with County standards.
- B. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background.

## 2.3 WIRE MARKERS

- A. Furnish materials in accordance with County standards.
- B. Description: Cloth tape, split sleeve, or tubing type wire markers.
- C. Legend:
  - 1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
  - 2. Control Circuits: Control wire number as indicated on [schematic and interconnection diagrams. shop drawings.

## 2.4 CONDUIT AND RACEWAY MARKERS

- A. Furnish materials in accordance with County standards.
- B. Description: Nameplate fastened with straps Nameplate fastened with adhesive Labels fastened with adhesive.
- C. Color:
  - 1. Fire Alarm System: Red lettering on white background.
- D. Legend:
  - 1. Fire Alarm System: FIRE ALARM.

## 2.5 STENCILS

- A. Furnish materials in accordance with County standards.

- B. Stencils: With clean cut symbols and letters of following size:
  - 1. Up to 2 inches Outside Diameter of Raceway: 1/2 inch high letters.
  - 2. 2-1/2 to 6 inches Outside Diameter of Raceway: 1 inch high letters.
- C. Stencil Paint: Semi-gloss enamel, colors conforming to the following:
  - 1. Red lettering on white background.

## 2.6 LOCKOUT DEVICES

- A. Lockout Hasps:
  - 1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

## **PART 3: EXECUTION**

### 3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

### 3.2 EXISTING WORK

- A. Install identification on existing equipment to remain in accordance with this section.
- B. Install identification on unmarked existing equipment.
- C. Replace lost nameplates labels and markers.
- D. Re-stencil existing equipment.

### 3.3 INSTALLATION

- A. Install identifying devices after completion of painting.
- B. Nameplate Installation:
  - 1. Install nameplate parallel to equipment lines.
  - 2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
  - 3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
  - 4. Secure nameplate to equipment front using screws, rivets, or adhesive.



5. Secure nameplate to inside surface of door on recessed panels in finished locations.
  6. Install nameplates for the following:
    - a. Panels.
- C. Label Installation:
1. Install label parallel to equipment lines.
  2. Install label for identification of individual control device stations.
  3. Install labels for permanent adhesion and seal with clear lacquer.
- D. Wire Marker Installation:
1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
  2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
  3. Install labels at data outlets identifying patch panel and port designation [as indicated on Drawings].
- E. Conduit Marker Installation:
1. Install conduit marker for each conduit longer than 6 feet.
  2. Conduit Marker Spacing: 20 feet on center.
  3. Raceway Painting: Identify conduit using field painting.
    - a. Paint colored band on each conduit longer than 6 feet.
    - b. Paint bands 20 feet on center.
    - c. Color:
      - 1) Fire Alarm System: Red.

**END OF SECTION**

## SECTION 28 31 00

### INTELLIGENT REPORTING FIRE DETECTION AND ALARM

#### PART 1: GENERAL

##### 1.1 CONTRACTOR QUALIFICATIONS

A. All work specified in this section shall be performed by a qualified Fire Life-safety System (FLS) contractor. The FLS contractor shall provide the following documentation to show compliance with contractor qualifications. The documents shall be bound, indexed in the order listed below and provided during the submittal process.

1. **CONTRACTOR'S LICENSE:** A copy of the FLS contractor's valid State of California C-10 License.
2. **PROOF OF EXPERIENCE:** Proof that the FLS contractor has been regularly engaged in the business of fire alarm contracting consisting of, but not limited to, engineering, fabrication, installation, and servicing of fire alarm systems of the type and manufacturer specified herein for at least the past ten (10) consecutive years.
3. **INSURANCE CERTIFICATES:** Copy of FLS contractor's current liability insurance and state industrial insurance certificates in conformance with the contract documents.
4. **PROJECT LIST:** A List containing at least ten (10) California installations completed within the last five (5) years by the FLS contractor that are comparable in scope and nature to that specified in the contract document. List to include only those jobs that have been performed under same company name by current owners.
5. **SERVICE CAPABILITY:** Documentation indicating in detail that the FLS contractor has competent engineering, installation, service personnel and facilities with reasonable stock of service parts within 100 air miles of the job site.
6. **CERTIFICATION:**
  - a. Evidence that the FLS contractor is Underwriters Laboratories, Inc. (UL) listed under the classification of PROTECTIVE SIGNALING SERVICES-LOCAL, AUXILIARY, REMOTE STATION AND PROPRIETARY (UUJS).
  - b. Evidence that the FLS contractor is Underwriters Laboratories, Inc. (UL) listed under the classification of CENTRAL STATION PROTECTIVE SIGNALING SERVICES (UUFX).
  - c. Copies of the following: (NICET) Certificates. Proof that the certificate holders are a part of the FLS contractor's local facility servicing this project and will be actively involved in this project.
    - 1) Technician Level 2 minimum of (4).
    - 2) Technician Level 4 minimum of (2).

7. PROOF OF TRAINED PERSONNEL:

- a. Documentation that the FLS contractor has on staff personnel **factory trained and certified** for the equipment proposed for this project. Also, a statement that personnel meeting these qualifications are in the local facility, and will be maintained at that facility throughout the duration of the project and the warranty period.
- b. Documentation that the FLS contractor is a NESCO-affiliated Engineered Systems Distributor (ESD). Documentation shall include verification that the FLS contractor has received the required training, has passed annual NOTIFIER quality audits, and is currently an affiliate in good-standing.

1.2 DESCRIPTION:

- A. This section of the specification includes the furnishing, installing, connecting and testing of the addressable, microprocessor controlled, networked fire detection and emergency voice evacuation system. The system shall monitor the following: manual fire alarm stations, water-flow alarm switches, valve supervisory tamper switches, post indicator valves, back-flow preventer supervisory switches, early warning smoke and heat detectors, duct smoke detectors and/or area smoke detectors for fan stop fire suppression system, kitchen fire extinguishing system and control of fire/smoke dampers. Smoke control functions shall comply with requirements specified by the designated Fire Protection Engineer through his Rational Analysis. The system shall include an integral Digital Alarm Communicator Transmitter (DACT) for Central Station Monitoring. System shall include digital voice evacuation system, fireman's telephone system, auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein. System design shall allow for a 20% expansion without the addition of any control equipment components.

1.3 APPLICABLE STANDARDS AND SPECIFICATIONS:

- A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the codes and standards applicable to the dates and occupancies specified by the Architect and shown in the bid documents.
- B. National Fire Protection Association: NFPA. 13 Sprinkler Systems, NFPA 70 National Electric Code, NFPA 72 National Fire Alarm Code, NFPA 90A Air Conditioning Systems, NFPA 92A Smoke Control Systems, NFPA 101 Life Safety Code
- C. Underwriters Laboratories Inc. (UL) - UL 268 Smoke Detectors for Protective Signaling Systems, UL 864 (9<sup>th</sup> Edition) Control Units for Protective Signaling Systems, UL 268A Smoke Detectors for Duct Applications, UL 521 Heat Detectors for Protective Signaling Systems, UL 464 Audible Signaling Appliances, UL 38 Manually Actuated Signaling Boxes, UL 346 Waterflow Indicators for Protective Signaling Systems, and UL 1971 Visual Notification Appliances
- D. California State Building Codes (CBC, CFC, CEC, and CMC).
- E. ANSI/ASME A17.2 and State of California Elevator Code requirements.

#### 1.4 SCOPE:

- A. Provide a new intelligent reporting, microprocessor controlled fire detection system. It shall be installed in accordance with the specifications and drawings.
- B. The FLS contractor shall install all peripheral devices and control equipment. All raceway, boxes, and terminal cabinets are to be furnished and installed by the Electrical Contractor.
- C. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site.
- D. All required special equipment, including a laptop computer, for programming, shall be furnished by the FLS contractor, turned over to the Building Owner and shall remain on site and shall be covered during the warranty period. A Control Panel that has an integral QWERTY keypad which allows for system program modifications on site is acceptable.
- E. Basic Performance:
  - 1. Alarm and trouble signals from the FACP and LCD shall be digitally encoded by listed electronic devices onto a NFPA Style 4 looped multiplex communication system.
  - 2. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
  - 3. Initiation Device Circuits (IDC) shall be wired NFPA Style B (Class B).
  - 4. Notification Appliance Circuits (NAC) shall be wired Class B (NFPA Style Y).
  - 5. A single ground or open on any system signaling line circuit, initiating device circuit, or notification appliance circuit shall not cause system malfunction and must transmit a trouble condition to the main panel.
  - 6. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
  - 7. Speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor, per elevator bank, and per stairway.
  - 8. Speaker circuits shall be electrically supervised for open and short circuit conditions. If a short circuit exists on a speaker circuit, it shall not be possible to activate that circuit.
  - 9. Speaker circuits shall be 25 or 70.7 VRMS. Speaker circuits shall have 20% space capacity for future expansion or increased power output requirements.
  - 10. Up to 32 minutes of custom digital audio messages shall be capable of being stored electronic-ally within the Digital Voice Command equipment (DVC).

11. Speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
12. Two-way telephone communication circuits shall be arranged to allow communication between the fire command center and up to seven (7) remote telephone locations simultaneously.
13. A system event/report printer shall be provided in the Fire Command Center.
14. All system smoke detectors shall be of the Addressable type.
15. Addressable Residential Room smoke detectors shall report as supervisory signals only. Residential Room smoke detectors shall be equipped with an audible sounder base which shall provide program capability for activation by command of the FACP. Power for the sounder base shall originate from a NAC circuit and shall allow synchronization of the temporal 3 pattern with other audible devices in the system.
16. Existing initialing devices shall be reconnected to the new system if found compatible; otherwise replace devices to obtain a functional system.

#### 1.5 SUBMITTALS:

- A. The FLS contractor shall submit three complete sets of equipment catalog data sheet documentation to ensure compliance with these specifications. Submittals will be automatically rejected if complete listing information from the California State Fire Marshal (CSFM) does not accompany submittals.
- B. Equipment and devices are as shown on the contract drawings. The FLS contractor shall submit shop drawings compliant with CBC Section 907, "Construction Documents" for approval. Installation shall not be performed prior to approval by Engineer and Authority Having Jurisdiction.

### **PART 2: PRODUCTS**

#### 2.1 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS:

- A. All equipment shall be new and of the manufacturer's latest design.

#### 2.2 EQUIPMENT MANUFACTURERS:

- A. The Fire Alarm System shall be limited to the following manufacturers.
  1. **NOTIFIER** as supplied by NESCO affiliate.
  2. No other manufactures will be considered.

#### 2.3 MAIN FIRE ALARM CONTROL PANEL – NFS2-3030:

- A. The FACP shall be a NOTIFIER Model NFS2-3030 and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the

following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, network node gateway and other system controlled devices.

B. The FACP shall provide the following features:

1. The control panel shall provide capacity for the number of devices required plus 20%, and be capable of expansion to 3,180 intelligent/addressable devices.
2. The alarm control panel shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and full QWERTY keypad for the field programming and control of the alarm system.
3. All programming or editing of the system software shall be achieved without special equipment and without interrupting the alarm monitoring functions of the alarm control panel. The system shall be fully programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.
4. The ability to display or print system reports.

C. Signaling Line Circuits (SLC)

1. The system shall include one SLC with the capability for expansion to ten. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a total system capacity of 3,180 devices. The SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring. System shall be capable of polling 318 devices in less than two seconds.
2. The Loop Control Module (LCM/LEM) shall send and receive fully digital information to and from all intelligent detectors for processing to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The digital information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
3. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
4. The detector software shall meet NFPA 72, Chapter 7 requirements and be certified by UL as a calibrated sensitivity test instrument.
5. The detector software shall allow manual or automatic sensitivity adjustment. System shall be capable of performing periodic detector test, conducted automatically by the software.

D. Digital Voice Command Center

1. The Digital Voice Command Center (DVC) located with the FACP shall contain the equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.
2. The DVC shall be capable of operating 8 channels of audio and 5 channels of firefighter's telephone simultaneously.
3. The DVC shall be capable of controlling up to 32 DAA series digital amplifiers or 4 channels of analog amplification using the DVC-AO option.
4. DVC's and DAA's shall operate as nodes on the Noti-Fire-Net network and shall support fiber or twisted pair communication methods.

E. Serial Interfaces

1. The system shall include a serial RS-232 interface. The interface shall be a means of connecting UL Listed Electronic Data Processing (EDP) peripherals.
2. The system shall include an RS-485 port for the serial connection of optional annunciators, Smoke Control Panel, and remote LCD displays.
3. The system shall include a Network/Service Connection (NUP) port for communications with the NFN Gateway Module and/or NCM High Speed Network Modules for either copper or fiber optic connection.

F. Notification Appliance Circuit (NAC)

1. Each DAA Digital Audio Amplifier shall provide two (2) Class A or four (4) Class B Supervised 25 or 70.7 VAC Audio Outputs and one (1) Fireman's Telephone Riser Circuit. Connected speaker loads shall provide for a minimum 50% headroom factor above the amplifier's rated output. Fireman's telephone risers shall support up to seven (7) independently addressed ringing telephone circuits.
2. Each ACPS-610 Addressable Charger/Power Supply shall provide four (4), Class A or four (4) Class B fully addressable Notification Appliance Circuits (NAC) rated for 1.5 Amps each at 24VDC. Power supply shall be capable of charging 12 to 200 AH batteries with full supervision.

G. Remote Notification Appliance Circuit (NAC)

1. Each FCPS-24S8 Field Charging Power Supply shall provide four (4) Class A or four (4) Class B Notification Appliance Circuits (NAC) rated for 1.5 Amps each at 24VDC. Power supply shall also be capable of providing 6 Amps of standalone resettable/non-resettable 24VDC Power for auxiliary devices.

H. Control Modules

1. Six circuit modules shall be configurable for 3.0 ampere, 24 VDC NAC output with synch, 63 Watts of 70.7 volt audio, or form C relay control with contacts rated at 3.0 amperes, 30 VDC.

2. Each circuit shall be capable of being activated by any initiating device or from any combination of initiating devices.

I. Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be selected for either right or left hand hinging.

2.4 SYSTEM COMPONENTS

A. Serially Connected Annunciator, NOTIFIER LCD-160

1. The annunciator shall communicate with the alarm control panel via a two wire RS-485 (multi-drop) communications interface. The annunciator shall provide a 640 character display.
2. The annunciator shall require no more than four wires for operation. Annunciation shall include: intelligent addressable points, system software zones, control relays, and notification appliance circuits.

B. Smoke Control Graphic Annunciator, NOTIFIER SCS/Kirkland Graphic

1. 1. The annunciator shall communicate with the alarm control panel via a two wire RS-485 communications interface. The annunciator shall provide necessary inputs and outputs for all HAND/OFF/AUTO functionality and all necessary indicators. The annunciator shall require no more than four wires for operation.
2. 2. The annunciator shall monitor switch positions and drive LED's on the faceplate of the Smoke Control Graphic display. Design of the Smoke Control Graphic shall be per the rational analysis provided by the Fire Protection Engineer and in accordance with applicable Code requirements.

2.5 ADDRESSABLE DEVICES:

A. General

1. Addressable devices shall use simple to install and maintain rotary decimal (1-159) type address switches.
2. Addressable smoke and thermal detectors shall provide dual, bi-color alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.



3. The alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity shall be capable of being automatically adjusted by the panel on a time-of-day basis.
4. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 10.
5. The detectors shall include a separate twist-lock base with tamper proof feature.
6. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
7. Detectors will operate in fully digital fashion, where the detector measures its designed environment variable and transmits a digital value to the FACP based on real-time measured values. Polling from the FACP is performed in a group fashion until a single device in the group provides new information, at which time the FACP stops the group poll and concentrates on the single device; greatly enhancing response speed. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.

B. Addressable Pull Box (manual station), NOTIFIER NBG-12LX

1. The addressable pull box shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. The pull box shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, the pull box cannot be restored to normal use except by the use of a key. Pull station shall contain a bi-colored status LED that functions as outlined above.
2. The manual station shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word "Fire" shall appear on the front of the station in raised letters, 1.75 inches or larger.

C. Intelligent Photoelectric Smoke Detector, NOTIFIER FSP-851

1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the detected level of smoke density.

D. Intelligent Heat Detector, NOTIFIER FST-851R and FST-851H

1. The detectors shall be 135 degree F rate-of-rise heat detectors and shall, on command from the control panel, send data to the panel representing the detected level of heat. For areas with higher anticipated ambient temperature levels, the detector shall be rated for 190 degree F and shall carry the "H" designation.

E. Intelligent Duct Smoke Detector, NOTIFIER DNR/DNR-W

1. The smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, that provides continuous monitoring and alarm verification from the panel. "W" suffix indicates weatherproof. Any duct smoke detectors to be installed outdoors shall be weatherproof, and shall not require any additional protection from excessive heat or moisture than that provided by the housing.
  2. Intelligent Duct Smoke Detectors shall be furnished under this section, and installed by the Mechanical Contractor. Manufacturer's installation instructions are to be furnished to the Mechanical Contractor for his use.
- F. Addressable Dry Contact Monitor Module, NOTIFIER FMM-1
1. Addressable monitor modules shall be provided to connect each waterflow and tamper switch and any other indicated dry contact device to be monitored by the FACP to the SLC.
  2. The monitor module shall mount in a 4-inch square, 2-1/2 inch deep electrical box.
  3. The IDC zone shall be suitable for Style D or Style B operation. A bi-color LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
- G. Addressable Dual Dry Contact Monitor Module, NOTIFIER FDM-1
1. Where waterflow and tamper switches are grouped together, addressable dual monitor modules shall be provided to connect the dry contacts of each waterflow and tamper switch to be monitored by the FACP to the SLC.
  2. The monitor module shall mount in a 4-inch square, 2-1/2 inch deep electrical box.
  3. The module shall report two consecutive and discreet addresses to the FACP.
- H. Addressable Dry Contact Mini Monitor Module, NOTIFIER FMM-101
1. Addressable mini monitor modules shall be provided to connect weatherproof heat detectors and manual stations and/or any other indicated dry contact device to be monitored by the FACP to the SLC.
  2. The monitor module shall be capable of installation inside a single gang electrical box and behind the dry contact device it is intended to monitor.
- I. Addressable Control Relay Module, NOTIFIER FRM-1
1. Addressable control relay modules shall be provided to control the operation of HVAC equipment, fire/smoke dampers, elevator control, and any other indicated dry contact control function.
  2. The control module shall mount in a standard 4-inch square, 2-1/2 inch deep electrical box.

3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relays may be energized at the same time on the same pair of wires.

J. Addressable Control Module, NOTIFIER FCM-1

1. Addressable control modules shall be provided to control the operation of circuits requiring a 24VDC supervised output. The module shall supervise input power as well as its controlled output.
2. The control module shall mount in a standard 4-inch square, 2-1/2 inch deep electrical box.
3. The module shall be suitable for Class A or B operation. A bi-color LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

2.6 NON-ADDRESSABLE DEVICES:

A. Multi-Voltage Single Pole Relay, NOTIFIER PR-1

1. Relay coil shall be rated for 24VDC, 24VAC, and 120VAC.
2. Each relay shall provide one set of Form C (SPDT) dry contacts rated for 7 Amps at 120VAC.
3. The relay shall be U.L. Listed and capable of constant duty use.

B. Waterflow Indicator:

1. Waterflow Switches shall be furnished and installed by the Sprinkler Contractor.
2. Waterflow Switches shall be connected under this section.
3. The Main sprinkler Waterflow Switch shall be connected to an exterior-mounted, 120VAC bell. Bell shall be furnished by the Sprinkler Contractor and powered and connected by the Electrical Contractor.

C. Sprinkler and Valve Supervisory Switches

1. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve, post indicator valve, and/or main gate valve shall be equipped with a supervisory switch.
2. Valve supervisory switches shall be connected under this section and furnished, installed, and adjusted for proper operation by the sprinkler contractor.

D. Electromagnetic Door Holders

1. Fire doors separating smoke compartments shall be furnished with electromagnetic door holders which shall release doors upon signal from the FACP or during loss of mains power.
2. Electromagnetic Door Holders shall be connected under this section and furnished, installed, and adjusted for proper operation by the Door Hardware

Contractor. 120VAC power shall be provided at the location of each door holder by the Electrical Contractor.

## 2.7 AUDIBLE, AUDIBLE/VISUAL, AND VISUAL DEVICES:

- A. Speakers and Speaker Strobes shall be System Sensor Spectralert S, SC, SP2, and SP2K or equal RS, AS, and E Series by Wheelock.
1. The notification appliances shall be Notifier Spectralert S, SC, and SP2 Series Wall Mount Strobe, Ceiling Mount Strobe and Ceiling Mount Speaker/Strobe appliances. Spectralert appliances with strobes shall be listed under UL Standard 1971 (Emergency Devices for the Hearing-Impaired for Indoor Fire Protection Service). Spectralert Speakers shall be UL listed under Standard 1480 (Fire Protective Signaling). Strobes shall be variable candela and suitable for wall or ceiling mount applications. Speakers shall provide variable power and line voltage taps (70.7 or 25 Volt line @ ¼, ½, 1, and 2 Watts). Weatherproof devices shall be Spectralert SP2K and shall incorporate characteristics of the SP2 series.
  2. Sound output for Spectralert Speakers at 10 feet shall be field selectable for 87, 84, 81 or 78 dBA anechoic with a frequency response of 100 to 10,000 Hz. Spectralert combination devices and strobe devices shall provide listed strobe intensities of 15, 30, 75, 95, 115 and 177 candela for ceiling mount applications, with a flash rate of one flash per second minimum across the listed voltage range. The strobe appliance shall incorporate a Xenon flashtube enclosed in a rugged Lexan lens.

## 2.8 FIREMAN'S TELEPHONE SYSTEM DEVICES:

- A. Fireman's Telephone Jacks and Handsets, NOTIFIER FPJ and FHS
1. Fireman's Telephone Jacks shall be furnished and installed as shown on the drawings and as required by the Code. The receptacle shall be semi-flush and mounted with a single-gang box.
  2. Jack shall be compatible with remote handsets, Model FHS (furnish 6 with FHSC-S enclosure or as local AHJ requires).
- B. Firephone Control Module, NOTIFIER FTM-1
1. The Firephone Control Module shall support up to two fireman's telephone jacks. The module shall allow for direct dial programming from the ACS annunciator to associated jacks and shall provide dial and ring tone to handsets inserted.
  2. The Firephone Control Module shall be connected to and powered by the SLC loop and shall be capable of Class A or B supervision.

## 2.9 CONDUIT, BOXES, AND WIRE:

- A. Conduit:
1. Conduit shall be in accordance with the National Electrical Code (NEC), local and state requirements.

2. All wiring shall be installed complete conduit system. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
  3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
  4. Conduit shall not enter any FACP, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the manufacturer.
  5. Wire and cable shall be installed in conduit. Conduit shall be 3/4 inch minimum.
- B. The FACP(s) shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution Panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The FACP cabinet shall be grounded.
- C. Wire:
1. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 16 AWG for initiating device circuits and signaling line circuits, and 12 AWG for notification appliance circuits.
  2. All field wiring shall be completely supervised and new at time of installation.
  3. Two-hour survivability shall be observed as required.

### **PART 3: EXECUTION**

#### **3.1 INSTALLATION:**

- A. The entire system shall be installed in a workmanlike manner in accordance with approved manufacturers' manuals and wiring diagrams. System devices and wire, except as noted, shall be installed by the FLS contractor. The Electrical Contractor shall furnish all conduit, outlet boxes, junction boxes, terminal cabinets and similar devices necessary for the completed installation.
- B. Installation of conduit, outlet boxes, junction boxes, terminal cabinets, special back boxes and similar devices shall comply with the requirements of other Sections.
- C. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas.
- D. Smoke detector heads shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- E. Duct mounted Smoke Detectors shall be furnished and wired by the FLS contractor and installed by the Mechanical contractor. All shutdown and interface wiring shall be

performed by the Electrical contractor. All air pressure differential testing shall be performed by the Mechanical/Air Balance contractor.

- F. The sprinkler flow and tamper switches shall be furnished, installed and adjusted by the Sprinkler contractor, wired and tested by the FLS contractor.
- G. Manual Pull Stations shall be mounted 48 inches above finished floor measured to the top of the station.
- H. Audible and Visual devices shall be mounted no lower than 80 inches nor higher than 96 inches above finished floor measured at strobe center. Audible devices shall be no closer than 6 inches to the ceiling surface.
- I. Area Smoke Detectors shall be mounted no closer than 36 inches to any HVAC supply or return register or lighting fixture.
- J. Area Smoke and Heat Detectors shall be mounted no closer than 6 inches to any wall where ceiling mounted or to the ceiling where wall mounted.

### 3.2 WARRANTY:

- A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one-year period shall be included in the submittal bid.

### 3.3 FINAL INSPECTION:

- A. At the final inspection a factory trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

### 3.4 INSTRUCTION:

- A. Provide instruction as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including control by event functions shall be provided. Instruction shall be recorded using audio and video for future use by the Owner.
- B. The contractor and/or the systems manufacturer's representatives shall provide a factory generated "Frame and Post" instruction set.

### 3.5 SPARE PARTS:

- A. Provide a minimum of two (2) of each type of automatic fire detector used in the project (Smoke, Duct, Heat, etc.).
- B. Provide a minimum of one (1) Manual Fire Alarm Station.
- C. Provide a minimum of one (1) of each type of Monitor Module used in the project (FMM and FDM).
- D. Provide a minimum of one (1) of each type of Control Module used in the project (FCM, FRM, etc.).

- E. Provide a minimum of one (1) of each type of Indicating Appliance used in the project (Speaker, Speaker Strobe, and Strobe). Where more than a single device type is required to provide the various candela ratings as used throughout the project, one of each device type shall be furnished.

**END OF SECTION**

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