

P [] [] [] [] [] [] **4J SECURITY IMPROVEMENT**

T [] [] [] [] **ADDENDUM 1**

Date: March 28, 2023

From: KC Eck, PIVOT Architecture

To: Interested Bidders

1. General Information

1. There was a printing problem with pages 292-418 of the Project Manual. Please replace these pages with the attached document tagged as Addendum 1. This covers Section 23 0518-Escutcheons for HVAC Piping through Section 28 3111-Building Intrusion Detection.
2. Section 01 11 00 Summary of Work 1.8: Products ordered in advance: Schedule of Products ordered in advance is: "Card Readers" for the Access Control System.

2. Response to Bidder Questions

1. N/A

3. Approved Substitution Requests

1. N/A

4. Alternates

1. N/A

5. Changes to the Project Manual

Replace current sections with the attached versions of the following:

1. SECTION 23 0518-ESCUTCHEONS FOR HVAC PIPING
2. SECTION 23 0553-IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
3. SECTION 23 0719-HVAC PIPING INSULATION
4. SECTION 23 2213-STEAM AND CONDENSATE HEATING PIPING
5. SECTION 23 2214-STEAM AND CONDENSATE HEATING SPECIALTIES
6. SECTION 23 8200-CONVECTION HEATING AND COOLING UNITS
7. SECTION 26 0500-COMMON WORK RESULTS FOR ELECTRICAL
8. SECTION 26 0505-SELECTIVE DEMOLITION FOR ELECTRICAL
9. SECTION 26 0519-LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

10. SECTION 26 0526-GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
11. SECTION 26 0529-HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
12. SECTION 26 0533.13-CONDUIT FOR ELECTRICAL SYSTEMS
13. SECTION 26 0533.16-BOXES FOR ELECTRICAL SYSTEMS
14. SECTION 26 0533.23-SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS
15. SECTION 26 0553-IDENTIFICATION FOR ELECTRICAL SYSTEMS
16. SECTION 26 2726-WIRING DEVICES
17. SECTION 27 0000-GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS
18. SECTION 27 0505-SELECTIVE DEMOLITION OF COMMUNICATIONS SYSTEMS
19. SECTION 27 0528-PATHWAYS FOR COMMUNICATIONS SYSTEMS
20. SECTION 27 0553-IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
21. SECTION 27 1500-COMMUNICATIONS HORIZONTAL CABLING
22. SECTION 28 0000-GENERAL REQUIREMENTS FOR ELECTRONIC SAFETY & SECURITY SYSTEMS
23. SECTION 28 0505-SELECTIVE DEMOLITION OF ELECTRONIC SAFETY AND SECURITY SYSTEMS
24. SECTION 28 1300-SECURITY MANAGEMENT SYSTEM
25. SECTION 28 1500-SECURITY MANAGEMENT SYSTEM HARDWARE DEVICES
26. SECTION 28 1523-INTERCOM ENTRY SYSTEM
27. SECTION 28 3111-BUILDING INTRUSION DETECTION

6. Changes to the Drawings

1. N/A

7. Attachments

4J Security Improvements Project Manual SECTION 23 0518 through SECTION 28 3111

End of Addendum 1

**SECTION 23 0518
ESCUTCHEONS FOR HVAC PIPING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. This project will require extended work hours in order to meet the completion date - see specification section 00210 for phasing and schedule requirements.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.03 ACTION SUBMITTALS

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

PART 2 PRODUCTS

2.01 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.02 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
 - g. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One-piece, floor-plate type.

3.02 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

**SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.
 - 3. Valve tags.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

1.04 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.01 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Black.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 incheshigh.
- E. All working/color combinations shall meet ANSI A13.1 Standards.

2.03 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass beaded chain.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.04 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use

fixtures and units. List tagged valves in a valve schedule.

- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
1. Valve-Tag Size and Shape:
 - a. Loop Water and Heating Water: 1-1/2 inches,.
 2. Valve-Tag Color:
 - a. Loop Water: Natural.
 3. Letter Color:
 - a. Loop Water: Black.

END OF SECTION 23 05 53

**SECTION 23 0719
HVAC PIPING INSULATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Low pressure steam and steam condensate piping, indoors.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.04 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.05 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," and "Outdoor, Aboveground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
- F. Mineral-Fiber, Preformed Pipe Insulation: Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

- E. PVC Jacket Adhesive: Compatible with PVC jacket.

2.03 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 4. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 - 2. Service Temperature Range: 0 to 180 deg F.
 - 3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 - 4. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 - 2. Service Temperature Range: Minus 50 to plus 220 deg F.
 - 3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 - 4. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: 60 percent by volume and 66 percent by weight.
 - 4. Color: White.

2.04 SEALANTS

- A. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: White.

2.05 FACTORY-APPLIED JAC ETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.06 FIELD-APPLIED JAC ETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
 - 1. Thickness: 0.016 inch (0.40 mm) sheet.
 - 2. Finish: Smooth.
 - 3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
 - 4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
 - 5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.
 - 6. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

2.07 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
 2. Thickness: 11.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Width: 2 inches.
 2. Thickness: 6 mils.
 3. Adhesion: 64 ounces force/inch in width.
 4. Elongation: 500 percent.
 5. Tensile Strength: 18 lbf/inch in width.
 6. Width: 2 inches.
 7. Thickness: 3.7 mils.
 8. Adhesion: 100 ounces force/inch in width.
 9. Elongation: 5 percent.
 10. Tensile Strength: 34 lbf/inch in width.

2.08 SECUREMENTS

- A. Bands:
1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2 inch wide with wing seal.
 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.

- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.

3.04 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.

- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 7 for firestopping and fire-resistive joint sealers.
- D. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 7.

3.05 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 - 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.07 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by

insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

- B. Insulation Installation on Pipe Flanges:
 - 1. Install preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 4. Install insulation to flanges as specified for flange insulation application.

3.08 FIELD-APPLIED JAC ET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.09 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Discharge piping from condensate receiver pumps.

3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Low pressure steam and steam condensate, 201 to 250 Deg F:
 - 1. NPS 4 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I: 2-1/2 inch thick.
- B. Low pressure steam and steam condensate, 251 to 350 Deg F:
 - 1. NPS 1 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I: 3 inch thick.
 - 2. NPS 1 to 1-1/2: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I: 4 inch thick.
 - 3. NPS larger than 1-1/2: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I: 4.5 inch thick.

3.12 INDOOR, FIELD-APPLIED JAC ET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed, within 8'-0" of finished floor, or as noted in drawings:
 - 1. Aluminum: 40 mils thick.

END OF SECTION 230719

**SECTION 23 2213
STEAM AND CONDENSATE HEATING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe and pipe fittings.
- B. Pipe hangers and supports.
- C. Steam piping system.
- D. Steam condensate piping system.

1.02 RELATED REQUIREMENTS

- A. Section 23 2500 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
- D. ASME B31.1 - Power Piping 2022.
- E. ASME B31.9 - Building Services Piping 2020.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, inc-Coated, Welded and Seamless 2022.
- G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2023.
- H. ASTM B32 - Standard Specification for Solder Metal 2020.
- I. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2022.
- J. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
- K. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.
- L. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

1.04 SYSTEM DESCRIPTION

- A. When more than one piping system material is selected, ensure systems components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.
- B. Use unions and flanges downstream of valves and at equipment or apparatus connections. Use dielectric unions where joining dissimilar materials. Do not use direct welded or threaded connections.
- C. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
- D. Use ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

- B. Installer Qualifications: Company specializing in performing the work of this section, with minimum 3 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labelling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Comply with ASME B31.9 and ASME B31.1 code for installation of piping system.
- B. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of welders.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

2.02 LOW PRESSURE STEAM PIPING (15 PSIG (103 PA) MAXIMUM)

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black.
 - 1. Fittings: ASME B16.3 malleable iron Class 150, or ASTM A234/A234M wrought steel.
 - 2. Joints: Threaded, or AWS D1.1/D1.1M welded.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn.
 - 1. Fittings: ASME B16.18, cast brass, or ASME B16.22 wrought copper.
 - 2. Joints: Solder, lead free, ASTM B32, HB alloy (95-5 tin-antimony), or tin and silver.

2.03 LOW PRESSURE STEAM CONDENSATE PIPING

- A. Steel Pipe: ASTM A53/A53M, Schedule 80, black.
 - 1. Fittings: ASME B16.3 malleable iron Class 150, or ASTM A234/A234M wrought steel.
 - 2. Joints: Threaded, or AWS D1.1/D1.1M welded.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn.
 - 1. Fittings: ASME B16.18, cast brass, or ASME B16.22, wrought copper.
 - 2. Joints: Solder, lead free, ASTM B32, HB alloy (95-5 tin-antimony), or tin and silver.
- C. Copper Tube: Listed, ASTM B88 (ASTM B88M), Type K (A), annealed.
 - 1. Fittings: ASME B16.18 cast copper or ASME B16.22 wrought copper.
 - 2. Joints: Compression connection or AWS A5.8M/A5.8, BCuP silver braze.
 - 3. Mechanical Press Sealed Fittings: Double-pressed type and approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

2.04 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
- C. Hangers for Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
- D. Hangers for Pipe Sizes 6 Inches (150 mm) and Over: Adjustable steel yoke, cast iron roll, double hanger.
- E. Multiple or Trapeze Hangers for Pipe Sizes to 4 inches (100 mm): Steel channels with welded spacers and hanger rods.

- F. Multiple or Trapeze Hangers for Pipe Sizes 6 Inches (150 mm) and Over: Steel channels with welded spacers and hanger rods; cast iron roll and stand.
- G. Wall Support for Pipe Sizes to 3 Inches (70 mm): Cast iron hook.
- H. Wall Support for Pipe Sizes 4 to 5 Inches (100 to 125 mm): Welded steel bracket and wrought steel clamp.
- I. Wall Support for Pipe Sizes 6 Inches (150 mm) and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll.
- J. Vertical Support: Steel riser clamp.
- K. Floor Support for Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- L. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- M. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
- N. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.05 UNIONS, FLANGES, AND COUPLINGS

- A. Unions for Pipe 2 Inches (50 mm) and Under:
 1. Ferrous Piping: 150 psig (1034 kPa) galvanized malleable iron, threaded.
 2. Copper Pipe: Bronze, soldered joints.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction protect open ends with temporary plugs or caps.
- E. After completion, fill, clean, and treat systems. See Section 23 2500.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- E. Pipe Hangers and Supports:
 1. Install in accordance with ASME B31.9.
 2. Place hangers within 12 inches (300 mm) of each horizontal elbow.
 3. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 4. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 5. Provide copper plated hangers and supports for copper piping.
- F. Provide clearance for installation of insulation and access to valves and fittings.
- G. Slope steam piping one inch in 40 feet (0.25 percent) in direction of flow. Use eccentric reducers to maintain bottom of pipe level.
- H. Slope steam condensate piping one inch in 40 feet (0.25 percent). Provide drip trap assembly at low points and before control valves. Run condensate lines from trap to nearest condensate

receiver. Provide loop vents over trapped sections.

- I. Install valves with stems upright or horizontal, not inverted. Valve to be placed in serviceable and accessible location.

END OF SECTION

**SECTION 23 2214
STEAM AND CONDENSATE HEATING SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Steam traps.
- B. Steam air vents.
- C. Safety relief valves.

1.02 RELATED REQUIREMENTS

- A. Section 23 2213 - Steam and Condensate Heating Piping.

1.03 REFERENCE STANDARDS

- A. ASME B31.9 - Building Services Piping 2020.
- B. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures 1999 (Reapproved 2022).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide for manufactured products and assemblies required for this project.
 - 2. Include product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
 - 3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each specialty.
 - 4. Include electrical characteristics and connection requirements.
- C. Operation and Maintenance Data: Include installation instructions, servicing requirements, and recommended spare parts lists.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements for additional provisions.
 - 2. Extra Pump Seals: One set for each type and size of pump.
 - 3. Steam Trap Service Kits: One for each type and size.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 STEAM TRAPS

- A. Manufacturers:
 - 1. Armstrong International, Inc: www.armstronginternational.com/ sle.
 - 2. Marshall Engineered Products Company: www.mepcollc.com/ sle.
 - 3. Spirax-Sarco: www.spiraxsarco.com/us/ sle.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Steam Trap Applications:
 - 1. Use Thermostatic Steam Traps for:
 - a. Convectors.

- C. Steam Trap Performance:
 - 1. Select to handle minimum of two times maximum condensate load of apparatus served.
 - 2. Pressure Differentials:
 - a. Low Pressure Systems (5 psi (34 kPa) and less): 1/4 psi (1.7 kPa).
- D. Float and Thermostatic Steam Traps:
 - 1. Manufacturers:
 - a. Armstrong International, Inc: www.armstronginternational.com/ sle.
 - b. Spirax-Sarco: www.spiraxsarco.com/us/ sle.
 - c. Watson McDaniel Company: www.watsonmcdaniel.com/ sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Metal body with bolted cover, stainless steel or bronze bellows type thermostatic air vent, stainless steel or copper float, stainless steel lever valve assembly, bottom drain plug, and accessible to internal parts without disturbing piping.
- E. Pressure Balanced Thermostatic Traps: ASTM A395/A395M cast iron body and bolted or screwed cover, and integral ball joint union for 125 psi (860 kPa) WSP; phosphor bronze bellows, stainless steel valve and seat, integral stainless steel strainer.

2.02 STEAM AIR VENTS

2.03 SAFETY RELIEF VALVES

- A. Valve: Bronze body, stainless steel valve spring, stem, and trim, direct pressure actuated, capacities ASME certified and labelled.
- B. Accessories: Drip pan elbow.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install steam and steam condensate piping and specialties in accordance with ASME B31.9.
- B. Install specialties in accordance with manufacturer's instructions.
- C. Steam Traps:
 - 1. Provide minimum 3/4 inch (20 mm) size on steam mains and branches.
 - 2. Install with union or flanged connections at both ends.
 - 3. Provide gate valve and strainer at inlet, and gate valve and check valve at discharge.
 - 4. Provide minimum 10 inch (250 mm) long, line size dirt pocket between apparatus and trap.

END OF SECTION

**SECTION 23 8200
CONVECTION HEATING AND COOLING UNITS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Steam convectors.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide typical catalog of information including arrangements.
- C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
- D. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

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

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Provide 5 year manufacturer's warranty for all convectors.

PART 2 PRODUCTS

2.01 STEAM CONVECTORS

- A. Manufacturers:
 - 1. Jaga; www.jaga-canada.com
 - 2. Trane; www.trane.com
 - 3. Modine Manufacturing Company: www.modineHVAC.com/ sle.
 - 4. Sterling Hydronics, a Mestek Company: www.sterlingheat.com/ sle.
 - 5. Vulcan Radiator, a Mestek Company: www.vulcanrad.com/ sle.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Perform factory run test under normal operating conditions, water, and steam flow rates.
- C. Heating Elements: Seamless copper tubing mechanically expanded into evenly spaced aluminum fins and bronze headers, steel side plates and supports, factory air pressure tested at 100 psi (690 kPa) under water, with means of adjusting pitch of element.
- D. Cabinet: 16 gauge, 0.0598 inch (1.52 mm) sheet steel front and top, 16 gauge, 0.0598 inch (1.52 mm) sheet steel back and ends; exposed corners rounded; easily secured removable front panels, adequately braced and reinforced for stiffness.
- E. Finish: Factory applied baked primer coat.
- F. Damper: Where not thermostatically controlled, provide knob-operated internal damper at enclosure air outlet.
- G. Access Doors: For otherwise inaccessible valves, provide factory-made permanently hinged access doors, 6 by 7 inch (150 by 175 mm) minimum size, integral with cabinet.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are suitable for installation.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.
- C. Do not damage equipment or finishes.
- D. Convector:
 - 1. Install where indicated.
 - 2. Coordinate to ensure correct recess size for recessed convectors.

3.03 CLEANING

- A. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.
- B. After construction and painting is completed, clean exposed surfaces of units.
- C. Vacuum clean coils and inside of units.
- D. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

3.04 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals for closeout submittals.

3.05 PROTECTION

- A. Provide finished cabinet units with protective covers during the balance of construction.

END OF SECTION

**SECTION 26 0500
COMMON WORK RESULTS FOR ELECTRICAL**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Basic Requirements
 - 2. Detailed Requirements
 - 3. Coordination
 - 4. Quality Assurance
 - 5. Codes, Ordinances, & Permits
 - 6. Common requirements for electrical installation
 - 7. Excavating & Backfilling
 - 8. Painting
 - 9. Cleaning & Rubbish

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit shop drawings, wiring diagrams, and descriptive literature on all equipment furnished in this contract. Contractor shall "approve" shop drawings as specified in Division 1 prior to submitting to Engineer for approval. Shop drawing submittals shall comply with Division 1 requirements.
 - 2. Make submittals as soon as practicable after the signing of the contract. Shipment shall not be released until drawings and literature have been finally approved.
 - 3. Shop drawings shall be checked by the Contractor for shape, dimensions, and details of attachment to the construction before submittal. Submitted shop drawings will be presumed to have been so checked by the Contractor.
 - 4. The literature shall be complete, giving materials, gauges, weights, finishes, etc., and in case of lighting fixtures, shall include ETL photometric curves.
 - 5. Wiring diagrams shall be furnished for all communication and control systems under this contract.
 - 6. In addition to the foregoing, the Contractor is to supply to the General Contractor, for delivery to the Owner, bound in a single set, a complete shop drawing portfolio of all equipment indicated under the specific specification section. Submit these near completion of the project arranged and indexed according to the CSI format.
- B. Test reports: Submit written installation test reports for review and approval immediately after testing has been satisfactorily completed.
- C. Acceptance certificates: Submit written manufacturer, testing agency and/or local Code authority acceptance certificates with project closeout documentation.
- D. Warranty: Submit a written warranty statement detailing all system and equipment warranties. Warranty shall be signed by Submittals are not required for this Section.
- E. Operation & Maintenance Instructions:
 - 1. Refer to Division 1 for submittal and training requirements.
 - 2. Furnish approved operation and maintenance instruction booklets covering each listed item of equipment installed under this contract. These booklets shall provide complete instructions on the proper operation, use and periodic maintenance, together with the source of replacement parts and service for the item of equipment covered.
 - 3. Operation and maintenance manuals shall include copies of test reports, acceptance certificates and warranty information.

4. In addition to the foregoing, the Contractor shall demonstrate to the Owner's designated personnel the use of the systems listed herein and shall furnish a digital copy of a general operation procedure, in searchable PDF format, with bookmarked identification for each major system component. Include locations and functions of switches, circuit breakers, fuses, etc.
 5. After final acceptance of all work and occupancy of the building, the Contractor shall have on the job, a qualified representative to make final adjustments of electrical systems and to instruct the Owner's representative in operating procedures, adjustment, and maintenance of system components, and to acquaint the Owner's representative with locations and functions of circuit breakers, fuses, switches, control devices, etc.
- F. Record Drawings:
1. Refer to Division 1 for submittal requirements.
 2. Furnish and maintain at the site one (1) fully sized printed set of construction document floor plans for the Contractor's use in making a record layout of actual locations of equipment, devices, routing of conduits and locations of pull boxes for the following facilities:
 - a. Electrical feeders
 - b. Branch circuits
 - c. Wiring devices
 - d. Empty conduits for use by others
 3. The information shall be neatly marked and the prints delivered to the Architect.
- G. Contractor's Warranty:
1. All work shall be warranted to be free of defects and to function properly for one year from the date of final acceptance or beneficial occupancy, whichever shall occur first. Defects appearing within the warranty period shall be repaired to the satisfaction of the Architect/Engineer. Refer to Division 1 for additional requirements.
 2. The warranty shall not obligate the Contractor for failure resulting from accident or from improper operation or care on the part of the Owner.
 3. Warranty for drivers and LEDs shall be as follows: Warranty failure shall be deemed to have occurred when 10% or more of the population of drivers or LED boards have failed. Should this occur, it is necessary that the Owner (or Contractor prior to substantial completion) make timely notification of the Architect/Engineer to facilitate a warranty claim with the manufacturer(s). Any extended warranties offered by Manufacturers shall not be preempted by this warranty.

1.04 BASIC REQUIREMENTS

- A. Before bidding, the Contractor. Extended warranties and manufacturer based warranties shall diligently study and compare all contract documents and shall be signed by the warranty holder and promptly report to the Architect/Engineer any discrepancies or deficiencies discovered by or made known to the Contractor.
- B. Discrepancies: Whenever a discrepancy or inconsistency exists between related information indicated on the contract drawings and/or specifications (such as differences between product descriptions and catalog numbers) this contractor shall obtain additional clarification and direction from the Architect/Engineer before proceeding. For bidding purposes, this contractor shall include the labor and materials necessary to comply with the alternative that results in the greatest cost to the Contract.
- C. Deficiencies: The Contractor and subcontractors shall resolve all known deficiencies and inadvertent omissions, including non-compliance with applicable codes, with the Architect/Engineer prior to ordering materials or proceeding with the work. Any work performed prior to receipt of instruction from the Architect/Engineer will be done so at the Contractor's risk.
- D. Manufacturer's Catalog Numbers: Product series, model, or catalog numbers, whether indicated on drawings or specifications, shall not be considered complete. This Contractor shall not order any product based solely upon the stated catalog number. Furnish products including accessories and options necessary to match the full product description and its intended purpose and application based on all information available from the contract documents.

1.05 DETAILED REQUIREMENTS

- A. Equipment and material specifications are minimum general requirements.
- B. In cases where construction requirements and/or special features not mentioned are stated in subsequent sections, on the drawings, or by local Code, the higher standard shall apply.
- C. Coordinate rough-in work and other electrical provisions for temperature sensors, CO2 sensors, humidistats, thermostats, and other wall-mounted BMS wired devices shown on the mechanical drawings. Refer to the mechanical plans and the mechanical symbols list to identify such items. Install a junction box with a plaster ring with pathway to equipment, unless otherwise indicated on mechanical drawings or specifications. Coordinate exact requirements with the contractor providing the wired device.
- D. Electrical installations shall not hinder the regular maintenance of or replacement of mechanical equipment. Conduit and cabling shall not be installed beneath suspended mechanical units. Coordinate and plan installations.

1.06 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, and wireways will be clear of obstructions and of the working and access space of other equipment.
- B. Prior to bidding, this contractor shall determine conduit and cabling routings, including the means and methods of installation, maximum feeder/branch-circuit lengths, pull boxes, junction boxes, conduit bodies, fittings, and any other related work in accordance with the contract documents and the applicable building codes.
- C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- D. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

1.07 QUALITY ASSURANCE

- A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."
- B. Tests & Adjustments
 - 1. Contractor shall perform at their own expense, except for electrical energy, any tests that the Architect/Engineer may order to prove the performance of any device(s) and/or equipment supplied under this contract.
 - 2. Such tests will be limited to non-destructive test and will involve only direct reading(s) of the parameter(s) involved, i.e., actual trip rating or time delay of a circuit breaker may be required but coordination study is beyond the scope of this requirement.

1.08 CODES, ORDINANCES, & PERMITS

- A. All governmental codes and ordinances that are applicable and in effect at the time and location of this work are hereby referenced as an integral part of the specification to establish minimum standards of design detail, materials, and workmanship. Extra payment will not be allowed for work or changes required by local code enforcement authorities and/or utility companies. This is not to preclude the establishment of non-conflicting higher standards as may be specified herein and/or indicated on the drawings. In case of conflict between any of the standards established herein and a governmental code or ordinance, refer to the Architect/Engineer and obtain instructions before proceeding with the work involved.
- B. Apply for, obtain, and pay for required permits and certificates of inspection

- C. Particular attention is directed to:
 - 1. Eugene School District 4j Technical Standards
 - 2. National Electrical Code
 - 3. Oregon Electrical Specialty Code
 - 4. Oregon Structural Specialty Code
 - 5. Oregon Energy Efficiency Specialty Code
 - 6. IEEE National Electrical Safety Code

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In all Division 26 Part 2 articles where titles introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified or prior approved product substitution. No product manufacturer will be accepted after this bid unless approved through a contractual change or written acceptance by Engineer. See "Substitutions" article herein.

2.02 PROPRIETARY REFERENCES

- A. Except where there is indication to the contrary, the intent of this specification is to be open to all brand names and suppliers that offer equipment that complies with the stated requirements of capacity, function, quality configuration, size, shape, and operating characteristics that are compatible with the design objectives of the system and interfacing equipment.
- B. Stated requirements are minimum in the case of unit output and maximum in the case of input requirements.
- C. The perceived operational limitations and maintenance requirements as well as the availability of suitable maintenance support will be evaluated in comparison to competing equipment as an important factor in deciding if an item of equipment is acceptable or not acceptable.
- D. The product manufacturers listed are manufacturers that are believed to be producers of like equipment or materials and locally represented, with service capability and otherwise meeting the requirements of the contract documents. Reference to a brand name is not to be construed as a representation that the named supplier actually has available the equipment or materials that meet the detailed requirements of the contract documents.
- E. Details of construction, control, or operation that are proprietary and not significant to the Owner's utilization of the equipment will not be used as a basis for qualifying or disqualifying any equipment.

2.03 SUBSTITUTIONS

- A. The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.
- B. No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Engineer at least 10 days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the work including changes in the work of other contracts that incorporation of the proposed substitution would require shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Engineer's decision of approval or disapproval of a proposed substitution shall be final. Refer to Division 1 for additional requirements.
- C. If the Engineer approves a proposed substitution prior to receipt of bids, such approval will be set forth in an addendum. Bidders shall not rely upon approvals made in any other manner.
- D. No substitutions will be considered after the contract award unless specifically provided in the contract documents.

2.04 UL LABEL

- A. All materials, devices, etc. installed under this contract shall bear the UL label, or be UL listed as applicable except those specified items not covered by existing UL Standards.

PART 3 EXECUTION

3.01 BUILDING CONSTRUCTION

- A. Refer to the general construction drawings, which are bound with the drawings of this work, for construction details, elevations, etc.

3.02 INSPECTION OF SITE

- A. Determine information regarding existing construction by the site inspection prior to bidding.
- B. By submitting a bid for this work, contractor agrees they have inspected the existing site and familiarized himself with existing conditions and how they relate to the contract documents.

3.03 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

3.04 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Examine the site and all the drawings before proceeding with the layout and installation of this work. Verify all door swings and clearances to cabinets, etc. before locating switch and outlet boxes. Locate conduits, boxes, etc., essentially as shown on the drawings, but in exact layout determined on the job to suit actual conditions. Locate work so it does not interfere with access to service for any equipment. Confer and cooperate with other trades on the job so all parts will be installed in proper relationship. Precise location of parts to coordinate with other work is the responsibility of the Contractor.
- B. Obtain and follow manufacturer's installation instructions in the installation of all electrical equipment. Observe all restrictions imposed by the equipment manufacturer, UL label, NEC, or other applicable code in regard to setting; anchoring; hanging; clearances; electric, magnetic or thermal separation; shielding; weather and moisture protection. In case of conflict between the specifications herein and instructions or code governing the installation, notify the Architect/Engineer and receive their instructions before proceeding.
- C. Arrange exposed work as closely as practicable to wall or ceiling surfaces and in accurate alignment with exposed features of structure and/or trim. Locate concealed work so fittings, connectors, and other projections will clear surfaces. Where the option of more than one material is given, selection shall be confined to those which may be properly installed.
- D. Install all work in a neat and orderly manner by workers thoroughly qualified in the trade or duties they are to perform. Rough work will be rejected.
- E. The Contractor is responsible for correct size and location of chases, slots, and openings require and will be liable for any cutting or patching made necessary by their failure to make proper arrangements in this respect.
- F. Maintain a competent full-time superintendent on the job to oversee and coordinate work with other trades, receive instructions from the Architect/Engineer, make layout of work to suit actual conditions, and to satisfy requirements of the drawings, specifications, and good workmanship.

3.05 EXCAVATING & BAC FILLING

- A. Provide excavating and backfilling necessary for installation of this work.
- B. Dig trenches to proper depth, graded for fall and to give solid bearing for each length of conduit or wire. Underground conduit or wire shall not be covered until inspected and the installation approved.
- C. Trenches under the building and under concrete slabs around the building shall be backfilled with mechanically tamped sand to level with surrounding earth. Dirt backfill shall not be used for these trenches.
- D. Sod and/or any surfacing (sidewalks, drives, parking, etc.) shall be replaced and restored to original condition where disturbed by excavations.

- E. Before starting any excavation, use every reasonable means (examination of drawings, check with local utility companies and completed site work, local inquiry and check of surface indications) to determine the presence of underground piping, wiring, etc. in the area to be excavated. If such are, or are suspected to be existing, obtain instructions from the Architect/Engineer before proceeding.
- F. Contractor shall verify, smooth or refill and reseed any settlement areas or mounded areas of trenching after one winter.

3.06 PAINTING

- A. Exposed electrical work in finished areas will require painting unless noted otherwise. Finished areas are those exposed to view by occupants, with the exception of mechanical and electrical equipment rooms.
- B. Protect the manufacturer's finish on equipment that is so finished. Clean and/or touch-up as necessary to repair damage at the end of the job.
- C. Paint exposed work installed under this contract with suitable primer and two coats of approved enamel, colors as specified or directed.
- D. Protect the manufacturer's finish on equipment that is so finished. Clean and/or touch-up as necessary to repair damage at the end of the job.

3.07 CLEANING & RUBBISH

- A. During the work, keep the premises clear of unnecessary accumulation of debris.
- B. Plug or cap open ends of conduits to prevent the entrance of dirt and/or moisture during construction. Protect boxes, panel enclosures, etc. against the entrance of mortar, plaster, moisture, and other foreign material during construction, and thoroughly clean these spaces before pulling wires, and again, if necessary, before installing covers of fronts.
- C. On completion of the work, remove and dispose of all rubbish and debris resulting from the work and the work of subcontractors.
- D. All equipment, fixtures, etc. shall be thoroughly cleaned of accumulated dust, plaster, finger prints, or other dirt and left in a satisfactory condition for use.

END OF SECTION

**SECTION 26 0505
SELECTIVE DEMOLITION FOR ELECTRICAL**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical demolition.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that abandoned wiring and equipment serve only abandoned facilities.
- B. Demolition drawings are based on casual field observation and existing record documents.
- C. Report discrepancies to Architect before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WOR

- A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
 - 1. PCB- and DEHP-containing lighting ballasts.
 - 2. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.
- B. Refer to electrical abbreviations on drawings for demolition tag descriptions: "E", "R", "RR", etc
- C. Remove, relocate, and extend existing installations to accommodate new construction.
- D. Remove abandoned wiring to source of supply.
- E. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- F. Remove abandoned surface mounted raceway. Where existing surface mounted raceway is installed and devices are shown to be removed, coordinate device removal with existing devices to remain. If removal of a device will effect the installation of remaining devices, notify the engineer prior to demolition.
- G. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank Stainless Steel cover for abandoned junction boxes.
- H. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- I. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- J. Repair adjacent construction and finishes damaged during demolition and extension work.

- K. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- L. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment that remain or that are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION

SECTION 26 0519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Metal-clad cable.
- C. Wiring connectors.

1.02 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).
- C. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- E. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable 2018.
- F. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2021.
- G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.
- J. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.
- K. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.
- L. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.
- M. UL 1569 - Metal-Clad Cables Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Metal-clad cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
 - 1) Maximum Length: 6 feet (1.8 m).

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70/ICEA S-95-658.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.
- H. Conductor Material:
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
- I. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20A, 120 V circuit longer than 100 ft (30 m): 10 AWG. for voltage drop.
- J. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor Stranding:
 - 1. Feeders and Branch Circuits: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.

2.04 METAL-CLAD CABLE

- A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- B. Conductor Stranding:
 - 1. Feeders and Branch Circuits: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- E. Grounding: Full-size integral equipment grounding conductor.

2.05 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Circuiting Requirements:
 - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 - 2. When circuit destination is indicated without specific routing, determine exact routing required.
 - 3. Arrange circuiting to minimize splices.
 - 4. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 - 5. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install metal-clad cable (Type MC) in accordance with NECA 120.
- E. Installation in Raceway:
 - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 - 2. Pull all conductors and cables together into raceway at same time.
 - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- F. Exposed Cable Installation (only where specifically permitted):
 - 1. Route cables parallel or perpendicular to building structural members and surfaces.
 - 2. Protect cables from physical damage.
- G. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- H. Terminate cables using suitable fittings.
 - 1. Metal-Clad Cable (Type MC):
 - a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- I. Install conductors with a minimum of 6-inches (15 cm) of slack at each outlet.
- J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- K. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- L. Make wiring connections using specified wiring connectors.
 - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 - 3. Do not remove conductor strands to facilitate insertion into connector.
- M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced

conductors.

- N. Insulate ends of spare conductors using vinyl insulating electrical tape.
- O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- P. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.02 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
- D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

**SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Bonding and Equipment Grounding:
 - 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 - 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 - 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 - 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 - 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 - 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

- E. Communications Systems Grounding and Bonding:
 - 1. Provide bonding jumper in raceway from building grounding electrode system to each communications room or backboard and provide ground bar for termination.
 - a. Bonding Jumper Size: As indicated.
 - b. Raceway Size: 3/4 inch (21 mm) trade size unless otherwise indicated or required.
 - c. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
 - d. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
 - 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
 - 1. Use insulated copper conductors unless otherwise indicated.
- C. Connectors for Grounding and Bonding:
 - 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 - 2. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
 - 3. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
 - 4. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Ground Bars:
 - 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 - 2. Size: As indicated.
 - 3. Holes for Connections: As indicated or as required for connections to be made.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
- E. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - a. Applications:
 - 1) Pipe and equipment grounding conductor terminations.
- F. Identify grounding and bonding system components in accordance with Section 26 0553.

3.02 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Tests and Inspection: After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions
 - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.
 - a. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 - 3. Prepare test and inspection reports. Report measured ground resistances that exceed the following values:
 - a. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 - b. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
 - 4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.
 - 5. Grounding system will be considered defective if it does not pass tests and inspections.

END OF SECTION

**SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

- A. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- B. Section 26 0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- C. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. MFMA-4 - Metal Framing Standards Publication 2004.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 - 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
- C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 - 1. Comply with MFMA-4.
 - 2. Channel Material:
 - a. Galvanized steel.

3. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 13/16 inch (21 mm) height.
- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:
 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
 2. Concrete: Use preset concrete inserts or screw anchors.
 3. Solid or Grout-Filled Masonry: Use screw anchors.
 4. Hollow Masonry: Use toggle bolts.
 5. Hollow Stud Walls: Use toggle bolts.
 6. Steel: Use beam clamps complying with MSS SP-96.
 7. Sheet Metal: Use sheet metal screws.
 8. Wood: Use Fasten with lag screws or through bolts.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
 1. Strength and support assemblies: where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
 2. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
 3. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 4. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 5. Use slotted-channel racks attached to substrate to support equipment surface-mounted on hollow stud walls and nonstructural building surfaces.
 6. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 7. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 3000 and as specified in this section.
 8. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
 9. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.
 10. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.
- H. Secure fasteners according to manufacturer's recommended torque settings.

- I. Remove temporary supports.

END OF SECTION

**SECTION 26 0533.13
CONDUIT FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Intermediate metal conduit (IMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Flexible metal conduit (FMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.
- H. Liquidtight flexible nonmetallic conduit (LFNC).
- I. Surface Mounted Raceways
- J. Conduit fittings.
- K. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- D. Section 26 0529 - Hangers and Supports for Electrical Systems.
- E. Section 26 0533.16 - Boxes for Electrical Systems.
- F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit 2018.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2020.
- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit 2018.
- I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
- J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.
- K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.
- M. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
- N. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.
- O. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.

- P. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
- Q. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.
- R. UL 1242 - Electrical Intermediate Metal Conduit-Steel Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 1. Under Slab on Grade: Use rigid PVC conduit.
 2. Exterior, Direct-Buried: Use rigid PVC conduit.
 3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit minimum 6-inches below where emerging from underground.
 4. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
- D. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).
- E. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).
- F. Interior, Damp or Wet Locations: Use intermediate metal conduit (IMC).
- G. Exposed, interior, Located within finished spaces: Use Decorative Surface Mounted Raceway.
- H. Exposed, Interior, Not Subject to Physical Damage, Located within unfinished spaces(mechanical rooms/storage rooms): Use electrical metallic tubing (EMT).
- I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- J. Exposed, Exterior: Use galvanized steel rigid metal conduit.
- K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.
- L. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

2.02 CONDUIT REQUIREMENTS

- A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:

1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel.
3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- B. Fittings:
 1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel.
 3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil (1.02 mm).
- C. PVC-Coated Fittings:
 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil (1.02 mm).
- D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil (0.38 mm).

2.06 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- B. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel.

2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- B. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel.

2.08 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- B. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel.
 3. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.

2.09 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- B. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.10 SURFACE MOUNTED RACEWAYS

- A. Provide all components, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.
- D. Surface Metal Raceways: Listed and labeled as complying with UL 5.
- E. Surface Nonmetallic Raceways: Listed and labeled as complying with UL 5A.
- F. Multioutlet Assemblies: Listed and labeled as complying with UL 111.
 - 1. Color: To be selected by architect prior to product order.
 - 2. Accessory Device Boxes: Suitable for the devices to be installed; color to match raceway.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.
- H. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated without specific routing, determine exact routing required.
 - 3. Conceal all conduits unless specifically indicated to be exposed.
 - 4. Install raceways square to enclosures and terminate with locknuts.
 - 5. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - c. Within joists in areas with no ceiling.
 - 6. Unless otherwise approved, do not route conduits exposed:
 - a. Across floors.
 - b. Across roofs.
 - c. Across top of parapet walls.
 - d. Across building exterior surfaces.
 - 7. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.

8. Arrange conduit to maintain adequate headroom, clearances, and access.
 9. Arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
 10. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
 11. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
 12. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:
 - a. Heaters.
 - b. Hot water piping.
 - c. Flues.
 13. Arrange stub-ups so curved portions of bends are not visible above finished grade.
- I. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 4. Support conduits within 12 inches of connected enclosure.
- J. Connections and Terminations:
1. Use approved conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 3. Use suitable adapters where required to transition from one type of conduit to another.
 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 5. Terminate threaded conduits in boxes and enclosures using threaded hubs for dry locations and raintight hubs for wet locations.
 6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
 7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
 8. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- K. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 4. Conceal bends for conduit risers emerging above ground.
 5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
 6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
 8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- L. Underground Installation:

1. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length.
 2. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
- M. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 3. Where conduits are subject to earth movement by settlement or frost.
- N. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
 3. Where conduits penetrate coolers or freezers.
- O. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.
- P. Provide grounding and bonding in accordance with Section 26 0526.
- Q. Surface Raceway Installation:
1. Install surface raceway with a minimum 2-inch radius control at bend points.
 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section.
 3. Support raceway according to manufacturers written instructions. Tape and glue are not acceptable support methods.

3.02 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- D. Correct deficiencies and replace damaged or defective conduits.

3.03 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.04 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

**SECTION 26 0533.16
BOXES FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).

1.02 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- D. Section 26 0529 - Hangers and Supports for Electrical Systems.
- E. Section 26 0533.13 - Conduit for Electrical Systems:
 - 1. Conduit bodies and other fittings.
- F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 2726 - Wiring Devices:
 - 1. Wall plates.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013 (Reaffirmed 2020).
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- I. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 2. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
 - 3. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
 - 4. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
 - 5. Coordinate the work with other trades to preserve insulation integrity.

6. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
7. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:
 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 2. Use cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 3. Use raised covers suitable for the type of wall construction and device configuration where required.
 4. Use shallow boxes where required by the type of wall construction.
 5. Do not use "through-wall" boxes designed for access from both sides of wall.
 6. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 7. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 8. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 9. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 10. Minimum Box Size, Unless Otherwise Indicated:
 - a. 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size
 11. Wall Plates: Comply with Section 26 2726.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 - a. Outdoor Locations: Type 4 Stainless Steel.
 - b. Wet or Damp locations: Type 4 Stainless Steel.
 3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
 - a. Provide lockable hinged covers, all locks keyed same as panelboards unless otherwise indicated.
 - b. Back Panels: Painted steel, removable.
 5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
 - 1. Mount at heights indicated on drawings. If mounting heights are not individually indicated, Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
 - 2. Unless dimensioned, box locations indicated are approximate.
 - 3. Locate boxes so that wall plates do not span different building finishes.
 - 4. Locate boxes so that wall plates do not cross masonry joints.
 - 5. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 - 6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.
 - 7. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
- I. Box Supports:
 - 1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
 - 4. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
 - 5. Do not support boxes by conduit alone.
- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:
 - 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
 - 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 - 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.
- L. Install boxes as required to preserve insulation integrity.
- M. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- N. Close unused box openings.

- O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- P. Provide grounding and bonding in accordance with Section 26 0526.
- Q. Identify boxes in accordance with Section 26 0553.

3.02 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.03 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 0533.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface raceway systems.
- B. Wireways.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0533.13 - Conduit for Electrical Systems.
- D. Section 26 0533.16 - Boxes for Electrical Systems.
- E. Section 26 2726 - Wiring Devices: Receptacles.
- F. Section 27 1000 - STRUCTURED CABLING: Voice and data jacks.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 5 - Surface Metal Raceways and Fittings Current Edition, Including All Revisions.
- D. UL 111 - Outline of Investigation for Multioutlet Assemblies Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
 - 1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS

- A. Provide all components, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.02 SURFACE RACEWAY SYSTEMS

- A. Manufacturers:
 - 1. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/ sle.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Surface Metal Raceways: Listed and labeled as complying with UL 5.
- C. Multioutlet Assemblies: Listed and labeled as complying with UL 111.
- D. Type 700 - Surface Raceway System:
 - 1. Raceway Type: Single channel, Galvanized Steel, Manufacturer standard enamel finish..
 - 2. Length: As required to serve field devices shown on plans..
 - 3. Color: To be selected by Architect.
 - 4. Accessory Device Boxes: Suitable for the devices to be installed; color to match raceway.

5. Integrated Device Provisions:
 - a. Receptacles:
 - 1) Comply with Section 26 2726.
 - 2) Configuration: As indicated on the drawings.
 - 3) Color: Match raceway.
 - 4) Spacing: As indicated on the drawings.
 - b. Communications Outlets:
 - 1) Voice and Data Jacks: As specified in Section 27 1000.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.
- B. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 APPLICATION

- A. Unless indicated on drawings, provide surface mounted raceway, plug strips, or wireways only where specifically indicated or approved:
 1. Surface Raceway: Provide for indoor locations within renovated spaces, finished or normally occupied.

3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install raceways plumb and level.
- D. Surface Raceway:
 1. Install surface raceway with a minimum 2-inch radius control at bend points.
 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- E. Secure and support raceways in accordance with Section 26 0529 at intervals complying with NFPA 70 and manufacturer's requirements.
- F. Close unused raceway openings.
- G. Provide grounding and bonding in accordance with Section 26 0526.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect raceways for damage and defects.
- C. Surface Raceway Systems with Integrated Devices: Test each wiring device to verify operation and proper polarity.
- D. Correct wiring deficiencies and replace damaged or defective raceways.

3.05 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 PROTECTION

- A. Protect installed raceways from subsequent construction operations.

END OF SECTION

**SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Floor marking tape.

1.02 RELATED REQUIREMENTS

- A. Section 26 2726 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.
- B. Section 27 1000 - STRUCTURED CABLING: Identification for communications cabling and devices.

1.03 REFERENCE STANDARDS

- A. ANSI 535.2 - American National Standard for Environmental and Facility Safety Signs 2011 (Reaffirmed 2017).
- B. ANSI 535.4 - American National Standard for Product Safety Signs and Labels 2011 (Reaffirmed 2017).
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.
- B. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components. Provide unique identification for all branch loads served.
 - a. Panelboards:
 - 1) Use typewritten circuit directory in location provided by panelboard manufacturer to identify load(s) served for panelboards with a door. Identify spares and spaces.
 - b. Enclosed switches, circuit breakers, and motor controllers:
 - c. Time Switches:
 - 1) Identify load(s) served and associated circuits controlled. Include location.
 - d. Enclosed Contactors:
 - 1) Identify load(s) and associated circuits controlled. Include location.
 - e. Centralized Emergency Lighting Inverters:
 - f. Transfer Switches:
 - 1) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
 - 2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.

3. Emergency System Equipment:
 - a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
 - b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
 4. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
- C. Identification for Conductors and Cables:
1. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - a. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
 - 1) Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
 - 2) Colors for 208/120-V Circuits:
 - (a) Phase A: Black.
 - (b) Phase B: Red.
 - (c) Phase C: Blue.
 - 3) Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
 2. Identification for Communications Conductors and Cables: Comply with Section 27 1000.
 3. Use underground warning tape to identify direct buried cables.
- D. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
 2. Use identification labels to identify circuits enclosed.
 - a. For exposed boxes in public areas, use only identification labels.
- E. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 27 1000.
 2. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.
 3. Use identification label to identify serving branch circuit for all receptacles.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - a. Use only for indoor locations.
 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- B. Format for Equipment Identification:
1. Minimum Size: 1.5 inches (38 mm) by 3 inches (76 mm).
 2. Legend:
 - a. System designation where applicable:
 - 1) Emergency Power System: Identify with text "EMERGENCY".
 - 2) Fire Alarm System: Identify with text "FIRE ALARM".
 - b. Equipment designation or other approved description.
 - c. Other information as indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height:
 - a. System Designation: 1/2 inch (13 mm).
 - b. Equipment Designation: 1/2 inch (13 mm).
 - c. Other Information: 1/4 inch (6 mm).

5. Color:
 - a. Normal Power System: White text on black background.
- C. Format for Receptacle Identification:
 1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
 2. Legend: Power source and circuit number or other designation indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch (5 mm).
 5. Color: Black text on clear background.

2.03 VOLTAGE MARKERS

- A. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- B. Minimum Size:
 1. Markers for Equipment: 1 1/8 by 4 1/2 inches (29 by 110 mm).
 2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches (29 by 110 mm).
 3. Markers for Junction Boxes: 1/2 by 2 1/4 inches (13 by 57 mm).
- C. Legend:
 1. Markers for Voltage Identification: Highest voltage present.
 2. Markers for System Identification:
 - a. Emergency Power System: Text "EMERGENCY".
- D. Color: Black text on orange background unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, drawings, shop drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout project.
- C. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 1. Interior Components: Legible from the point of access.
 2. Boxes: Outside face of cover.
 3. Conductors and Cables: Legible from the point of access.
 4. Devices: Outside face of cover.
- D. Install identification products centered, level, and parallel with lines of item being identified.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Unless labels and nameplates are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
- G. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles, fingerprints, or wrinkles and ensure edges are properly sealed.
- H. Conductors to be Extended in the Future: Attach write-on tags to conductors and list source.
- I. Equipment To Be Labeled:
 1. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
 2. Enclosures and electrical cabinets.
 3. Access doors and panels for concealed electrical items.

4. Emergency system boxes and enclosures.
5. Push-button stations.
6. Remote-controlled switches, dimmer modules, and control devices.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 2726 WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Receptacles.
- C. Wall plates.

1.02 RELATED REQUIREMENTS

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0533.16 - Boxes for Electrical Systems.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2014h, with Amendments (2017).
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification) 2014g, with Amendment (2017).
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2020).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2021.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.
- K. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
 - 3. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 - 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. Do not use combination switch/receptacle devices.

2.02 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: Ivory with stainless steel wall plate, Verification during submittal process.

2.03 MODULAR CONNECTORS

- A. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranded building wire.
 - 2. Devices shall comply with the requirements in this Section.

2.04 MANUFACTURERS

- A. Hubbell Incorporated: www.hubbell.com/ sle.
- B. Leviton Manufacturing Company, Inc: www.leviton.com/ sle.
- C. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/ sle.
- D. Eaton(Arrow Hart).
- E. Substitutions: See Section 01 6000 - Product Requirements.

2.05 SOURCE LIMITATIONS

- A. Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.06 PRODUCT GRADE

- A. Receptacles: Unless indicated otherwise, Industrial specification grade.
- B. Switches: Unless indicated otherwise, Industrial specification grade.

2.07 WALL SWITCHES

- A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- B. Standard Wall Switches: 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.08 RECEPTACLES

- A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
- B. Convenience Receptacles:
 - 1. Standard Convenience Receptacles: 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.

2.09 WALL PLATES

- A. Wall Plates: Comply with UL 514D.
 - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 - 2. Size: Standard.
 - 3. Screws: Metal with slotted heads finished to match wall plate finish.
- B. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel unless indicated otherwise by architect during submittal process.

PART 3 EXECUTION

3.01 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130.
- B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section. Unless otherwise indicated, measurements are to center line of device.
 - 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switches: 46" (1168 mm) above finished floor.
 - b. Receptacles: 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter where indicated.
 - 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - 3. Where multiple receptacles or wall switches are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
 - 4. Locate wall switches on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.
 - 4. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 5. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
 - d. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- I. Install wall switches with OFF position down.
- J. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- K. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- L. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- M. Identify wiring devices in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch with circuit energized to verify proper operation.
- D. Test each receptacle to verify operation and proper polarity.
 - 1. Line voltage: Acceptable range is 105 to 132 V.
 - 2. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 3. Voltage Drop: For branch circuits, a value of 3 percent or higher is unacceptable.
- E. Correct wiring deficiencies and replace damaged or defective wiring devices.
- F. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete

3.04 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.05 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

**SECTION 27 0000
GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Division 27 Specifications are provided to define the standards and criteria to be used to bid, plan, furnish, install, test, and document communication systems for 4J Multi-Site High School Facilities. These specifications shall form the basis for implementation of the procurement, installation, inspection, and close-out process.
- B. Division 27 has been designed and developed based on NFPA 70 (NEC), National Electrical Safety Code (NESC), Institute of Electronic and Electrical Engineers (IEEE), and a combination of ANSI/TIA Telecommunication Standards, and BICSI methodologies. The requirements within those documents are not superseded herein unless specifically stated. NEC and NESC code requirements are unable to be superseded by this document at any time. ANSI/TIA standards and BICSI methodologies are guidelines and recommendations for best practices and may be superseded, as specified, or may be made more stringent by this document.
- C. Any use of the word "shall" marks a mandatory requirement. Use of the word "may" or "should" suggests optional elements. All conflicts within this document shall be resolved by the General Contractor in consultation with the Design Team. The standards of OWNER'S NAME shall take precedence in the resolution of any dispute.
- D. Unauthorized changes and/or deviations from these specifications, regardless of scale, may result in re-design, reconstruction, or re-installation of communications elements at the contractor's expense. Contractors shall obtain formal written approval prior to bidding and prior to installation in order to deviate from these specifications or from ANSI/TIA standards and BICSI methodologies. Contractors shall not deviate from NEC and NESC requirements.
- E. Division 27 Specifications address information transport pathways, multiple different types of communication systems, spaces, media, grounding, identification, testing, and documentation requirements in support of multiple information transport infrastructures.
- F. Specific responsibilities of Division 27 include, but are not limited to:
 - 1. Installation of the intra-building pathways, cabling, and coordinating space requirements necessary to house the communication systems and associated electronic information transport equipment. Pathways and spaces shall be provided to support the known systems and cabling requirements, as well as provisions for those that may be required in the future for growth purposes.
 - 2. The procurement and installation of each communications system and the associated components and cabling to create a fully functional system.
 - 3. Thorough testing shall be conducted of each individual communications system to illustrate compliance with specific performance requirements.
 - 4. Definition and establishment of administration and labeling schemes, conforming to Owner's requirements.
 - 5. Securing all necessary permits and licenses, payment of all fees, and provision of all construction work notifications.
 - 6. Compliance with all applicable laws, ordinances, rules, and regulations.
 - 7. Mandatory project manager attendance at a weekly project status meeting with the General Contractor.
 - 8. It is the intent of the project drawings and specifications to provide complete and fully functional Division 27 communication systems, ready for use. Any item, not specifically shown in the project drawings or called for in the project specifications but normally required for a complete system, is to be considered a part of this contract.
- G. System Continuity:
 - 1. Reconnect all existing items that remain in use. Provide all materials and labor required to retain continuity of existing circuits or systems that are disrupted by these alterations even though not indicated on the drawings.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 & 01 Specification Sections, apply to this Section.
- B. The following documents shall also be considered as a part of and shall relate directly to this section:
 - 1. Section 27 0505 - SELECTIVE DEMOLITION OF COMMUNICATIONS SYSTEMS
 - 2. Section 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
 - 3. Section 27 0528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS
 - 4. Section 27 0536 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
 - 5. Section 27 0544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING
 - 6. Section 27 0553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
 - 7. Section 27 1116 - COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES
 - 8. Section 27 1300 - COMMUNICATIONS BACKBONE CABLING
 - 9. Section 27 1500 - COMMUNICATIONS HORIZONTAL CABLING
 - 10. Section 27 4100 - AUDIO-VISUAL SYSTEMS
 - 11. Section 274133 - MASTER ANTENNA TELEVISION SYSTEM
 - 12. Section 275116 - PUBLIC ADDRESS SYSTEMS
 - 13. Section 27 5313 - CLOCK SYSTEMS

1.03 ABBREVIATIONS AND ACRONYMS

- A. The following definitions are applicable to the work as indicated and as shown herein:
 - 1. Amplifier: (CATV) A device that boosts the strength of a CATV signal.
 - 2. ACR: Attenuation-to-Crosstalk Ratio
 - 3. ADA: Americans with Disabilities Act
 - 4. AFF: Above Finished Floor
 - 5. ANSI: American National Standards Institute
 - 6. APC: Angle Physical Connector
 - 7. ASTM: American Society for Testing & Materials (ASTM International)
 - 8. AWG: American Wire Gauge
 - 9. BCT: Bonding Conductor for Telecommunications
 - 10. BET: Building Entrance Terminal
 - 11. BICSI: Building Industry Consulting Service International, Inc.
 - 12. BTU: British Thermal Unit
 - 13. CATV: Community Antenna Television (Cable Television)
 - 14. dB: Decibel
 - 15. dBmV: Decibel Millivolt
 - 16. EF: Entrance Facility
 - 17. EIA: Electronic Industries Association
 - 18. ELFEXT: Equal Level Far-End Crosstalk
 - 19. EMC: Electromagnetic Compatibility
 - 20. EMI: Electromagnetic Interference
 - 21. EMT: Electrical Metallic Tubing
 - 22. ER: Equipment Room
 - 23. FCC: Federal Communications Commission
 - 24. FD: Floor Distributor
 - 25. FEXT: Far-End Crosstalk
 - 26. F/FTP: Overall foil screened cable with foil screened twisted pair.
 - 27. F/UTP: Overall foil screened cable with unshielded twisted pair.
 - 28. FTP: Shielded twisted pair.
 - 29. FOTP: Fiber Optic Test Procedure
 - 30. Freq: Frequency

31. GE: Grounding Equalizer (replacing TBBIBC)
32. HC: Horizontal Cross-Connect
33. HH: Hand Hole
34. HVAC: Heating, Ventilation, and Air Conditioning
35. Hz: Hertz
36. IC: Intermediate Cross-Connect
37. IDC: Insulation Displacement Connector
38. IDF: Intermediate Distribution Frame
39. IMC: Intermediate Metal Conduit
40. IEEE: Institute of Electrical and Electronics Engineers
41. ISO: International Organization for Standardization
42. LAN: Local Area Network
43. LC: Lucent Connector
44. LCD: Liquid Crystal Display
45. Mbps: Megabits per second
46. MC: Main Cross-Connect
47. MDF: Main Distribution Frame
48. MHz: Megahertz
49. MM: Multimode
50. NEC: National Electrical Code, NFPA 70
51. NESC: National Electric Safety Code
52. NFPA: National Fire Protection Association
53. NRTL: Nationally Recognized Testing Laboratory
54. OSHA: Occupational Safety and Health Administration
55. OSP: Outside cable Plant
56. OTDR: Optical Time Domain Reflectometer
57. OLTS: Optical Loss Test Set
58. PR: Pair
59. RCDD: Registered Communications Distribution Designer
60. RFI: Radio Frequency Interference
61. RH: Relative Humidity
62. RMC: Rigid Metallic Conduit
63. RNC: Rigid Non-Metallic Conduit
64. S/FTP: Overall braid screened cable with foil screened twisted pair
65. S/UTP: Overall braid screened cable with unshielded twisted pair
66. SC: Subscriber Connector
67. SE: Service Entrance
68. SFP: Small Form-Factor Pluggable Transceiver
69. SM: Single Mode
70. TBB: Telecommunication Bonding Backbone
71. TBBIBC: Telecommunications Bonding Backbone Interconnecting Bonding Conductor
72. TGB: Telecommunications Grounding Bus Bar
73. TIA: Telecommunications Industry Association
74. TMGB: Telecommunications Main Grounding Bus Bar
75. TO: Telecommunications Outlet
76. TR: Telecommunications Room
77. TV: Television
78. UL: Underwriters Laboratory
79. UPS: Uninterruptible Power Supply
80. WAO: Work Area Outlet
81. WAP: Wireless Access Point
82. UTP: Unshielded Twisted Pair

1.04 DEFINITIONS

- A. The following definitions are applicable to the work as indicated and as shown herein:
1. Amplifier: (CATV) A device that boosts the strength of a CATV signal.
 2. APC: Angle Physical Connector - An optical fiber connector that is polished at an angle of 8 to 10 degrees to reduce the back reflection of the signal.
 3. Attenuation: The decrease in power of a signal, light beam, or light wave, either absolutely or as a fraction of a reference value. Attenuation is the opposite of gain and is measured in decibels (dB).
 4. Backbone System: The cabling and connecting hardware that provides interconnection between Telecommunications Rooms, Equipment Room, and Entrance Facilities.
 5. BCT: Bonding Conductor for Telecommunications - A conductor that interconnects the building's service equipment (power ground) to the telecommunications grounding system.
 6. BET: Building Entrance Terminal - Cable termination equipment used to terminate outside plant (OSP) cables at or near the point of building entry.
 7. Coaxial Cable: A cable composed of an insulated central conducting wire wrapped in another cylindrical conducting wire and then wrapped in another insulating layer and an outer protecting layer.
 8. Conduit Chase Pipe: Short section of bushed EMT conduit with sufficient size and capacity to support horizontal cabling bundles from ceiling space, through ceiling tile, onto the ladder tray system connecting wall to rack or cabinet.
 9. Cross Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
 10. dBmV: (CATV) A signal measurement whereby 0 dBmV equals 1000 microvolts across 75 ohms. A recommended signal level for a TV to receive is 10 dBmV.
 11. Design Team: A group of individuals comprised of Architect(s) and Engineer(s) involved in assembling the contract documents known as the drawings and specifications.
 12. Distribution Amplifier: (CATV) A device that provides several isolated outputs from one looping or bridging input and has a sufficiently high input impedance and input-to-output isolation to prevent loading of the input source.
 13. EF: Entrance facility - A location within a building for both public and private network service cables. A facility that provides all necessary mechanical and electrical services for the entry of telecommunications cables into a building and that complies with all relevant regulations. Also referred to as SE: Service Entrance.
 14. ER: Equipment Room - A centralized space designed for telecommunications equipment that serves the occupants of a building. Equipment therein is considered distinct from an IDF (Telecommunications Room) because of its nature or complexity. Also frequently referred to as MCR or MDF.
 15. F-Connector: (CATV) The final piece of hardware on a cable designed for CATV or DBS or other signal distribution applications. It is cylindrical with a center pin protruding out, that plugs into the set-top box, cable ready TV, satellite receiver, or VCR.
 16. Fusion Splicing: An optical fiber splicing method that consists of two clean (stripped of coating) cleaved fibers then joining them and fusing the ends together with an electric arc.
 17. GE: Grounding Equalizer - A conductor that interconnects elements of the telecommunications grounding infrastructure (formerly Telecommunications Bonding Backbone Interconnecting Bonding Conductor).
 18. Head end: (CATV) A CATV systems control center where incoming signals from satellites and other sources are fed into a distribution system. The originating point of a signal in CATV systems.
 19. Horizontal System: The cabling between, and including, the TO (Telecommunications Outlet) connector and the HC (Horizontal Cross-connect) in the Telecommunications Room.
 20. HC: Horizontal Cross-Connect - A group of connectors, such as patch panel or punch down block, that allows equipment and backbone cabling to be cross-connected with patch cords or jumpers. Floor Distributor (FD) is the international term for HC. Also

frequently referred to as IDF.

21. Jack: Also commonly called an “outlet”, it is the fixed, female connector.
22. J-Hook: A supporting device for horizontal cables that is shaped like a “J”. It is attached to some building structures. Horizontal cables are laid in the opening formed by the “J” to provide support for cables.
23. LC: Lucent Connector - A small form factor (SFF) single fiber, optical fiber connector used for the termination of both multimode and single mode optical fiber cables. The housing mechanism of the LC connector (simplex and duplex) is a push-pull type connection.
24. Minor Pathway Support Hardware: Anchors, support brackets, clamps, clips, cable ties, D-rings, rack screws, velcro straps and etc. used to dress and secure cabling, conduits and surface raceways.
25. Modulator: (CATV) The electronic equipment required to combine video and audio signals and convert them to TV radio frequencies (RF) for distribution to other equipment (including televisions) on a CATV system.
26. Multimode Optical Fiber: Optical fiber with a core diameter of 50 or 62.5 micron (micrometer) and a cladding diameter of 125 micron; light wave propagation allows many modes within multimode fiber. Also abbreviated as MM or FOMM.
27. OTDR: Optical Time Domain Reflectometer - An instrument that measures transmission characteristics by sending a series of short light pulses down an optical fiber element/strand and provides a graphic representation of the backscattered light.
28. OLTS: Optical Loss Test Set - A tool, consisting of a stabilized light source and optical power meter, that directly measures loss by computing the difference between the optical power entering a fiber element/strand and the optical power exiting it.
29. Plug: Also commonly called a “connector”, it is the removable, male telecommunications connector.
30. RF: Radio Frequency - The area (or band) of the electromagnetic spectrum where most radio communication takes place, typically from 100 KHz to 100 GHz. A frequency at which coherent electromagnetic radiation of energy is useful for communication purposes. Analog electrical signals sent on cable or over the air. Conventional (broadcast) television and radio, as well as cable TV, deliver RF signals to your television/radio.
31. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
32. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
33. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
34. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
35. SC: Subscriber Connector - An “full-size” optical fiber connector used for the termination of both multimode and single mode optical fiber cables (both simplex and duplex), having a square front profile with push-pull latching mechanism.
36. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
37. SE: Service Entrance - An entrance to a building for both public and private network service cables. A facility that provides all necessary mechanical and electrical services for the entry of telecommunications cables into a building and that complies with all relevant regulations. Also referred to as EF: Entrance Facility.
38. Shield: A metallic layer, either a foil or braid, placed around a group of conductors.
39. Single Mode Optical Fiber: Optical fiber with a relatively small core diameter of 8-9 micron (micrometer) and a cladding diameter of 125 micron; light wave propagation is restricted to a single path, or mode, in single mode optical fiber. Also abbreviated as SM or FOSM.
40. Splice: A joining of conductors meant to be permanent. A device that joins conducting or transmitting media. Also referred to as straight splice.
41. Splice Case: A metal or plastic housing with a semi-cylindrical cavity used to clamp around a cable splice, providing a closure.

42. Splitter: (CATV) A passive device that takes a signal and splits it into two or more lower-level output signals.
43. Tap: (CATV) A device used on community antenna television cables for matching impedance and connecting service drops.
44. TBB: Telecommunications Bonding Backbone - A copper conductor used to connect the Telecommunications Main Grounding Busbar (TMGB) to the Telecommunications Grounding Busbar (TGB).
45. TE: Telecommunications Enclosure - A case or housing for telecommunications cable terminations and cross-connect cabling.
46. TGB: Telecommunications Grounding Bus Bar - A common point of connection for telecommunications system and equipment bonding to ground and located in the telecommunications room or equipment room.
47. TMGB: Telecommunications Main Grounding Bus Bar - A bus bar placed in a convenient and accessible location and bonded, by means of the bonding conductor for telecommunications, to the building service equipment (power) ground.
48. TO: Telecommunications Outlet - A device placed at the user workstation for termination of horizontal media and for connectivity of network equipment. Also referred to as WAO (Work Area Outlet).
49. Transition Splice: A planned splice point, at the building entrance, used to transition from non-rated outdoor to indoor-rated cable designs.
50. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.
51. WAO: Work Area Outlet - A device placed at the user workstation for termination of horizontal media and for connectivity of network equipment. Also referred to as TO (Telecommunications Outlet).

1.05 CODE REFERENCES AND STANDARDS

- A. All work shall be in compliance with the following codes and agencies. Nothing contained within these specifications shall be misconstrued to permit work not in conformance with the most stringent of applicable codes and standards. It is assumed that bidders have access to, and specific knowledge of, the listed reference materials in order to ensure conformity with them.
 1. National Electrical Code (NEC)
 2. National Electrical Safety Code (NESC)
 3. National Fire Protection Association (NFPA)
 4. International Building Code (IBC)
 5. Federal, State, and Local Codes.
 6. National Electronic Manufacturer's Association (NEMA)
 7. Institute of Electronic and Electrical Engineers (IEEE)
 8. American National Standards Institute/ Industries Association Telecommunication/ Electronic Industries Association (ANSI/TIA/EIA)
 9. Occupational Safety & Health Administration (OSHA)
 10. Federal Communications Commission (FCC)
- B. All new materials, equipment, and installation practices shall meet the requirements of the following standards, unless specifically instructed otherwise by the Design Team.
 1. TIA-455-C Requirements for Standard Test Procedures for Optical Fibers (August 2014)
 2. TIA-526-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (July 2015)
 3. TIA-526-14-C - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant (April 2015)
 4. TIA-568.0-D - Generic Telecommunications Cabling for Customer Premises (December 2015, July 2017 addendum)
 5. TIA-568.1-D - Commercial Building Telecommunications Infrastructure Standard (September 2015, March 2018 addendum)
 6. TIA-568.3-D - Optical Fiber Cabling and Components Standard (October 2016, January 2019 addendum)

7. TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards (August 2009)
8. TIA-569-E - Telecommunications Pathways and Spaces (May 2019)
9. TIA-598-D, Optical Fiber Cable Color Coding (July 2014)
10. TIA-606-C - Administration Standard for Telecommunications Infrastructure (June 2017)
11. TIA-607-C - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (November 2015)
12. NFPA 70 - National Electric Code (NEC)
13. BICSI - Telecommunications Distribution Methods Manual 13th, or most recent, edition.
14. BICSI - Information Transport Systems Installation Manual 7th, or most recent, edition
15. Federal, State, and local codes, rules, regulations, and ordinances.
 - a. Perform all work in accordance with local jurisdiction requirements that is governing the work and as fully part of the specifications attached.

1.06 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing: Ensure that any wide area network, telephone service, and internet service connectivity cutover is achieved in a coordinated and orderly manner.
- B. All Division 27 Contractor Project Managers shall schedule and conduct a coordination meeting with OWNER'S NAME Information Technology Department to confirm and coordinate scope of work requirements prior to commencement of work. Project meetings shall be scheduled through the General Contractor.

1.07 SUBMITTALS

- A. Refer to Division 1 for exact submittal procedures.
- B. The Division 27 Contractor shall provide for review, without exception prior to material acquisition and installation, the following items. Failure to submit required items shall disqualify the bidder.
 1. Product Data Sheets (Catalog Cuts)
 2. Backbone Diagram
 3. Riser Diagram
 4. Cabling Diagram
 5. System Schematics
 6. Signal Flow Diagram
 7. Dimensioned plans, sections and elevations and fabrication details.
 8. Specification Sheets for Test Equipment
 9. Bill of Materials
 10. Contracting Firm Qualifications and Certifications
 11. Installation Team Qualifications by Individual
 12. Current Manufacturer Certifications
- C. Provide prior to completion:
 1. Cable data base listing patch panel station cable assignments. Database shall be provided on compact disc or other electronic media format when requested by the General Contractor, OWNER'S NAME or the Design Team. Database shall be submitted to the requesting party within seven (7) calendar days.
 2. Cable administration drawings, as requested to assist in the planning process. Drawings will be requested prior to final documentation.
- D. Provide at completion of each construction phase area:
 1. Cable test and certification reports; summary hard copy or full test results on digital media when requested by the owner or design team. Reports shall be submitted to the requesting party within seven (7) calendar days.
 2. One (1) set of record drawings of the actual installation of the Division 27 systems. Drawings shall be given as full size originals and on disk in AutoCAD format

- E. Provide at final completion Closeout Submittals. This shall consist of three (3) bound sets of O&M (Operating and Maintenance) Manuals formatted as defined by Division 1 and one (1) electronic copy provided on digital media. Each copy of the O&M Manual shall include, at minimum, items listed as follows:
 - 1. Cable test and certification reports; summary hard copy and full test results on digital media. Test results shall be delivered at the completion of each project phase and at any time when called for by the Owner.
 - 2. Provide one (1) full-size hard copy set of record drawings (as-builts) to be submitted to the Design Team for approval, immediately upon completion of the installation.
 - 3. Instruction manuals including equipment and schedules, operating instructions, and manufacturer's instructions.
 - 4. Manufacturer Warranty Certificate.
 - a. Warranty contacts including but not limited to names, telephone numbers (office and mobile).
 - 5. Networked Devices
 - a. Provide the owner a list of all networked devices including all IP addresses and passwords for devices and managing software.

1.08 QUALITY ASSURANCE

- A. Contracting firm shall constitute a company with a minimum of five (5) years successful installation experience with projects utilizing infrastructure and systems work similar to that required for this project.
- B. Service Qualifications: Installing and servicing contractor shall have a permanent office within a 120-mile radius of the project site.
- C. Cabling Contractor shall have at least one (1) Registered Communications Distribution Designer and installers with Installer-level BICSI Certifications on staff responsible for this project. Provide copies of these certificates in the submittal process.
- D. Work crew, not involved in installing cable elements (e.g. laborers delivering/moving materials, installing grounding by an electrician, or workers installing pathway elements) do not require BICSI or manufacturer certification or registration.
- E. Contractor shall provide a Manufacturer Certification for the system solution bid, issued directly in the bidder's company name, valid for the time frame in which the installation will be completed. Contractor shall be manufacturer certified in order to participate in the bid event.
- F. The contractor shall be knowledgeable in local, state, regional, and national codes and regulations. All work shall comply with the latest revision of codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall apply.
- G. Only installers trained and certified by the proposed manufacturer shall be allowed to install products. Installers must possess the highest level of certification available by the manufacturer for the specific solution being installed.
- H. Only installers trained and certified by the proposed manufacturer shall be allowed to install firestop products.
- I. Only installers trained and certified by the proposed manufacturer shall be allowed to terminate and test optical fiber. Others specified above may pull/ place optical fiber cable under the supervision of an installer trained and certified by the manufacturer.
- J. Before bidding, the contractor shall study and compare all contract documents and promptly notify the Design Team of any discrepancies or deficiencies discovered by or made known to the contractor.
- K. Discrepancies: Whenever a discrepancy or inconsistency exists between related information indicated on the contract drawings and/or specifications, this contractor shall obtain additional clarification and direction from the Design Team before proceeding. For bidding purposes, this contractor shall include the labor and materials necessary to comply with the solution that

results in the greatest cost to the contract.

1. If there is a conflict between applicable documents, then the more stringent requirement shall apply.
 2. The failure to question any controversial item will constitute acceptance by the bidder who shall execute it to the satisfaction of the owner after being awarded the contract.
- L. Deficiencies: The contractor and associated subcontractors shall resolve all known deficiencies and omissions, including non-compliance with applicable codes, with the Design Team prior to ordering materials or proceeding with the work. Any work performed prior to receipt of instructions from the Design Team will be done so at the contractor's risk.
1. If mention has been omitted pertaining to details, items or related accessories required for the completion of any system, it is understood such item and accessories are included in the contract. After the contract is awarded, claims based on insufficient data or incorrectly assumed conditions, or claims based on misunderstanding the nature of the work, will not be recognized.
 2. All devices, symbols and work illustrated shall be new work provided under this contract except work labeled existing to remain and equipment labeled to be furnished (or supplied) by others but installed by this contractor.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Equipment, materials, and supplies shall be shipped, handled and stored in ways that shall prevent damage to the items.
- B. All items shall be handled and stored as recommended by the manufacturer.
- C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under manufacturer's specified conditions, and free from damage or deterioration.
- D. Equipment, materials, and supplies to be incorporated in the area of work shall be new unless otherwise specified.
- E. Equipment, materials, and supplies shall be produced in a good workmanlike manner.
- F. When the quality of a material, process, or article is not specifically set forth in the Drawings or Specifications, the best available quality of the material, process, or article shall be provided.

1.10 PROJECT CONDITIONS

- A. Conditions and Measurements: Visit the jobsite to verify installation conditions and confirm measurements for all required systems and associated cabling connectivity.

1.11 WARRANTY

- A. The Contractor shall submit, in the bid documents, any additional contractor-specific warranties or guarantees to be offered on the project.
- B. The Contractor shall supply any and all necessary documentation needed to process and record the warranty(s) and to verify the installation solution.
- C. Data Cabling System Warranty
 1. All cabling systems shall include a minimum twenty-five (25) year application assurance warranty as a manufacturer registered system installation. During the warranty period, and for non-conformities of which contractor has notice, contractor shall take all necessary and appropriate action; free of charge, to correct any non-conformity with the warranties contained in the manufacturer agreement. During the warranty period, contractor shall provide to the Owner, free of costs and charges, all support necessary to ensure that the cabling system meets the requirements specified in this document and performance guarantees provided by the contractors. During the warranty period, contractors shall furnish, or cause to be furnished, all maintenance, service, parts and replacements necessary to maintain the cabling system in good working condition, at no cost to the Owner.

2. The contractor shall supply a full manufacturer's application assurance warranty for all new installations, to include approved termination hardware and cabling media from the proposed manufacturer's list of approved materials. Services to be provided by this contractor to the Owner during the warranty period shall include, without limitation, the following:
 - a. Remedial Maintenance
 - 1) Contractor shall provide service on the Owner's site as necessary including, but not limited to, fault isolation, diagnosis, and repair.
 - b. Maintenance Records
 - 1) Contractor shall maintain, at the jobsite, a current record of the cabling system configuration.
 - c. Replacement Parts
 - 1) Contractor shall provide and install replacement parts, including new components.
- D. All Other Communications Systems Warranty
 1. Unless listed elsewhere within these specifications, a warranty shall be provided for a minimum of one (1) year for all other communications systems listed. One year shall begin from the date of Substantial Completion. This warranty shall cover both product and service to address remedial maintenance and replacement parts as is appropriate to keep each system complete and fully functional.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. If a Bidder proposes to Substitute an article, device, material, equipment, form of construction, fixture, or item other than the approved manufacturers and part numbers, listed and named in the Specifications, the Bidder shall certify that the proposed item is equal in quality and all aspects of performance and appearance, to the items specified. The Bidder shall submit a request for Substitution to the Design Team by following the instruction in Specification Section 01 6000, which must include:
 1. The name and complete description of the proposed Substitution including Drawings, performance and test data, and other information necessary for a complete evaluation; and
 2. A statement setting forth any changes that the Proposed Substitution will require in the Contract Documents or the project.
- B. If the Design Team approves the Proposed Substitution, the Design Team shall issue an Addendum. If the Design Team does not approve the substitution, the Design Team shall inform the Bidder of its decision, which is final. The Design Team may reject a proposed Substitution because the Bidder failed to provide sufficient information to enable the Design Team to completely evaluate the Proposed Substitution without causing a delay in the scheduled bid opening.
 1. Proposed Substitutions received by the Design Team after the allotted time allowed by Section 01 6000 shall not be considered.
- C. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.
 1. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified and itemized.

2.02 ASSEMBLIES

- A. Sleeves and Pathways for Cabling:
 1. Where additional conduits are needed beyond those shown on the drawings to accommodate the installation of systems cabling, this contractor (Division 27) shall include such provisions in this contract. Provide conduit suitable for its application and sized in accordance with industry standards. Include nylon bushings at conduit ends and

firestopping as required around conduits wherever building barriers are penetrated. If necessary, this contractor shall hire a qualified contractor to perform this work.

PART 3 - EXECUTION

3.01 CLEANING

- A. Division 27 Contractor shall thoroughly clean all assemblies within the telecommunications room's space before they are turned over to the OWNER'S NAME IT Services for operation. Cleaning shall include, but not be limited to, all ladder tray, racks and wire managers (both inside and out), copper and optical fiber panels (both inside and out). Should any telecommunications room or closet be completed prior to the balance of the floor space construction that it serves, racks, cabinets, and wall frames shall be covered with plastic sheeting to repel dust and other contaminants to which they will be subjected.
- B. At the end of each workday or shift, the Contractor shall be required to clean-up the work area and remove all construction debris such that the site is clean and usable without hazard to workers.

3.02 PROJECT CONDITIONS

- A. The Owner shall not be responsible for delays in work because of shutdowns due to unsafe working practices by Contractors.
- B. The active information transport system and cabling associated with specific work beyond the construction area shall not be disrupted at any time.
- C. Contractor shall clean work areas each day and remove debris properly and legally from the project site. Materials and supplies stored for use in the project shall be neatly stacked outside the circulation areas. All exits and paths shall be cleaned so as to prevent dirt from being tracked into the site.
- D. It shall be the responsibility of the Contractor to secure any parking permits prior to the first day of work on-site.
- E. Work outside of normal operating hours and days shall be coordinated with OWNER'S NAME.

3.03 SAFETY REQUIREMENTS

- A. All contract work shall be performed in accordance with the policies, procedures, and standards established by the Owner.
- B. In construction areas, all Contractor personnel shall wear personnel protection devices, as deemed appropriate by the General Contractor and as required by OSHA for the work location and work operation being performed. Devices shall include, but not be limited to hardhats, work boots, safety eye protection, reflective vests, etc.
- C. All exposed holes, pits, pipes, etc., either inside or outside the project site, shall be barricaded or plated and adequately secured when Contractor personnel are not present. All ladders, hanging wires, pipes, and other items protruding at a pedestrian level travel way must be removed or secured following the final shift of the day.
- D. During breaks or when only a portion of work has been completed, tools shall not be left exposed where others may risk injury or attempt to use them. Windows and doors shall not be left unsecured or propped open during breaks. At the completion of the final shift each day, doors, windows, or other openings shall be adequately secured.
- E. When driving on the Owner's property, Contractor personnel shall observe all traffic safety regulations and pay particular attention to pedestrians. All loose material and debris on vehicles shall be adequately secured and tied down.

END OF SECTION

**SECTION 27 0505
SELECTIVE DEMOLITION OF COMMUNICATIONS SYSTEMS**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Demolition and removal of selected portions of building or structure.
- B. Demolition, temporary removal, relocation, or reconfiguration of selected site elements and/or Information Technology (IT), Security or other Special Systems or infrastructure.
- C. Salvage of existing items to be reused or recycled.
- D. Contractor shall include in the Bid all labor, materials, tools, transportation, storage costs, equipment, insurance, temporary protection, permits, inspections, taxes and all necessary and related items required to provide complete demolition and cutover of existing telecommunication systems shown and described in the drawings and specifications herein.
- E. The Contractor is responsible for providing and coordinating phased activities and construction methods that minimize disruption to operations and provide complete and operational systems. Equipment and devices shall not be removed or reconfigured until removal or reconfiguration has been coordinated with owner and approval is given in writing.
- F. The Contractor shall coordinate interfaces to existing systems that are being demolished in order to minimize disruption to the existing systems operations. Any systems outages shall be approved in advance and scheduled with OWNER'S NAME.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The following documents shall also be considered as a part of and shall relate directly to this section:
 - 1. Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.03 ABBREVIATIONS AND ACRONYMS

- A. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.04 DEFINITIONS

- A. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.05 CODE REFERENCES AND STANDARDS

- A. Comply with Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.06 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Demolition Meeting
 - 1. Conduct a pre-demolition meeting at Project Site with OWNER'S NAME and all affected stakeholders.
 - a. Inspect and discuss condition of construction to be selectively demolished.
 - b. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - c. Existing telecommunications rooms that have demolition work may involve electrical, mechanical and architectural demolition. Review and coordinate requirements of work performed by other trades.
 - d. Review areas where existing construction is to remain and requires protection.
 - e. Review procedures to be followed when critical systems are inadvertently interrupted. The Contractor shall be responsible for the coordination required with OWNER'S

NAME prior to device removal to ensure systems that must remain operational are not compromised during the demolition process.

1.07 QUALITY ASSURANCE

- A. Comply with Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.08 PROJECT CONDITIONS

- A. The owner WILL occupy portions of building during selective demolition.
- B. Conduct selective demolition so Owner's operations will not be disrupted.
- C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- D. Field verify the existing conditions, device equipment locations to determine the extent of the demolition required. Notify the Design Team of discrepancies between existing conditions and Drawings before proceeding with selective demolition. Proceeding with demolition indicates and acceptance of existing conditions by the contractor.
- E. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify the Design Team. Hazardous materials will be removed by Owner under a separate contract.
- F. Storage or sale of removed items or materials on-site is not permitted.
- G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Demolition and construction methods shall conform to 4J School District requirements and all applicable building codes.
- B. Verify that utilities have been disconnected and capped per approved procedures before starting selective demolition operations.
- C. Survey existing condition of all communications systems related conduits and cables from origin to destination and correlate with requirements indicated to determine extent of selective demolition required.
- D. Label all conduits and cables with origin, destination and what system they serve.
- E. Consult with the Owner to determine whether systems can be disabled or whether a new parallel system needs to be installed.
- F. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to the Design Team.

3.02 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Comply with requirements for access and protection.
- C. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- D. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

- E. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
- F. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
- G. Cover and protect furniture, furnishings, and equipment that have not been removed.
- H. Comply with requirements for temporary enclosures, dust control, heating, and cooling.

3.03 SELECTIVE DEMOLITION

- A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically. Complete selective demolition operations above each floor or tier, before disturbing supporting members on the next lower level, if applicable. Remove all abandoned cable from origin to destination.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 5. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - 6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 7. Dispose of demolished items and materials promptly.
- B. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's designated storage area. Coordinate delivery of equipment with the Owner seven (7) days prior to delivery.
 - 5. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse.
 - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 - 3. Protect items from damage during transport and storage.
 - 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
 - 5. Perform testing on reinstalled active systems and get sign-off by the Owner or Owner's representative inspector that systems are re-connected and working properly.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.04 UTILITY SERVICES AND COMMUNICATION SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions.
2. For existing equipment with active components in them, provide dust protection and circulate cooling air with a portable air conditioning unit or other means to ensure equipment does not overheat.

3.05 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 1. Do not allow demolished materials to accumulate onsite.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.06 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.
- B. The contractor shall be required, on a daily basis, to dispose of any demolished material not required to be returned to the Owner. All materials shall be transported off of the Owner's property at the expense of the Contractor.
- C. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS.

END OF SECTION

**SECTION 27 0528
PATHWAYS FOR COMMUNICATIONS SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Conduit and fittings.
- B. Wireways and auxiliary gutters.
- C. Surface pathways.
- D. Hooks.
- E. Junction Boxes
- F. Devices Boxes
- G. Enclosures, and cabinets.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The following documents shall also be considered as a part of and shall relate directly to this section:
 - 1. Section 26 0526 - Grounding and Bonding for Electrical Systems
 - 2. Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS
 - 3. Section 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
 - 4. Section 27 1500 - COMMUNICATIONS HORIZONTAL CABLING

1.03 ABBREVIATIONS AND ACRONYMS

- A. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.04 DEFINITIONS

- A. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.05 CODE REFERENCES AND STANDARDS

- A. Comply with Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.06 SUBMITTALS

- A. Comply with Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.07 QUALITY ASSURANCE

- A. Comply with Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

PART 2 PRODUCTS

2.01 CONDUIT AND FITTINGS

- A. Approved Manufacturers:
 - 1. Allied Tube & Conduit
 - 2. Western Tube & Conduit Corp.
 - 3. Wheatland Tube Company

4. Substitutions: See Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS
- B. Conduit types:
1. EMT shall be steel, hot-dipped galvanized or electro-galvanized, with an inner coating to protect cables and aid pulling, UL listed, and meeting the requirements of UL 797 and ANSI C80.3.
 2. RMC shall be steel, hot-dipped galvanized inside and outside with factory threaded ends full cut and galvanized after threading, UL listed, and meeting the requirements of UL 6 and ANSI C80.1.
 3. RNC shall be PVC Schedule 40 rigid plastic unless otherwise noted on the Drawings, shall be rated for use with 90 degree C wire, and shall conform to UL 651, WC-1094C and NEMA TC2.
 4. Flexible (flex) conduit: Flex conduit is not approved and not acceptable. Where, in rare instances, flex conduit is the only remaining viable option, the Contractor shall notify the Engineer and await the Engineer's direction prior to procurement and installation.
 5. Conduit bodies (LB's): Conduit bodies (LB's) are not approved and are not acceptable.
- C. Fittings:
1. Provide fittings as follows:
 - a. EMT fittings shall be steel compression type with a nylon insulated throat for rain-tight and concrete-tight applications, steel set screw type or steel compression type for all other connections. Conduit ends shall be fitted with bushings - bushings shall be threaded type for RMC and IMC, set screw type for EMT, and have a nylon insulated throat.
 - b. RMC fittings shall be threaded galvanized steel. Conduit ends shall be fitted with bushings - shall be threaded and have a nylon insulated throat.
 - c. RNC fittings shall be of same material and manufacturer as the conduit and shall be UL listed and conform to UL 514.
 2. Expansion fittings shall be provided across structural joints, shall be of a design to compensate for expansion and contraction, and shall be sealed to prevent entrance of water and moisture, and shall safely deflect and expand up to twice the distance of the structural movement. Expansion fittings shall be approved for grounding duty.
 3. Minimum Trade Size:
 - a. Communication systems conduit: 1 inch.
- D. Joint Compound for EMT, RMC, or RNC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 WIREWAYS AND AUXILIARY GUTTERS

- A. Approved Manufacturers:
1. Pentair/Hoffman
 2. Cooper B-Line
 3. Hubbell
 4. Thomas & Betts
 5. Hellermann Tyton
 6. Substitutions: See Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS
- B. Wireway and Gutter types:
1. Metal gutter shall be sheet metal trough of rectangular cross section fabricated to required size and shape, without holes or knockouts, and with hinged or removable covers.
 2. Non-metallic gutter shall be fiberglass polyester or PVC, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless steel screws and oil resistant gaskets

- C. General Requirements for Wireways and Auxiliary Gutters:
 1. Wireways shall comply with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
 2. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 3. Comply with TIA-569-D.
- D. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- E. Wireway Covers: Hinged cover unless otherwise indicated.
- F. Finish: Manufacturer's standard finish.
- G. Solvents and Adhesives: As recommended by conduit manufacturer.

2.03 SURFACE PATHWAYS

- A. Comply with the requirements listed in Section 26 05 33.23 - Surface Raceways for Electrical Systems.

2.04 HOO S

- A. Approved Manufacturers:
 1. Caddy/Erico
 2. Cooper B-Line
 3. Thomas & Betts
 4. Substitutions: See Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS
- B. Description: Prefabricated sheet metal cable supports for telecommunications cable.
- C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with TIA-569-D.
- E. Galvanized steel.
- F. J shape.

2.05 JUNCTION BOXES

- A. Approved Manufacturers:
 1. Hubbell/Raco
 2. Garvin Industries
 3. Substitutions: See Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS
- B. Junction boxes shall be provided to serve as a transition point between pathways/raceways. Junction boxes shall be galvanized stamped steel, deep drawn one piece (without welds or tab connections), with knockouts for conduit entrances, meeting NEMA OS 1.
- C. Junction boxes shall not be placed in non-accessible ceiling locations unless specifically shown on the Communications Construction Drawings or approved in writing by the Engineer prior to rough-in and installation.
- D. Junction boxes in locations other than walls shall be sized according to the NEC.
- E. Junction boxes in walls:
 1. Unless otherwise shown on the Drawings, junction boxes shall be 4-11/16 inch by 4-11/16 inch by 2-1/8 inch deep with blank cover, and knockouts pre-manufactured to support the conduit size serving the junction box.
 2. Size according to the NEC and provide the larger of the minimum size mentioned above or the NEC requirements.

2.06 DEVICE BOXES

- A. Approved Manufacturers:
 - 1. Hubbell/Raco
 - 2. Garvin Industries
 - 3. Substitutions: See Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS
- B. Device boxes shall be galvanized stamped steel, deep drawn one piece (without welds or tab connections), with knockouts for conduit entrances, meeting NEMA OS 1, and equipped with extension rings to suit construction and application.
- C. Device Box Types:
 - 1. Device Box: Typically installed as an empty box with faceplate, conduit and pull string for future use, unless specifically noted otherwise on the Communications Construction Drawings.
 - a. Shall be a minimum 4-11/16 inch by 4-11/16 inch by 2-1/8 inch deep capable of accepting a minimum of (2) 1 inch conduits.
 - b. Shall be equipped with a minimum single-gang mud ring unless otherwise noted on the Drawings.
 - c. Provide a blank faceplate to match the material, style and color being used on the Electrical Wiring Devices
 - 2. Outlet Box: Outlet boxes shall be provided to house Communications System outlets and connectors. Unless otherwise noted in the Communications Construction Drawings the typical Outlet Box(es) shall be as follows:
 - a. Shall be a minimum 4-11/16 inch by 4-11/16 inch by 2-1/8 inch deep capable of accepting a minimum of (2) 1 inch conduits.
 - b. Shall be equipped with a minimum single-gang mud ring unless otherwise noted on the Drawings.
 - c. Provide a cover plate in lieu of a single-gang mud ring at Wireless Access Point locations.

2.07 ENCLOSURES, AND CABINETS

- A. Approved Manufacturers:
 - 1. Pentair/Hoffman
 - 2. Hubbell
 - 3. Eaton/Cooper
 - 4. Substitutions: See Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS
- B. Description: Enclosures for communications.
- C. General Requirements for Enclosures, and Cabinets:
 - 1. Comply with TIA-569-D.
 - 2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
- D. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1, with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures:
 - a. Material: Plastic.
 - b. Finished inside with radio-frequency-resistant paint.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- E. Cabinets:
 - 1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.

3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 EXECUTION

3.01 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
 1. Exposed Conduit: RNC, Type EPC-80-PVC.
 2. Concealed Conduit, Aboveground: RNC, Type EPC-40-PVC.
 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply pathway products as specified below unless otherwise indicated:
 1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT, RNC, Type EPC-40-PVC, or innerduct.
 5. Damp or Wet Locations: GRC.
 6. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, communications cable pathway.
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel units in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size: 1 inch trade size for communications cables unless otherwise noted.
- D. Pathway Fittings: Compatible with pathways and suitable for use and location.
 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use set-screw, steel fittings. Comply with NEMA FB 2.10.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface pathways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.02 INSTALLATION

- A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:
 1. NECA 1.
 2. NECA/BICSI 568.
 3. TIA-569-D.
 4. NECA 101
 5. NECA 102.
 6. NECA 105.
 7. NECA 111.

- B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- C. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- D. Comply with requirements in Section 27 0544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING.
- E. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- F. Complete pathway installation before starting conductor installation.
- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- H. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical-fiber cables.
- I. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- J. Support conduit within 12 inches of enclosures to which attached.
- K. Pathways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
 - 3. Arrange pathways to keep a minimum of 2 inches of concrete cover in all directions.
 - 4. Do not embed thread-less fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from nonmetallic conduit and fittings to RNC, Type EPC-40-PVC and fittings before rising above floor.
- L. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for pathways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- N. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- P. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.
- Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.
- R. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- S. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.

- T. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.
- U. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- V. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- W. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC that is located where environmental temperature change may exceed 100 deg F, and that has straight-run length that exceeds 100 feet.
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- X. Hooks:
 - 1. Size to allow a minimum of 50 percent future capacity without exceeding design capacity limits.
 - 2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
 - 3. Hook spacing shall allow no more than 6 inches of slack. The lowest point of the cables shall be no less than 6 inches adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
 - 4. Space hooks no more than 5 feet o.c.
 - 5. Provide a hook at each change in direction.
- Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
 - . Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- AA. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

- BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- DD. Set metal floor boxes level and flush with finished floor surface.
- EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 27 0544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING.

3.04 FIRESTOPPING

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

3.05 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

**SECTION 27 0553
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Color and legend requirements for labels and signs.
- B. Labels.
- C. Bands and tubes.
- D. Signs.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The following documents shall also be considered as a part of and shall relate directly to this section:
 - 1. Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS
 - 2. Section 27 1116 - COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES
 - 3. Section 27 1300 - COMMUNICATIONS BACKBONE CABLING
 - 4. Section 27 1500 - COMMUNICATIONS HORIZONTAL CABLING

1.03 ABBREVIATIONS AND ACRONYMS

- A. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS.

1.04 DEFINITIONS

- A. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS.

1.05 CODE REFERENCES AND STANDARDS

- A. Comply with Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS.

1.06 SUBMITTALS

- A. Comply with Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS.

1.07 QUALITY ASSURANCE

- A. Comply with Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 70 and TIA 606-B.
- B. Comply with ANSI 535.4 for safety signs and labels.
- C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.02 COLOR AND LEGEND REQUIREMENTS

- A. Identification Labels:
 - 1. Black letters on a white field.

2.03 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
- B. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, polyester flexible labels with acrylic pressure-sensitive adhesive.
 - 1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating protective shields over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
- C. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
 - 1. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches for raceway and conductors.
 - b. 3-1/2 by 5 inches for equipment.
 - c. As required by authorities having jurisdiction.

2.04 BANDS AND TUBES

- A. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters of raceway or cable they identify, that stay in place by gripping action.

2.05 SIGNS

- A. Baked-Enamel Signs:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal Size: 7 by 10 inches.
- B. Laminated-Acrylic or Melamine-Plastic Signs:
 - 1. Engraved legend.
 - 2. Thickness:
 - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
 - b. For signs larger than 20 sq. in., 1/8 inch thick.
 - c. Engraved legend with black letters on white face.
 - d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

PART 3 EXECUTION

3.01 PREPARATION

- A. Self-Adhesive Identification Products: Before applying communications identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.02 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.
- G. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- H. Polyester Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear tape, with adhesive appropriate to the location and substrate.
 - 3. Provide label 6 inches from cable end.
- I. Self-Adhesive Wraparound Labels:
 - 1. Secure tight to surface at a location with high visibility and accessibility.
 - 2. Provide label 6 inches from cable end.
- J. Self-Adhesive Labels:
 - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.

3.03 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.
- C. Accessible Fittings for Raceways and Cables within Buildings: Identify covers of each junction and pull box with self-adhesive labels containing wiring system legend.
 - 1. System legends shall be as follows:
 - a. Telecommunications.
- D. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation, composed of the following, in the order listed:
 - 1. Wiring closet designation.
 - 2. Dash.
 - 3. Work area outlet number.
- E. Equipment Room Labeling:
 - 1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels containing equipment designation.
 - 2. Patch Panels: Label individual rows in each rack, starting at top and working down, with self-adhesive labels.
 - 3. Data Outlets: Label each outlet with a self-adhesive label using the same scheme defined under Faceplates.
- F. Backbone Cables: Label each cable with a polyester self-adhesive wraparound label indicating the location of the far or other end of the backbone cable. Patch panel or punch down block where cable is terminated should be labeled identically.
- G. Horizontal Cables: Label each cable with a polyester self-adhesive wraparound label indicating the following, in the order listed:
 - 1. Room number.
 - 2. Colon.
 - 3. Faceplate number.

- H. Instructional Signs: Self-adhesive labels.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures: Baked-enamel warning signs or metal-backed butyrate.
 - 1. Apply to exterior of door, cover, or other access.
- J. Equipment Identification Labels:
 - 1. Indoor Equipment: Baked-enamel signs, Metal-backed butyrate, laminated-acrylic or melamine-plastic sign.
 - 2. Equipment to Be Labeled:
 - a. Communications racks/cabinets.
 - b. Uninterruptible power supplies.
 - c. Power distribution components.

END OF SECTION

**SECTION 27 1500
COMMUNICATIONS HORIZONTAL CABLING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Category Cabling
- B. Twisted Pair Cable Hardware
- C. Grounding and Bonding
- D. Labeling

1.02 DESCRIPTION

- A. Horizontal cable cabling system shall provide interconnections between the floor distributor and the equipment outlet, otherwise known as "Cabling Subsystem," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
 - 1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
 - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
 - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. A work area is approximately 100 sq. ft. and includes the components that extend from the equipment outlets to the station equipment.
- C. The maximum allowable horizontal Category cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.
- D. Provide category cable terminated to a biscuit jack at each interior video surveillance camera. Refer to site plan for cabling requirements for site cameras.

1.03 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The following documents shall also be considered as a part of and shall relate directly to this section:
 - 1. Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS
 - 2. Section 27 0528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS
 - 3. Section 27 0544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING
 - 4. Section 27 0553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

1.04 ABBREVIATIONS AND ACRONYMS

- A. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.05 DEFINITIONS

- A. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.06 CODE REFERENCES AND STANDARDS

- A. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.07 SUBMITTALS

- A. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.08 QUALITY ASSURANCE

- A. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

1.10 WARRANTY

- A. Reference Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

PART 2 PRODUCTS

2.01 CATEGORY CABLING

- A. General Cable Characteristics:
 - 1. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.
 - 2. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
 - 3. Grounding: Comply with TIA-607-C.
 - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
 - a. Communications, Plenum Rated: Type CMP complying with UL 1685 or Type CMP in listed plenum communications raceway or Type CMP in listed cable routing assembly.
 - 5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
 - 6. RoHS compliant.
- B. Category 6A Twisted Pair Cable
 - 1. Approved Manufacturers:
 - a. Commscope Systimax GigaSPEED X10D
 - b. Panduit TX6A
 - c. Substitutions: See Section 27 0000 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS
 - 2. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz.
 - 3. Standard: Comply with TIA-568-C.2 for Category 6a cables.
 - 4. Conductors: 100-ohm, 23 AWG solid copper.
 - 5. Shielding/Screening: Unshielded twisted pairs (UTP).
 - 6. Cable Rating: Plenum and Outdoor-rated.
 - a. Infrastructure routed in conduit underground at any facility shall be outdoor-rated.
 - 7. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz.
 - 8. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.
 - 9. Jacket Color:
 - a. Typical Work Area Outlet: Plenum, Blue Thermoplastic.

2.02 TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. General Requirements for Twisted Pair Cable Hardware:
 - 1. Comply with the performance requirements of Category 6a.
 - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.

3. Cables shall be terminated with connecting hardware of same category or higher.
- C. Source Limitations: Obtain twisted pair cable hardware from same manufacturer as twisted pair cable, from single source.
- D. Patch Panel: Modular panels housing numbered modular jack openings compatible with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.
 1. Features:
 - a. Universal T568A and T568B wiring labels.
 - b. Labeling areas adjacent to conductors.
 - c. Modular 24 or 48 ports.
 2. Construction: 16-gauge steel and mountable on 19-inch (483 mm) equipment racks.
 3. Number of Jacks per Field: One for each four-pair cable indicated, plus spares and blank positions adequate to suit specified expansion criteria.
- E. Patch Cords: Factory-made, four-pair cables; terminated with an eight-position modular plug at each end.
 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
 2. Patch cords shall have color-coded boots for circuit identification.
 3. Quantity:
 - a. At the Rack - Provide patch cabling for 100% of the connectivity illustrated. For bid purposes provide 7'-0" patch cables. Coordinate actual length and color requirements with the owner prior to bidding.
 - b. At the Device - Provide patch cabling for 100% of the connectivity illustrated. For bid purposes provide 15'-0" patch cables. Coordinate actual length and color requirements with the owner prior to bidding.
- F. Plugs and Plug Assemblies:
 1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
 2. Standard: Comply with TIA-568-C.2.
 3. Marked to indicate transmission performance.
- G. Jacks and Jack Assemblies:
 1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
 2. Designed to snap-in to a patch panel or faceplate.
 3. Standard: Comply with TIA-568-C.2.
 4. Marked to indicate transmission performance.
- H. Faceplate:
 1. Four-port, vertical single gang faceplates designed to mount to single gang wall boxes.
 2. Metal Faceplate: Stainless steel.
 3. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.
 - a. Flush mounting jacks, positioning the cord at a 45-degree angle.
- I. Legend:
 1. Machine printed, in the field, using adhesive-tape label.
 2. Snap-in, clear-label covers and machine-printed paper inserts.

2.03 GROUNDING AND BONDING

- A. Comply with requirements in Section 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS for grounding conductors and connectors.
- B. Comply with TIA-607-C.

2.04 IDENTIFICATION PRODUCTS

- A. Comply with requirements in Section 27 0553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.
- B. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 EXECUTION

3.01 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, attics, and gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables, except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Section 27 0528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS.
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

3.02 INSTALLATION OF PATHWAYS

- A. Comply with Section 27 0528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS.
- B. Drawings indicate general arrangement of pathways and fittings.

3.03 INSTALLATION OF TWISTED-PAIR AND COAXIAL HORIZONTAL CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.
- B. General Requirements for Cabling:
 - 1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
 - 2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
 - 3. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
 - 4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 5. Consolidation points may be used only for making a direct connection to equipment outlets:
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - b. Locate consolidation points for twisted-pair cables at least 49 feet from communications equipment room.
 - 6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 7. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - 8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
 - 9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

10. Cold-Weather Installation: Bring cable to room temperature before unreeling. Heat lamps shall not be used for heating.
 11. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
 12. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.
- C. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- D. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
 2. Install cabling after the flooring system has been installed in raised floor areas.
 3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.
- E. Group connecting hardware for cables into separate logical fields.
- F. Separation from EMI Sources:
1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
 4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.04 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with "Firestopping Systems" Article in BICSI's "Telecommunications Distribution Methods Manual."

3.05 GROUNDING

- A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

- B. Comply with TIA-607-B and NECA/BICSI-607.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.06 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
 - 1. Administration Class: Class 1.
 - 2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 1 level of administration.
- C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- E. Cable and Wire Identification:
 - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
 - 4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
 - b. Label each unit and field within distribution racks and frames.
 - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- F. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:
 - 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Tests and Inspections:

- a. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA-568-C.1.
- b. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- c. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - 1) Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.
- E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- F. End-to-end cabling will be considered defective if it does not pass tests and inspections.

END OF SECTION

SECTION 28 0000
GENERAL REQUIREMENTS FOR ELECTRONIC SAFETY & SECURITY SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Division 28 specifications are provided to define the standards and criteria to be used to bid, plan, furnish, install, test, and document electronic safety & security systems for 4J Community School District's Multi-site High School Facilities. These specifications shall form the basis for implementation of the design, installation, inspection, and close-out process.
- B. Division 28 has been designed and developed based on the most current and adopted International Series Building and Fire Code, Facility Guidelines, Iowa Administrative Code and Amendments, NFPA 72, NFPA 70 (NEC), and National Electrical Safety Code (NEC) requirements. The requirements within those documents are not superseded herein unless specifically stated. Code requirements are unable to be superseded by this document at any time. The absence of a specific reference to an element within the aforementioned codes, and standards does not relieve all parties of compliance with them.
- C. Within this document use of the word "shall" marks mandatory requirements. Use of the word "may" or "should" suggests optional elements. All conflicts within this document shall be resolved by the General Contractor in consultation with the Design Team. The standards of 4J School District shall take precedence in the resolution of any dispute.
- D. Unauthorized changes and/or deviations from these specifications, regardless of scale, may result in re-design, reconstruction, or re-installation of communications elements at the contractor's expense. Contractors shall obtain formal written approval prior to bidding and prior to installation in order to deviate from these specifications. Contractors shall not deviate from code requirements.
- E. Division 28 Specifications address information transport pathways, multiple different types of Safety and Security systems, spaces, media, grounding, identification, testing, and documentation requirements in support of multiple information transport infrastructures.
- F. Specific responsibilities of Division 28 include, but are not limited to:
 - 1. Installation of the intra-building pathways, cabling, and coordinating space requirements necessary to house the safety and security systems and associated electronic information transport equipment. Pathways and spaces shall be provided to support the known systems and cabling requirements, as well as provisions for those that may be required in the future for growth purposes.
 - 2. The procurement and installation of each safety and security system and the associated components and cabling to create a fully functional system.
 - 3. Thorough testing shall be conducted of each individual safety and security system to illustrate compliance with specific performance requirements.
 - 4. Definition and establishment of administration and labeling schemes, conforming to Owner's requirements.
 - 5. Securing all necessary permits and licenses, payment of all fees, and provision of all construction work notifications.
 - 6. Compliance with all applicable laws, ordinances, rules, and regulations.
 - 7. Mandatory project manager attendance at a weekly project status meeting with the General Contractor.
 - 8. It is the intent of the project drawings and specifications to provide complete and fully functional Division 28 safety and security systems, ready for use. Any item, not specifically shown in the project drawings or called for in the project specifications but normally required for a complete systems, is to be considered a part of this contract.
- G. System Continuity:
 - 1. Reconnect all existing items that remain in use. Provide all materials and labor required to retain continuity of existing circuits or systems that are disrupted by these alterations even

though not indicated on the drawings.

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 00 & 01 Specification Sections, apply to this section.
- B. The following documents shall also be considered as a part of and shall relate directly to this section:
 - 1. Section 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
 - 2. Section 27 0528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS
 - 3. Section 27 0553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
 - 4. Section 28 0505 - SELECTIVE DEMOLITION OF ELECTRONIC SAFETY AND SECURITY SYSTEMS
 - 5. Section 28 1300 - SECURITY MANAGEMENT SYSTEM
 - 6. Section 28 1500 - SECURITY MANAGEMENT SYSTEM HARDWARE DEVICES

1.03 ABBREVIATIONS AND ACRONYMS

- A. The following definitions are applicable to the work as indicated and as shown herein:
 - 1. AC - Alternating Current
 - 2. ANSI - American National Standards Institute
 - 3. API - Application Programming Interface
 - 4. AWG - American Wire Gauge
 - 5. CFR - Code of Federal Regulations
 - 6. CSI - Construction Specifications Institute
 - 7. DC - Direct Current
 - 8. DNS - Domain Name System
 - 9. DPDT - Double Pull-Double Throw
 - 10. DVMS - Digital Video Management System
 - 11. DVR - Digital Video Recorder
 - 12. EACS - Electronic Access Control System
 - 13. EMT - Electrical Metallic Tubing
 - 14. FACP - Fire Alarm Control Panel
 - 15. FCC - Federal Communications Commission
 - 16. FTP - File Transfer Protocol
 - 17. HVAC - Heating, Ventilation, and Air Conditioning
 - 18. ID - Identification
 - 19. IEC - International Environmental Corporation.
 - 20. IEEE - Institute of Electrical and Electronic Engineers
 - 21. IP - Internet Protocol
 - 22. IS - Integrated Systems
 - 23. ISO - International Organization for Standardization
 - 24. LAN - Local Area Networks
 - 25. LDAP - Lightweight Directory Access Protocol
 - 26. LED - Light Emitting Diode
 - 27. mA - Milliampere.
 - 28. NAS - Network-Attached Storage
 - 29. NECA - National Electrical Contractors Association
 - 30. NEMA - National Electrical Manufacturers Association
 - 31. NFPA - National Fire Protection Area
 - 32. NICET -
 - 33. NRTL - Nationally Recognized Testing Laboratories.
 - 34. NVR - Network Video Recorder
 - 35. ODBC - Open Database Connectivity

36. ONVIF - Open Network Video Interface Forum
37. OS - Operating Systems
38. OVID - Open Video Interface Document
39. PC - Personal Computer
40. PIN - Personal Identification Number
41. PIR - Passive Infrared
42. Pro
43. PSIA - Physical Security Interoperability Alliance
44. RAID - Redundant Array of Independent Disks
45. RFI - Radio-Frequency Interface
46. RFID - Radio Frequency Identification
47. RoHS - Restriction of Hazardous Substances Directive
48. ROM - Read Only Memory
49. SFTP - Secure File Transfer Protocol
50. SHA - Secure Hash Algorithm
51. SIA - Security Industry Association
52. SLA - Sealed Lead Acid
53. SLDAP - Secure Lightweight Directory Access Protocol
54. SMS - Security Management System.
55. SQL - Structured Query Language
56. SSL - Secure Sockets Layer
57. STI - Speech Transmission Index
58. TIA - Telecommunications Industry Association.
59. TCP - Transmission Control Protocol
60. UL - Underwriters Laboratories
61. UPS - Uninterruptible Power Supply
62. VMS - Video Management System
63. WAN - Wide Area Network

1.04 DEFINITIONS

1.05 PROJECT CONDITIONS

- A. The project involves the 22043 - 4j Security Upgrades with added square footage. Some portions of the building will not require work and those that are will be installed so that they match the existing building standards.

1.06 CODES AND STANDARDS

- A. All work shall be in compliance with the following codes and agencies. Nothing contained within these specifications shall be misconstrued to permit work not in conformance with the most stringent of applicable codes and standards. It is assumed that bidders have access to, and specific knowledge of, the listed reference materials in order to ensure conformity with them.
 1. International Building Code
 2. International Fire Code
 3. Facility Guidelines Institute
 4. National Electrical Code (NEC)
 5. National Electrical Safety Code (NESC)
 6. National Fire Protection Association (NFPA)
 7. National Electronic Manufacturer's Association (NEMA)
 8. Occupational Safety & Health Administration (OSHA)
 9. Federal Communications Commission (FCC)
- B. All new materials, equipment, and installation practices shall meet the requirements of the following standards, unless specifically instructed otherwise by the Design Team.
 1. Federal, State, and local codes, rules, regulations, and ordinances.

- a. Perform all work in accordance with local jurisdiction requirements that is governing the work and as fully part of the specifications attached.

1.07 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of the safety and security systems with the Electrical contractor and the Owner's selected carrier.
- B. Sequencing: Ensure that any fire alarm, access control and video surveillance cutover is achieved in a coordinated and orderly manner.
- C. All Division 28 Contractor Project Managers shall schedule and conduct a coordination meeting with 4J School District to confirm and coordinate scope of work requirements prior to commencement of work. Project meetings shall be scheduled through the general contractor.

1.08 SUBMITTALS

- A. Refer to Division 1 for exact submittal procedures.
- B. The Division 28 contractor shall provide for review, without exception prior to material acquisition and installation, three (3) copies of the following items. Failure to submit required items shall disqualify the bidder.
 - 1. Product Data Sheets (Catalog Cuts)
 - 2. Riser/Cabling Diagrams
 - 3. System Schematics
 - 4. Specification Sheets for Test Equipment
 - 5. Bill of Materials
 - 6. Contracting Firm Qualifications and Certifications
 - 7. Installation Team Qualifications by Individual
 - 8. Current Manufacturer Certifications
- C. In addition to the above submittal information, the fire detection and alarm contractor shall also adhere to the authority having jurisdiction (local and/or state) submittal requirements. The bid represented by this contractor shall include the necessary fees required for this governing body to review the project.
- D. Provide throughout installation:
 - 1. Material samples, if requested by the design team.
 - 2. Periodic field quality control reports.
- E. Provide at completion of each construction phase area:
 - 1. System test and certification reports; summary hard copy or full test results on digital media when requested by the owner or design team. Reports shall be submitted to the requesting party within seven (7) calendar days.
 - 2. One (1) set of record drawings of the actual installation of the Division 28 systems. Drawings shall be given as full size originals and on disk in AutoCAD format
- F. Provide at final completion, three (3) bound sets of O&M (Operating and Maintenance) Manuals formatted as defined by Division 1 and one (1) electronic copy provided on digital media. Each copy of the O&M Manual shall include, at minimum, items listed as follows:
 - 1. System test and certification reports; summary hard copy and full test results on digital media. Test results shall be delivered at the completion of each project phase and at any time when called for by the Owner.
 - 2. Provide one (1) full-size hard copy set of record drawings (as-builts) to be submitted to the Design Team for approval, immediately upon completion of the installation.
 - 3. Instruction manuals including equipment and schedules, operating instructions, and manufacturer's instructions.
 - 4. Manufacturer warranty certificate.
 - 5. Warranty contacts including but not limited to: names, telephone numbers (office and mobile).

1.09 QUALITY ASSURANCE

- A. Contracting firm shall constitute a company with a minimum of five (5) years successful installation experience with projects utilizing infrastructure and systems work similar to that required for this project.
- B. Fire alarm contractor shall have at least one (1) NICET Level II on staff responsible for this project. Provide copies of these certificates in the submittal process.
- C. Work crew, not involved in final connections to the fire alarm system (e.g. laborers delivering/moving materials, installing grounding by an electrician, or workers installing pathway elements) do not require NICET or manufacturer certification or registration.
- D. Contractor shall provide with a manufacturer certification for the system solution bid, issued directly in the bidder's company name, valid for the time frame in which the installation will be completed. Contractor shall be manufacturer certified in order to participate in the bid event.
- E. The Contractor shall be knowledgeable in local, state, regional, and national codes and regulations. All work shall comply with the latest revision of codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall apply.
- F. Only installers trained and certified by the proposed manufacturer shall be allowed to install products. Installers must possess the highest level of certification available by the manufacturer for the specific solution being installed.
- G. Only installers trained and certified by the proposed manufacturer shall be allowed to install firestop products.
- H. Only installers trained and certified by the proposed systems manufacturer shall be allowed to terminate and test any of the electronic safety & security systems. Others may pull cabling and install field devices under the supervision of an installer trained and certified by the manufacturer.
- I. Service Qualifications: Installing and servicing contractor shall have a permanent office within a 120 mile radius of the project site.
- J. Before bidding, the contractor shall study and compare all contract documents and promptly notify the Design Team of any discrepancies or deficiencies discovered by or made known to the contractor.
- K. Discrepancies: Whenever a discrepancy or inconsistency exists between related information indicated on the contract drawings and/or specifications, this contractor shall obtain additional clarification and direction from the Design Team before proceeding. For bidding purposes, this contractor shall include the labor and materials necessary to comply with the solution that results in the greatest cost to the contract.
 - 1. If there is a conflict between applicable documents, then the more stringent requirement shall apply.
 - 2. The failure to question any controversial item will constitute acceptance by the bidder who shall execute it to the satisfaction of the owner after being awarded the contract.
- L. Deficiencies: The contractor and associated subcontractors shall resolve all known deficiencies and omissions, including non-compliance with applicable codes, with the Design Team prior to ordering materials or proceeding with the work. Any work performed prior to receipt of instructions from the Design Team will be done so at the contractor's risk.
 - 1. If mention has been omitted pertaining to details, items or related accessories required for the completion of any system, it is understood such item and accessories are included in the contract. After the contract is awarded, claims based on insufficient data or incorrectly assumed conditions, or claims based on misunderstanding the nature of the work, will not be recognized.
 - 2. All devices, symbols and work illustrated shall be new work provided under this contract except work labeled existing to remain and equipment labeled to be furnished (or

supplied) by others, but installed by this contractor.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Equipment, materials, and supplies shall be shipped, handled and stored in ways that shall prevent damage to the items.
- B. All items shall be handled and stored as recommended by the manufacturer.
- C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under manufacturer's specified conditions, and free from damage or deterioration.
- D. Equipments, materials, and supplies to be incorporated in the area of work shall be new unless otherwise noted.
- E. Equipment, materials, and supplies shall be produced in a good workmanlike manner.
- F. When the quality of a material, process, or article is not specifically set forth in the Drawings or Specifications, the best available quality of the material, process, or article shall be provided.

1.11 FIELD CONDITIONS

- A. Conditions and Measurements: Visit the jobsite to verify installation conditions and confirm measurements for all required systems and associated cabling connectivity.

1.12 WARRANTY

- A. The Contractor shall submit, in the bid documents, any additional contractor-specific warranties or guarantees to be offered on the project.
- B. The Contractor shall supply any and all necessary documentation needed to process and record the warranty(s) and to verify the installation solution.
- C. Unless listed elsewhere within these specifications, a warranty shall be provided for a minimum of one (1) year for all safety and security systems. One year shall begin from the date of Substantial Completion. This warranty shall cover both product and service to address remedial maintenance and replacement parts as is appropriate to keep each system complete and fully functional.

PART 2 PRODUCTS

2.01 MANUFACTURER'S, PRODUCTS, AND SERVICES

- A. If a bidder proposes to substitute an article, device, material, equipment, form of construction, fixture, or item other than the approved manufacturers and part numbers, listed and named in the specifications, the bidder shall certify that the proposed item is equal in quality and all aspects of performance and appearance, to the items specified. The bidder shall submit a request for substitution to the Design Team by following the instruction in Specification Section 01 6000, which must include:
 - 1. The name and complete description of the proposed Substitution including Drawings, performance and test data, and other information necessary for a complete evaluation; and
 - 2. A statement setting forth any changes that the Proposed Substitution will require in the Contract Documents or the project.
- B. If the Design Team approves the proposed substitution, the Design Team shall issue an Addendum. If the Design Team does not approve the substitution, the Design Team shall inform the bidder of its decision, which is final. The Design Team may reject a proposed Substitution because the bidder failed to provide sufficient information to enable the Design Team to completely evaluate the proposed substitution without causing a delay in the scheduled bid opening.
- C. Proposed substitutions received by the Design Team after the allotted time allowed by Section 01 6000 shall not be considered.

- D. Bidder shall confirm all reference part numbers, listed within Division 28, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.
- E. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified and itemized.
- F. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will provide service to the project site within two (2) hours of receipt of notification that service is needed. Submit name and address of service organizations during the submittal process.

2.02 SLEEVES FOR PATHWAYS AND CABLES

- A. Where additional conduits are needed beyond those shown on the drawings to accommodate the installation of systems, this contractor (Division 28) shall include such provisions in this contract. Provide conduit suitable for its application and sized in accordance with industry standards. Include nylon bushings at conduit ends and firestopping as required around conduits wherever building barriers are penetrated. If necessary, this contractor shall hire a qualified contractor to perform this work.

PART 3 EXECUTION

3.01 PROJECT CONDITIONS

- A. Contractor shall clean work areas each day and remove debris properly and legally from the property. Materials and supplies stored for use in the project shall be neatly stacked outside the circulation areas. All exits and paths shall be cleaned so as to prevent dirt from being tracked into the facilities.
- B. Contractor shall ensure that all building fixtures have been re-installed to their original condition at the conclusion of the final shift of the day.
- C. It shall be the responsibility of the Contractor to secure any parking permits prior to the first day of work on-site.
- D. Work outside of normal operating hours and days shall be coordinated with 4J School District .

3.02 FINAL CLEANING

- A. Division 28 Contractor shall thoroughly clean all enclosures, assemblies and field devices before they are turned over to 4J School District for operation. Should the special system's room(s) be completed prior to the balance of the floor space construction that it serves, racks, cabinets, and wall frames shall be covered with plastic sheeting to repel dust and other contaminants to which they will be subjected.

3.03 SAFETY REQUIREMENTS

- A. All contract work shall be performed in accordance with the policies, procedures, and standards established by the 4J School District.
- B. In construction areas, all Contractor personnel shall wear personnel protection devices, as deemed appropriate by the General Contractor and as required by OSHA for the work location and work operation being performed. Devices shall include, but not be limited to hardhats, work boots, safety eye protection, reflective vests, etc.
- C. All exposed holes, pits, pipes, etc., either inside or outside the project facilities, shall be barricaded or plated and adequately secured when Contractor personnel are not present. All ladders, hanging wires, pipes, and other items protruding at a pedestrian level travel way must be removed or secured following the final shift of the day.
- D. During breaks or when only a portion of work has been completed, tools shall not be left exposed where others may risk injury or attempt to use them. Windows and doors shall not be left unsecured or propped open during breaks. At the completion of the final shift each day, doors, windows, or other openings shall be adequately secured.

- E. When driving on property, Contractor personnel shall observe all traffic safety regulations and pay particular attention to pedestrians. All loose material and debris on vehicles shall be adequately secured and tied down.

END OF SECTION

**SECTION 28 0505
SELECTIVE DEMOLITION OF ELECTRONIC SAFETY AND SECURITY SYSTEMS**

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition, temporary removal, relocation, or reconfiguration of selected site elements and/or Information Technology (IT), Security or other Special Systems or infrastructure.
 - 3. Salvage of existing items to be reused or recycled.
- B. Contractor shall include in the Bid all labor, materials, tools, transportation, storage costs, equipment, insurance, temporary protection, permits, inspections, taxes and all necessary and related items required to provide complete demolition and cutover of existing telecommunication systems shown and described in the drawings and specifications herein.
- C. The Contractor is responsible for providing and coordinating phased activities and construction methods that minimize disruption to operations and provide complete and operational systems. Equipment and devices shall not be removed or reconfigured until removal or reconfiguration has been coordinated with owner and approval is given in writing.
- D. The Contractor shall coordinate interfaces to existing systems that are being demolished in order to minimize disruption to the existing systems operations. Any systems outages shall be approved in advance and scheduled with 4J School District .

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The following documents shall also be considered as a part of and shall relate directly to this section:
 - 1. Section 28 0000 - GENERAL REQUIREMENTS FOR ELECTRONIC SAFETY & SECURITY SYSTEMS

1.03 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Field verify the existing conditions, device equipment locations to determine the extent of the demolition required. Notify the Design Team of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify the Design Team. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1.04 DEFINITIONS

- A. Reference section 28 0000 - GENERAL REQUIREMENTS FOR ELECTRONIC SAFETY & SECURITY SYSTEMS

1.05 QUALITY ASSURANCE

- A. Comply quality assurance requirements listed in section 28 0000 - GENERAL REQUIREMENTS FOR ELECTRONIC SAFETY & SECURITY SYSTEMS

1.06 CODES AND STANDARDS

- A. Comply with codes and standards listed in section 28 0000 - GENERAL REQUIREMENTS FOR ELECTRONIC SAFETY & SECURITY SYSTEMS

1.07 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Demolition Meeting
 1. Conduct a pre-demolition meeting at Project Site with 4J School District and all affected stakeholders.
 - a. Inspect and discuss condition of construction to be selectively demolished.
 - b. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - c. Existing telecommunications rooms that have demolition work may involve electrical, mechanical and architectural demolition. Review and coordinate requirements of work performed by other trades.
 - d. Review areas where existing construction is to remain and requires protection.
 - e. Review procedures to be followed when critical systems are inadvertently interrupted. The Contractor shall be responsible for the coordination required with 4J School District prior to device removal to ensure systems that must remain operational are not compromised during the demolition process.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL - SELECTIVE DEMOLITION

- A. Demolition and construction methods shall conform to 4J School District requirements, requirements of the State of Iowa and all applicable building codes.
- B. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Proceed with selective demolition systematically. Complete selective demolition operations above each floor or tier, before disturbing supporting members on the next lower level, if applicable. Remove all abandoned cable from origin to destination.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 5. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 7. Dispose of demolished items and materials promptly.
- C. Removed and Salvaged Items:
 1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.

4. Transport items to Owner's designated storage area. Coordinate delivery of equipment with 4J School District seven (7) days prior to delivery.
 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
 5. Perform testing on reinstalled active systems and get sign-off by a the Owner or Owner's representative inspector that systems are re-connected and working properly.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.02 EXAMINATION

- A. Verify that utilities have been disconnected and capped per approved procedures before starting selective demolition operations.
- B. Survey existing condition of all communications systems related conduits and cables from origin to destination and correlate with requirements indicated to determine extent of selective demolition required.
- C. Label all conduits and cables with origin, destination and what system they serve.
- D. Consult with the Owner to determine whether systems can be disabled or whether a new parallel system needs to be installed.
- E. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to the Design Team.

3.03 UTILITY SERVICES AND COMMUNICATION SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 1. Comply with requirements for existing services/systems interruptions.
 2. For existing equipment with active components in them, provide dust protection and circulate cooling air with a portable air conditioning unit or other means to ensure equipment does not overheat.
- B. Existing Services/Systems to Be Removed, or Relocated: Locate, identify, disconnect, and seal or cap off indicated utility services and communications systems serving areas to be selectively demolished.
 1. Owner will arrange to shut off indicated services/systems when requested by Contractor. Coordinate the disconnection of all electrical circuits with the Electrical Contractor prior to disconnection.
 2. Arrange to shut off indicated utilities with utility companies.
 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

3.04 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 1. Comply with requirements for access and protection.

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

3.05 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate onsite.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.06 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.
- B. The contractor shall be required, on a daily basis, to dispose of any demolished material not required to be returned to the Owner. All materials shall be transported off of the Owner's property at the expense of the Contractor.
- C. At the end of each work day or shift, the Contractor shall be required to clean-up the work area and remove all construction debris such that the site is clean and usable without hazard to workers.

END OF SECTION

**SECTION 28 1300
SECURITY MANAGEMENT SYSTEM**

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Platform
 - 2. Controller Management
 - 3. Door Management
 - 4. Web Client

1.02 DESCRIPTION

- A. Provide a complete Security Management System (SMS) solution for the 4J Community School District's security improvements project. This shall be an extension of the existing Lenel OnGuard platform.
- B. The ACS shall be an enterprise class access control software solution. It shall be fully embedded within a Unified Security Platform (USP). The USP shall allow the seamless unification of the ACS with an IP video management system (VMS). The SMS shall also integrate fully with the designed intrusion detection system.
- C. The ACS shall be highly scalable to support configurations consisting of thousands of doors with facilities spanning multiple geographic areas.
- D. The ACS shall support an unrestricted number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.
- E. The ACS shall support a variety of access control functionalities, including but not limited to:
 - 1. Controller (Unit) management, door management, elevator management, and area management.
 - 2. Cardholder and cardholder group management, credential management, and access rule management.
 - 3. Badge printing and template creation.
 - 4. Offering a framework for third party hardware integration such as card and signature scanner.

1.03 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The following documents shall also be considered as part of and shall relate directly to this Section:
 - 1. Section 08 - Door Hardware
 - 2. Section 28 0000 - GENERAL REQUIREMENTS FOR ELECTRONIC SAFETY & SECURITY SYSTEMS
 - 3. Section 28 1500 - SECURITY MANAGEMENT SYSTEM HARDWARE DEVICES

1.04 ABBREVIATIONS AND ACRONYMS

- A. Reference Section 28 0000 - GENERAL REQUIREMENTS FOR ELECTRONIC SAFETY & SECURITY SYSTEMS.

1.05 DEFINITIONS

- A. Reference Section 26 2416.16 - ELECTRONICALLY OPERATED CIRCUIT-BREAKER PANELBOARDS
- B. ACS - Access Control System
- C. CSA - Client Software Application
- D. DGM - Dynamic Graphical Maps
- E. SSM - Server Software Module

- F. UI - User Interface
- G. USP - Unified Security Platform
- H. UWC- Unified Web Client
- I. VMS - Video Management System

1.06 CODE REFERENCES AND STANDARDS

- A. Reference Section 28 0000 - GENERAL REQUIREMENTS FOR ELECTRONIC SAFETY & SECURITY SYSTEMS.
- B. The Security Management System shall be certified by to meet the following standards:
 - 1. UL294 Listed
 - 2. ISO 9000 Listed
 - 3. FCC Part 15
 - 4. RoHS

1.07 SUBMITTALS

- A. Reference Section 26 2416.16 - ELECTRONICALLY OPERATED CIRCUIT-BREAKER PANELBOARDS.

1.08 QUALITY ASSURANCE

- A. Reference Section 28 0000 - GENERAL REQUIREMENTS FOR ELECTRONIC SAFETY & SECURITY SYSTEMS.
- B. Electrical Components, Devices, Accessories, and Installation shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 1. Comply with NECA 1.
 - 2. Comply with NFPA 70.
 - 3. Comply with NFPA 101.
- C. Software integration between the Security Management System, Video Management System, and all other integrated system components shall be tested and certified for interoperability by the manufacturers of each system.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Reference Section 28 0000 - GENERAL REQUIREMENTS FOR ELECTRONIC SAFETY & SECURITY SYSTEMS.

1.10 WARRANTY

- A. Reference Section 28 0000 - GENERAL REQUIREMENTS FOR ELECTRONIC SAFETY & SECURITY SYSTEMS.

1.11 ENVIRONMENTAL CONDITIONS

- A. SMS components shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - 1. All Components:
 - a. Operation: Rated for continuous operation in ambient temperatures of 32 to 95 deg F (0 to 35 deg C) and a relative humidity of 5 to 90 percent, noncondensing.
 - b. Storage: Component storage at ambient temperatures of -4 to 120 deg F (-20 to 49 deg C) and relative humidity of 5 to 90 percent, non-condensing.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

- A. Lenel - OnGuard (Extend Existing)
- B. No Approved Equal

2.02 PLATFORM

- A. Access Control System (ACS) Platform

1. Extend the existing ACS platform currently hosted inside the school district. Setup individual users that have specific privileges to access the new openings illustrated on the plans. Coordinate these access rights with the end user.
 2. Hardware Compatibility List
 - a. The ACS shall have an open architecture that supports the integration of third party IP-based door controllers and I/O modules. The ACS shall simultaneously support mixed configurations of access control hardware from multiple vendors.
 - b. The ACS shall support 802.1x authentication.
 - c. The ACS shall support the use of TLS 1.2 and certificates.
 - d. The ACS shall support multiple types of hardware devices: single-reader controllers, 2-reader controllers, 1- to 64-reader controllers, integrated readers and door controllers, and Power-over-Ethernet (PoE) enabled door controllers.
 - e. The ACS shall support most industry standard card readers that output card data using the Wiegand protocol and Clock-and-Data.
- B. Unified Security Platform (USP)
1. USP shall be an enterprise class IP-enabled security and safety software solution.
 2. The USP shall support the seamless unification of IP access control system (ACS), IP video management system (VMS) under a single platform. The USP user interface (UI) applications shall present a unified security interface for the management, configuration, monitoring, and reporting of embedded ACS, and VMS systems, and associated edge devices.
 3. Functionalities available with the USP shall include:
 - a. Configuration of embedded systems, such as ACS and VMS systems.
 - b. Live event monitoring.
 - c. Live video monitoring and playback of archived video.
 - d. Alarm management.
 - e. Reporting, including creating custom report templates and incident reports.
 - f. Microsoft Active Directory integration for synchronizing USP user accounts and ACS cardholder accounts.
 - g. Intrusion device and panel integration (live monitoring, reporting, and arming/disarming).
 - h. SIP Intercom device integration for bi-directional communication.
 - i. Dynamic graphical map viewing.
 4. The USP shall be deployed as follows:
 - a. Unified access and video platform.
 5. Licensing:
 - a. A single central license shall be applied centrally on the configuration server hosted at the school district. Provide license updates that grant the site the additional functionality illustrated on the plans and defined within this specification.
- C. Architecture:
1. The USP shall be based on a client/server model. The USP shall consist of a standard Server Software Module (SSM) and Client Software Applications (CSA).
 2. The USP shall be an IP enabled solution. All communication between the SSM and CSA shall be based on standard TCP/IP protocol and shall use TLS encryption with digital certificates to secure the communication channel.
 3. The SSM shall be a Windows service that can be configured to start when the operating system is booted and run in the background. The SSM shall automatically launch at computer startup, regardless of whether or not a user is logged on the machine.
 4. Users shall be able to deploy the SSM on a single server or across several servers for a distributed architecture. The USP shall not be restricted in the number of SSM deployed.
 5. The USP shall protect against potential database server failure and continue to run through standard off-the-shelf solutions.
 6. The USP shall support an unrestricted number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.

2.03 CONTROLLER MANAGEMENT

- A. The ACS shall support the discovery, configuration, and management of IP enabled controllers and I/O modules (hardware units). A user shall be permitted to add, delete, or modify a controller if they have the appropriate privileges.
- B. The ACS shall support unit configuration through a preconfigured door template.
- C. The ACS shall support automatic unit discovery. The user shall establish the settings for discovery ports and for the types of unit discovery and the ACS shall automatically detect all connected devices.
- D. The ACS shall support pre-configuration of the system prior to the physical hardware installation.
- E. The ACS shall support Firmware upgrade in bulk from the application.

2.04 DOOR MANAGEMENT

- A. The ACS shall support the configuration and management of doors. A user shall be able to add, delete, or modify a door if they have the appropriate privileges.
- B. The ACS shall permit multiple access rules to be associated to a door.
- C. It shall be possible to unlock all doors from an area at once.
- D. The ACS shall support the following forms of authentication: Card Only, Card or Keypad (PIN), or Card and Keypad (PIN). It shall be possible to define a schedule for when Card Only or Card and Keypad authentication modes shall be required.
- E. It shall be possible to set an extended grant time on a per-door basis (in addition to the standard grant time). Cardholder properties shall include the option of using the extended grant time. When flagged cardholders are granted access, the door shall be unlocked for the duration of the extended grant time instead of the standard grant time.
- F. The ACS shall allow the configuration of the relocking mode on doors such as on door open, after a definite time, or on door close.
- G. The ACS shall support the ability to enforce the use of two valid reads from different cardholders to grant access to an area.
- H. The ACS shall support the ability to enable access rules for other cardholders once a supervisor has accessed an area.
- I. The ACS shall support the ability to enable unlocking schedule on a door once an employee has entered the facility.
- J. Unlocking schedules and exceptions to unlocking schedules shall be associated with a door. An unlocking schedule shall determine when a door should be automatically unlocked. The ACS shall also support the use of a specific offline unlocking schedule. Exceptions to unlocking schedules shall be used to define time periods during which unlocking schedules shall not be applied, such as during statutory holidays.
- K. The ACS shall support one or more cameras per door. Video shall then be associated to door access events, such as access grant or access denied.

2.05 WEB CLIENT

- A. The USP shall support a unified web client (UWC) for access control and video..
- B. The UWC shall be a truly thin client with no download required other than an internet web browser or standard web browser plugins.
- C. The UWC shall be platform independent and run within Microsoft Internet Explorer, Firefox, Safari, and Google Chrome.
- D. The UWC shall be designed as an HTML5 application.
- E. The UWC shall support display on tablet format.
- F. The UWC will support native H.264 video in the web client.

- G. Web pages for the web client shall be managed and pushed by the Web Client Server. Microsoft IIS or any other web hosting service shall not be required given that all the web pages shall be hosted by the Mobile Server.
- H. The Web Client Server shall provide the ability to define a unique URL to access the web client, to ensure the security of the application.
- I. The UWC shall provide the ability to configure, save, and reload camera layouts.
- J. Functionalities:
 - 1. Log in using name and password or Active Directory support shall be available.
 - 2. Encrypted communications for all transactions.
 - 3. Access Control.
 - a. Cardholder and group (add/modify/delete)
 - b. Credential management (modify/delete)
 - c. Visitor management (check-in/modify/check-out)
 - d. Unlock door
 - e. Override the unlocking schedule on a door
 - f. Door Activities report
 - 4. Alarms.
 - a. Alarm report
 - b. Threat Level management.

PART 3 EXECUTION

3.01 WARRANTY

- A. The product shall perform in all material respects in accordance with the accompanying user manual, and the media on which the Software Product resides will be free from defects in materials and workmanship under normal use. Software defects are covered through Service Releases and Cumulative Updates which are available for a period of 1 year from the date of the software purchase.

3.02 DEPLOYMENT SERVICES AND SYSTEM COMMISSIONING

- A. General Requirements:
 - 1. The contractor shall engage the services of the USP vendor to assist in the management of the deployment of the USP at the end-user site on projects that involve:
 - a. Multiple contractors or subcontractors that will be responsible for deploying the USP at multiple client sites in different geographical regions.
 - b. Extensive use of customized solutions/plugins developed by the vendor that will be integrated into the USP.
 - 2. The USP vendor services shall include Deployment Management and System Configuration and Commissioning.
- B. Deployment Management Service:
 - 1. The Deployment Management service from the vendor shall include a Project Manager acting as the single point of contact for all communications between the contractor and the vendor organization and who will be responsible for:
 - a. Conducting a Risk Assessment of the impact of potential risk factors on the operation of the vendor's USP.
 - b. Providing a project plan for the deployment of the vendor's USP.
 - c. Managing the development and deployment of the custom solution components that will be integrated into the vendor's USP (if applicable).
 - d. Providing a scope of work detailing the services to be provided by the vendor to assist in the deployment of the vendor's USP.
 - e. Coordinating and scheduling the vendor field services with the contractor to assist with the deployment of the vendor's USP.
 - f. Providing regular project status updates to the contractor regarding the development of custom solutions (if applicable) and the deployment of the vendor's USP.
- C. Solution Architect Service:

1. The Solution Architect service from the vendor shall include a Solutions Architect Engineer acting as a single technical point of contact throughout the deployment of the USP, and who will be responsible for:
 - a. Assisting the contractor/subcontractor with the design and architecture of the vendor's USP.
 - b. Conducting technical consultation activities that may include fit/gap analysis, system design reviews, device compatibility assessments, functional and technical design reviews, as well as performance reviews of the vendor's USP.
 - c. Conducting a system assessment and ensuring best practices of the vendor's USP are followed.
 - d. Providing upgrade and migration strategy for the vendor's USP where applicable.
 - e. Providing documentation regarding the system architecture, system design, hardware specifications and compatibility requirements, camera bandwidth calculations, and best practices as they relate to the vendor's USP.
- D. System Configuration and Commissioning Service:
 1. The System Configuration and Commissioning service from the vendor shall include a Field Engineer who will be responsible for:
 - a. Assisting the contractor's or subcontractor's onsite/remote technicians with the configuration and commissioning of the vendor's USP at the client site.
 - b. Conducting a test of the USP following the deployment of the system using real-world operator scenarios to ensure optimal system performance.
 - c. Providing the contractor with a Service Report detailing the tasks completed during the deployment of the USP at the client site, as well as any recommendations for improving the performance of the USP that must be implemented by the contractor.
 - d. Providing a knowledge transfer of the vendor's USP to the contractor following the deployment of the USP at the client site.

3.03 MANUFACTURER END USER OPERATOR TRAINING

- A. The contractor shall engage the services of the USP vendor to assist in the end user training of the USP at the end-user site.
- B. Provide two (2) 2-hour training session at the owner's discretion. One training may be utilized initially and the 4J Community School District will hold the right to have the 2nd training "refresh" later but within the first year of the installation.

END OF SECTION

**SECTION 28 1500
SECURITY MANAGEMENT SYSTEM HARDWARE DEVICES**

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Enclosure and Power Supplies
 - 2. Intelligent Network Controllers
 - 3. Door Controllers
 - 4. Card readers
 - 5. Door position switches
 - 6. Cables

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The following documents shall also be considered as a part of and shall relate directly to this section:
 - 1. Section 28 0000 - GENERAL REQUIREMENTS FOR ELECTRONIC SAFETY & SECURITY SYSTEMS
 - 2. Section 28 1300 - SECURITY MANAGEMENT SYSTEM

1.03 DEFINITIONS

- A. Credential: Data assigned to an entity and used to identify that entity.
- B. Identifier: A credential card; keypad personal identification number; or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.
- C. Location: A Location on the network having a PC-to-controller communications link, with additional controllers at the Location connected to the PC-to-controller link with a TIA 485-A communications loop. Where this term is presented with an initial capital letter, this definition applies.
- D. PC: Personal computer. Applies to the central station, workstations, and file servers.
- E. RAS: Remote access services.
- F. RF: Radio frequency.
- G. TCP/IP: Transport control protocol/Internet protocol.
- H. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings. Test and evaluation data presented in Product Data shall comply with SIA BIO-01.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Diagrams for cable management system.
 - 2. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.
 - 3. Wiring Diagrams. For power, signal, and control wiring.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:
 - 1. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on USB media of the hard-copy submittal.
 - 2. System installation and setup guides with data forms to plan and record options and setup decisions.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Credential card blanks, ready for printing. Include a total of one-hundred cards. Coordinate all card options including but not limited to magnetic stripe, slot punching and keyfob alternatives with the Owner prior to ordering.
 - 2. Fuses of all kinds, power and electronic, equal to 10 percent of amount installed for each size used, but no fewer than three units.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain central station, workstations, controllers, Identifier readers, and all software through one source from single manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F, and not more than 80 percent relative humidity, noncondensing.
- B. Open each container; verify contents against packing list; and file copy of packing list, complete with container identification, for inclusion in operation and maintenance data.
- C. Mark packing list with the same designations assigned to materials and equipment for recording in the system labeling schedules that are generated by software specified in "Cable and Asset Management Software" Article.
- D. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.09 PROJECT CONDITIONS

- A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - 1. Control Station: Rated for continuous operation in ambient conditions of 60 to 85 deg F and a relative humidity of 20 to 80 percent, noncondensing.

PART 2 PRODUCTS

2.01 OPERATION

- A. Security access system hardware shall use a single database for access-control and credential-creation functions.

2.02 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70, "National Electrical Code."

2.03 ENCLOSURE AND POWER SUPPLIES

- A. Approved Manufacturers:
 - 1. Lenel LNL-AL600ULX-4CB6 (Panels and Panel Power)
 - a. Complete with ABT-12 Battery Backup Option

2. Altronix Maximal 33E (Electric Strike Power)
 3. Engineer approved equal
- B. Enclosure Description:
1. Dimensions: 18.25" W x 24.25" H x 4.5" D
 2. Capacity: Integral Standoffs to host five (1) dual reader controllers, one (1) intelligent system controller and 12VDC power supply.
 3. Protected AC cover with on/off circuit breaker for maintenance safety
 4. Pre-drilled mounting holes for field upgrades.
 5. Removable door with "fast disconnect" ground strap.
 6. Multiple knockouts on all four sides.
- C. Quantity: Provide enclosure and power supply quantities as required for a completed installation.

2.04 INTELLIGENT CONTROLLERS

- A. Approved Manufacturers:
1. Lenel LNL3300
 2. Engineer Approved Equal
- B. General Description:
1. The intelligent controller must provide decision making, event reporting, and database storage as a hardware platform. Two reader interfaces must provide control for two doors in addition to supporting an additional 62 doors, paired and or alternate reader configurations with peripheral interface devices.
 2. The controller must communicate with the host via on-board 10BaseT/100BaseTX Ethernet port and support TLS encryption as a minimum security implementation.
 3. The intelligent controller must be capable of elaborate processes and procedures without host intervention. Once configured, the intelligent controller must function independently of the host, and must be capable of controlling access, managing alarms, interfacing with an array of hardware devices, all while providing the decision-making oversight that each system configuration requires.
 4. The intelligent controller must provide centralized biometric template management and support a wide range of reader technologies, including OSDP, Wiegand, magnetic stripe and biometric.
 5. Two physical barriers must be controlled. Each reader port must accommodate a read head that utilizes OSDP (RS-485), OSDP SC, Wiegand, magnetic stripe, or F2F protocol/electrical signaling standards, one or two wire LED controls, and buzzer control.
 6. Controller must support, as a minimum the following open standards, PSIA Area Control, SNMPv3/v2c, OSDP and OSDP SC.
- C. Technical Description and Specifications:
1. The interface is for use in low voltage, Class 2 Circuits only.
 2. The installation of this device must comply with all local fire and electrical codes.
 3. Primary Power: 12 to 24 Vdc \pm 10 %, 500 mA maximum (reader and USB ports not included)
 4. Memory and Clock Backup Battery: 3 Volt Lithium, type BR2330 or CR2330
 5. Host Communication: Ethernet: 10-BaseT/100Base-TX and Micro USB port (2.0) with optional adapter: pluggable model USB2-OTGE100
 6. Serial I/O Device One each: 2-wire RS-485, 2,400 to 115,200 bps, asynchronous, half-duplex, 1 start bit, 8 data bits, and 1 stop bit
 7. Cable requirements
 - a. Ethernet: CAT-5e, minimum
 - b. RS-485
 - 1) (I/O Device Port): 1 twisted pair, shielded, 120 ohm impedance, 24 AWG, 4,000 ft. (1,219 m) max.

- 2) (Reader Port): 1 twisted pair, shielded, 120 ohm impedance, 24 AWG, 2,000 ft. (610 m) max.
 - c. Alarm Input: 1 twisted pair, 30 ohms maximum
 - 8. Environmental
 - a. Temperature:
 - 1) -55 to +85 °C, storage
 - 2) 0 to +70 °C, operating
 - b. Humidity: 5 to 95 % RHNC
 - 9. Mechanical
 - a. Dimension: 8 in. (203.2 mm) W x 6 in. (152.4 mm) L x 1 in. (25 mm) H
 - b. Weight: 9 oz. (255 g) nominal, board only
 - 10. Product Compliance
 - a. UL294 Recognized
 - b. FCC Part 15 Class A
 - c. CE Compliant
 - d. ROHS
 - e. NIST Certified Encryption
 - 11. Warranty: Mercury Security warrants the product is free from defects in material and workmanship under normal use and service with proper maintenance for one year from the date of factory shipment.
- D. Features:
 - 1. Connectivity: 10/100 Ethernet. Optional alternate 10/100 Ethernet (using USB/Ethernet converter)
 - 2. Security:
 - a. Host/Controller connection protected by TLS 1.2/1.1 or AES-256/128
 - b. Controller/IO Expansion connection protected by AES
 - c. Generate and load custom peer certificates for TLS
 - d. Port based network access control using 802.1X
 - e. Crypto memory chip
 - f. FIPS 140-2 user of OpenSSL
 - g. HTTPS protection for installer web pages
 - h. Secure cookies
 - i. SNMPv3/v2c
 - j. DIP switch toggle sets 5 minute time to disable webpage access
 - k. Disable default login credentials
 - l. Authorized IP address filtering
 - m. IP Client Proxy
 - n. Bulk erase controller and periphery devices during replacement
 - o. Strong password enforcement
 - 3. Access Control:
 - a. 240,000 Cardholder capacity
 - b. 50,000 Transaction buffer
 - c. If/Then Macro capability
 - d. Adjustable cardholder capacity
 - e. Supports up to 520 inputs and 516 outputs
 - 4. Card Formats:
 - a. 16 card formats per active reader, 8 per offline reader
 - b. Entire card number reported on invalid read
 - c. 19 digit (64-bit) User ID and 15 digit PIN numbers maximum
 - d. PIV, CAC, TWIC card compatible
 - e. 255 Access Levels per cardholder
 - f. Activation/Deactivation Date or Date & Times
 - 5. Card Reader Functions

- a. Multiple card format support by reader
- b. Paired reader support
- c. Alternate reader support
- d. Elevator support
- e. Turnstile support
- f. Biometric device support
- g. Open Supervised Device Protocol (OSDP) and OSDP SC compliant
- h. Occupancy count
- i. Support of multi-occupancy rules
- j. Anti-passback support
 - 1) Area-based, reader-based, or time based
 - 2) Nested area, hard, soft, or timed forgiveness
- k. Supports host-based approval rules
- l. Keypad support with programmable user commands, card input
- m. Shunt relay support
- n. Strike follower relay support
- o. Threat level and Operating Modes
- p. Host controlled OSDP reader passthrough
- q. Elevator floor override
- 6. Database Functions
 - a. Encrypted database
 - b. Configurable card database
 - c. Supports up to nineteen (19) digit card numbers
 - d. Supports pin codes up to fifteen (15) digits
 - e. Card issue code of up to 32 bits, ADA and VIP flags; PIV (75 bits); Smart Card (200 bits)
 - f. Ability to track people and objects
- 7. Intrusion Alarm Functions
 - a. Supports entry delays and exit delays
 - b. Area monitoring
 - c. Standard alarm masking
 - d. Provides control and alarm processing from the keypad
- 8. Supported Integrations
 - a. Regional I/O shares I/O status
 - b. Wireless locks
 - c. Map Power Supply Alarms and Events using PSIA
 - d. Reader firmware and configuration download
 - e. Supports 1 total RS-485 I/O protocols
- 9. System Functions
 - a. Relay count activations
 - b. Interoperability with older host software using Legacy Mode feature
- 10. Synchronize time using NTP

2.05 DOOR CONTROLLERS

- A. Approved Manufacturers:
 - 1. Lenel LNL1320
 - 2. Engineer approved equal
- B. General Description:
 - 1. The peripheral interface device shall provide a solution for interfacing to TTL/Wiegand/RS-485 type readers and door hardware. The intelligent controller shall accept data from a reader with clock/data, Wiegand or RS-485 signaling, provide a tri-stated LED control and buzzer control. It shall also provide six

2. Form-C relay outputs and eight supervised inputs for monitoring. The controller shall communicate via a 2-wire RS-485 interface.
- C. Technical Description and Specifications:
1. Primary Power:
 2. 12-24VDC $\pm 10\%$, 550mA maximum, plus reader current
 3. 12VDC at 450mA nominal, plus reader current
 4. 24VDC at 270mA nominal, plus reader current
 5. Communication: 2-wire RS-485, 4,000 feet using Belden 9841
 - a. Reader Interface: two reader ports, data card/keypad, clock/data, data-1/data-0, or 2-wire RS-485
 - b. LED: one-wire bi-color LED support or two-wire
 - c. Buzzer: one-wire LED mode
 - d. Keypad: 8-bit Mercury, 8-bit Dorado, or 4-bit HID
 - e. Reader Power:
 - 1) Pass through or 12Vdc regulated power, 125mA each reader
 - f. Inputs: eight general purpose programmable type and two dedicated for tamper and power monitor
 - g. Outputs: six relays - Form-C, 5 Amps at 28Vdc
 - h. Temperature: 0 to 70 degrees Centigrade operational, -55 to 85 degrees Centigrade storage
 - i. Humidity: 10-95 percent RHNC
- D. Features:
1. Card Formats:
 - a. Eight active card formats per intelligent controller
 - b. 19 digit (64-bit) User ID and 15 digit PIN numbers maximum
 - c. PIV-II, CAC, TWIC card compatible
 2. Card Reader Functions
 - a. Multiple card format support by reader
 - b. Paired reader support
 - c. Alternate reader support
 - d. Turnstile support
 - e. Biometric device support
 - f. Keypad support with programmable user commands, card input
 - g. Shunt relay support
 - h. Strike follower relay support
 3. Database Functions
 - a. Supports up to nineteen (19) digital card numbers
 4. Intrusion Alarm Functions
 - a. Supports entry delays and exit delays
 - b. Provides control and alarm processing from the keypad
 5. Offline mode operation
 - a. Door mode
 - 1) Unlocked, locked, facility code only
 - 2) Relay Mode
 - (a) Programmable for offline conditions

2.06 CARD READERS (OFCI)

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Hughes Identification Devices (HID) 920PTNTEK00000 RP40. (Owner-furnished, contractor-installed)
 2. Engineer Approved Equal
- B. Card-Reader Power: Powered from its associated controller, including its standby power source, and shall not dissipate more than 5 W.

- C. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the controller. Response time shall be 800 ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.
- D. Communication Protocol: Compatible with local processor.

2.07 DOOR POSITION SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Aritech
 - a. Recessed: Product No. 1078CW (For doors with a channel at the top utilize 1840 Rare Earth Magnet)
 - b. Surface: Aritech 2505A-L
 - 2. Engineer Approved Equal
- B. Flush-mount: Provide recessed ¾" magnetic reed switch set for all hollow frame applications. Utilize double pole double throw switches to allow for an additional set of contacts.
- C. Surface-mount: Provide surface mount magnetic reed switch set for all filled frames in which a concealed pathway is not possible. Utilize double pole double throw switches to allow for an additional set of contacts.
- D. Overhead door: Provide surface mounted and extruded aluminum floor mounting door contacts for overhead door monitoring applications. Utilize double pole double throw switches to allow for an additional set of contacts.

2.08 SWITCHES & PUSHBUTTONS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following suited for this listed application:
 - 1. Door Lockdown (LD): Pass & Seymour 1250-Red with Pass & Seymour WP1
 - a. Single pole, double throw 15A rated, 120/277V manual switch, red finish. Provide with dustproof stainless steel cover engraved with red lettering stating "EMERGENCY LOCKDOWN".
 - 2. Door Lockout (LO): Pass & Seymour 1250-Red with Pass & Seymour WP1
 - a. Single pole, double throw 15A rated, 120/277V manual switch, red finish. Provide with dustproof stainless steel cover engraved with red lettering stating "EMERGENCY LOCKOUT".
 - 3. Momentary Door Release (MDR): Owner-furnished, contractor-installed.

2.09 VISUAL NOTIFICATION DEVICE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following suited for this listed application:
 - 1. Lockdown-Lockout Indicator Light: Federal Signal SLM 1450 (Fresnel)
 - a. Multicolor multifunctional LED beacon. Multichannel technology allowing up to three (3) separate levels of alarm controllable via wiring selection. Each channel capable of selecting unique color (amber, blue, clear, cyan, green, magenta, red, yellow), flash pattern (steady, 1x, 3x, 5x, random flash) and light output brightness (33%, 66%, 100%) via integrated buttons.
 - b. In coordination with 4J school district, wire and program to provide functionality as follows:
 - 1) State of lockdown: Blue color, steady flash pattern, 100% brightness
 - 2) State of lockout: Red color, steady flash pattern, 100% brightness

2.10 CABLES

- A. General Cable Requirements: Provide a plenum rated solution that complies with the security management system manufacturer's recommendations for each application. Providing individual pair and multi-pair cables or a composite cable is an approved method.
- B. Review all amperage and distance requirements for proper wire gauge selection. Coordinate this selection with the specified electrified door hardware.

- C. 4J Standards:
 1. Card Reader: 22 AWG, 8-Conductor, Stranded, Shielded with orange jacket.
 2. Power to Electric Strikes: 16 AWG, 2-Conductor, Stranded with orange jacket.
 3. Door Contacts: 22 AWG, 4-Conductor, Stranded with orange jacket.
 4. Request-to-exit Devices: 22 AWG, 4-Conductor, Stranded with orange jacket.
 5. Door Lockdown/Lockout Devices: 22 AWG, 4-Conductor, Stranded with orange jacket.
 6. Momentary Door Release: 22 AWG, 4-Conductor, Stranded with orange jacket. (Verify with owner-furnished equipment)
 7. Door Lockdown/Lockout Indicator Light: 18 AWG, 4-Conductor, Stranded with orange jacket.
- D. Cabling routed in conduit underground shall also be outdoor-rated.

2.11 TRANSFORMERS

- A. NFPA 70, Class II control transformers, NRTL listed. Transformers for security access-control system shall not be shared with any other system.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- B. Examine rough-in control cable conduit systems to PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Comply with recommendations in SIA CP-01.
- B. Comply with TIA 606-B, "Administration Standard for Commercial Telecommunications Infrastructure."
- C. Product Schedules: Obtain detailed product schedules from manufacturer of access-control system or develop product schedules to suit Project. Fill in all data available from Project plans and specifications and publish as Product Schedules for review and approval.
- D. In meetings with Architect and Owner, present Product Schedules and review, adjust, and prepare final setup documents. Use approved, final Product Schedules to set up system software.

3.03 CABLING

- A. Comply with NECA 1, "Good Workmanship in Electrical Construction."
- B. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
- C. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental airspaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
- D. Boxes and enclosures containing security-system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.
- E. Install end-of-line resistors at the field device location and not at the controller or panel location.

3.04 CABLE APPLICATION

- A. Comply with TIA 569-D, "Commercial Building Standard for Telecommunications Pathways and Spaces."
- B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.
- C. TIA 232-F Cabling: Install at a maximum distance of 50 ft. between terminations.
- D. TIA 485-A Cabling: Install at a maximum distance of 4000 ft. between terminations.
- E. Card Readers and Keypads:
 - 1. Install number of conductor pairs recommended by manufacturer for the functions specified.
 - 2. Unless manufacturer recommends larger conductors, install No. 22 AWG wire if maximum distance from controller to the reader is 250 ft., and install No. 20 AWG wire if maximum distance is 500 ft.
 - 3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the controller.
 - 4. Install minimum No. 18 AWG shielded cable to readers and keypads that draw 50 mA or more.
- F. Install minimum No. 16 AWG cable from controller to electrically powered locks. Do not exceed 250 ft. between terminations.
- G. Install minimum No. 18 AWG ac power wire from transformer to controller, with a maximum distance of 25 ft. between terminations.

3.05 GROUNDING

- A. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."
- B. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- C. Bond shields and drain conductors to ground at only one point in each circuit.
- D. Signal Ground:
 - 1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
 - 2. Bus: Mount on wall of main equipment room with standoff insulators.
 - 3. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.06 IDENTIFICATION

- A. In addition to requirements in this article, comply with applicable requirements in Section 27 0553 "Identification for Communications Systems" and with TIA 606-B.
- B. Using software specified in "Cable and Asset Management Software" Article, develop cable administration drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with the same designation. Use logical and systematic designations for facility's architectural arrangement.
- C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - 1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.
- D. At completion, cable and asset management software shall reflect as-built conditions.

3.07 SYSTEM SOFTWARE AND HARDWARE

- A. Develop, install, and test software and hardware, and perform database tests for the complete and proper operation of systems involved. Assign software license to Owner.

3.08 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power-supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.
 - 2. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.
- C. Devices and circuits will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.09 STARTUP SERVICE

- A. Engage a factory-authorized service representative to supervise and assist with startup service.
 - 1. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.
 - 2. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

3.10 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain security access system.
- B. Develop separate training modules for the following:
 - 1. Computer system administration personnel to manage and repair the databases and to update and maintain software.
 - 2. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.
 - 3. Security personnel.
 - 4. Hardware maintenance personnel.
 - 5. Corporate management.

END OF SECTION

**SECTION 28 1523
INTERCOM ENTRY SYSTEM**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Intercom entry system and associated door/entry stations, interior stations, and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of intercom stations with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate the work with other installers to provide power for equipment at required locations.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meetings:
 - 1. Conduct meeting with facility representative to review intercom station and equipment locations.
 - 2. Conduct meeting with facility representative and other related equipment manufacturers to discuss intercom entry system interface requirements.
- C. Sequencing:
 - 1. Do not install intercom stations until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. ADA Standards.
 - 2. NFPA 70 (National Electrical Code).
 - 3. Applicable TIA/EIA standards.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Intercom Entry System - Basis of Design: Aiphone Corporation: JFS-2AEDV
- B. No Engineer approved equal.

2.02 INTERCOM ENTRY SYSTEM

- A. Provide new intercom entry system consisting of required equipment, conduit, boxes, wiring, connectors, hardware, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. System Description:
 - 1. System Type: Audio-video, analog.
- C. Door/Entry Stations:
 - 1. Vandal resistant, with tamper proof hardware.
 - 2. Suitable for the environment where installed.
 - 3. Provide means to initiate call to designated interior station(s).
 - 4. Provide for hands-free two-way communication with interior station(s).
- D. Interior Stations:
 - 1. Audio-Video Master Station:
 - a. Provides for hands-free and handset two-way communication with designated door/entry station(s).
 - b. Provide means for unlocking/releasing door corresponding to door/entry station communication is established with.
 - c. Provide means to initiate video monitoring of connected door/entry station(s).
 - d. Mounting: Wall or desk.
 - e. Features:
 - 1) Adjustable audible call notification volume.
 - 2) Adjustable communication volume.
 - 3) Adjustable LCD screen brightness.
 - 4) Automatic recording of visitor images upon call initiation from door/entry station.
 - 5) Manual video recording capability.
 - 6) Capability to transfer an answered call to another master station.
- E. Accessories:
 - 1. Provide components as indicated or as required for a complete operating system.
 - 2. Wiring: Provide manufacturer's recommended cables as indicated or as required for connections between system components.
 - 3. Provide accessory racks/cabinets as indicated or as required for equipment mounting.
 - 4. Provide relays and modules as indicated or as required for interfacing with existing access control system.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Provide grounding and bonding in accordance with Section 26 0526.
- D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- E. Identify system wiring and components in accordance with Section 26 0553.

3.02 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Test to verify wiring is free of shorts and grounds.
- C. Prepare and start system in accordance with manufacturer's instructions.
- D. Test system for proper operation.
- E. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.03 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.04 CLOSEOUT ACTIVITIES

3.05 PROTECTION

- A. Protect installed system components from subsequent construction operations.

END OF SECTION

**SECTION 28 3111
BUILDING INTRUSION DETECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Intrusion detection system requirements.
- B. Initiating devices.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0533.13 - Conduit for Electrical Systems.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 28 1500 - SECURITY MANAGEMENT SYSTEM HARDWARE DEVICES.

1.03 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices current edition.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 365 - Police Station Connected Burglar Alarm Units and Systems Current Edition, Including All Revisions.
- E. UL 609 - Local Burglar Alarm Units and Systems Current Edition, Including All Revisions.
- F. UL 634 - Connectors and Switches for Use with Burglar-Alarm Systems Current Edition, Including All Revisions.
- G. UL 639 - Intrusion-Detection Units Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate compatibility of devices for the installed locations with work provided under other sections or by others.
 - a. Doors and Windows: See appropriate Division 8 sections.
 - 2. Coordinate the placement of sensors and keypads with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install sensors and keypads until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.
- C. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include system interconnection schematic diagrams. Include requirements for interface with other systems.
- D. Design Data: Include standby battery calculations.
- E. Certify that proposed system design and components meet or exceed specified requirements.
- F. Evidence of qualifications for installer.

- G. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
- H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- I. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.
- J. Software: One copy of software not resident in read-only memory.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with intrusion detection systems of similar size, type, and complexity and providing contract maintenance service as a regular part of their business; authorized representative of control unit manufacturer.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 INTRUSION DETECTION SYSTEM REQUIREMENTS

- A. Provide modifications and extensions to existing intrusion detection system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide DMP 714-18T (4 zone) expander panel compatible with the existing Digital Monitoring Products (DMP) XR550. Connect panels together via the copper bus port. Size cabling appropriately for the length of run required.
- C. Initiating Device Requirements:
 - 1. Protected Premises: Entire building as indicated.
 - 2. Provide magnetic contacts to monitor opened/closed position for:
 - a. All perimeter and owner-designated interior man doors.
- D. Alarm Notification and Reporting Requirements:
 - 1. Activate alarm notification at alarm control unit and associated keypads/annunciators with appropriate zone information displayed.
 - 2. Activate existing local notification appliances.
 - 3. Transmit alarm report via existing system.
- E. Interface with Other Systems:

1. Provide products compatible with other systems requiring interface with intrusion detection system.
 2. Interface with access control system as specified in Section 28 1300 - SECURITY MANAGEMENT SYSTEM.
- F. Provide products listed, classified, and labeled as suitable for the purpose intended.
1. Local Alarm Units and Systems: Listed and labeled as complying with UL 609.
- G. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.

2.02 INITIATING DEVICES

- A. Manufacturers: Same as manufacturer of alarm control units where possible.
- B. General Requirements:
1. Provide devices suitable for intended application and location to be installed.
- C. Contacts:
1. Listed and labeled as complying with UL 634.
 2. Magnetic Contacts: Encapsulated reed switch(es) and separate magnet; designed to monitor opened/closed position of doors or windows.
 3. Basis of Design Products: Refer to Specification Section 28 15 00 - SECURITY MANAGEMENT SYSTEM HARDWARE DEVICES.

2.03 ACCESSORIES

- A. Provide cables as indicated or as required for connections between system components.
- B. Provide end-of-line resistors (EOLR) as required for supervision of hardwired zones.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Wiring Method: Unless otherwise indicated, use wiring in conduit.
1. Conduit: Comply with Division 26 Specifications.
- D. Provide grounding and bonding in accordance with Section 26 0526.
- E. Identify system wiring and components in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Prepare and start system in accordance with manufacturer's instructions.
- C. Inspection and testing to include, at a minimum:
1. Test each initiating device for proper response by alarm control unit.
 2. Test for proper operation of output relays.
 3. Test for proper operation of communication interfaces and central station reporting.
 4. Test for proper interface with other systems.

- D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 ADJUSTING

- A. Program system parameters according to requirements of Owner.

3.05 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

3.07 PROTECTION

- A. Protect installed system components from subsequent construction operations.

END OF SECTION