

# CASCADE UNION ELEMENTARY SCHOOL DISTRICT

Bid No. CUESD-CUPCCAA-2023-09-29

## REQUEST FOR PROPOSAL

### Low Voltage Wiring and Audio/Visual System for Meadow Lane Elementary New Gymnasium

Addendum No. 03

Date: 2023/10/11

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FOR THE ABOVE-MENTIONED REQUEST FOR PROPOSAL AND TO ALL PROSPECTIVE BIDDERS, THIS ADDENDUM IS ISSUED AS A RESPONSE TO THE REQUESTS FOR INFORMATION, AND FOR AREAS IN THE ORIGINAL DOCUMENT THAT REQUIRED FURTHER DETAILS OR CLARIFICATION.

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#### REVISIONS:

##### GENERAL:

- Please see the attached *Technology Specification* for this RFP.

##### FOR **AUDIO/VISUAL SYSTEM PORTION** OF PROJECT:

- Some ancillary devices (originally communicated only as “related accessories”) for the Audio/Visual System were not specifically included in the original RFP. To be included in the list under the section “Hardware and brand requirements”:
  - 2ea Atlona Single Gang Dual HDMI Wall Transmitter
  - 1ea Atlona 8-Button Network Control Panel
  - 1ea Atlona 4K/UHD HDMI Over 100M HDBaseT Receiver with Ethernet, Control and PoE
- Quantities for some devices were not included in the original RFP. To be included in the list under the section “Hardware and brand requirements”:
  - 7ea JBL AWC159-BK 15” 2-way all-weather compact coaxial loudspeaker
  - 2ea Sennheiser EW-D EM digital single channel receiver
  - 2ea Sennheiser EW-D SKM-S digital handheld transmitter with mute switch
  - 2ea Sennheiser MMD 835-1 BK microphone module
  - 2ea DBX ZC-2 wall-mounted programmable zone controller

## REQUEST FOR INFORMATION:

**Q:** Is plenum-rated data cabling required?

**A:** Plenum-rated cabling (CMP) is expected for all “plenum spaces”. However, the new Meadow Lane Gymnasium is a fully modern single-story structure and so the number of these spaces is expected to be minimal or nonexistent. Vendor is expected to refer to city, county and state building codes, review the map provided in the RFP, and attend a site-walk to address any potential areas of concern.

As mentioned in *Addendum 02*, all work must meet or exceed *California Building Codes* and *DSA* requirements. The *Technology Specification* for the new Meadow Lane Gymnasium has been included in this addendum to provide additional supporting details and information.

**Q:** What frequency is required for the Sennheiser EW-D EM and EW-D SKM-S products?

**A:** The original RFP did not specify the quantity of these items, which is 2ea (see revision above). Therefore, any two different frequency ranges are acceptable—that is, the sole concern is that duplicate hardware does not have overlapping frequency ranges which may cause signal interference.

**Q:** The warranty option for the Epson V11HA65920 Projector is five years: *5-Year Next Business Day Whole Unit Exchange Upgrade (Years 1-3) and Extension (Years 4-5)*. Is this acceptable?

**A:** Yes, this five year extended warranty is acceptable.

## SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Optical-fiber-cable pathways and fittings.
  - 2. Smoke and acoustical pathways.
  - 3. Hooks.
  - 4. Velcro one-hole straps.
  - 5. Suspended Ceiling Cable Penetration.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For all products.

#### 1.3 LISTINGS

- A. Provide and install products to the project that are labeled and/or listed for the intended location and use per manufacturer's guidelines and the California Electric Code.

### PART 2 - PRODUCTS

#### 2.1 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Description: Comply with UL 2024; flexible-type pathway with a circular cross section, approved for general-use installation unless otherwise indicated.
- B. Listed and labeled as defined in CEC, by an NRTL, and marked for intended location and application.
- C. Comply with TIA-569-D.

#### 2.2 SUSPENDED CEILING CABLE PENETRATION SYSTEM

- A. Description: Suspended cable penetration plate with (3) 4" conduit riser tubes and flanges per 2x2 ceiling tile.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. CTS.

C. Contents must include:

1. Flange.
2. #18 gauge steel grid wire (4) per flange.
3. Compression ring assemblies.
4. Lock ring.
5. Tube.

## 2.3 HOOKS

- A. Description: Prefabricated sheet metal cable supports for telecommunications cable.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Panduit Corp.
  2. Wiremold / Legrand.
  3. Arlington.
  4. Commscope
- C. Listed and labeled as defined in CEC, by an NRTL, and marked for intended location and application.
- D. Comply with TIA-569-D.
- E. J shape.

## 2.4 VELCRO ONE-HOLE STRAP

- A. Description: Velcro bundle support device with one hole strap for securing smaller cable runs to the building structure.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Rip Tie.

## 2.5 SUSPENDED CEILING PENETRATIONS:

- A. For every 4" conduit penetration into the MDF/Data room from the Attic space, provide (1) ceiling cable penetration directly over the 4" conduit secured above.

# PART 3 - EXECUTION

## 3.1 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed Conduit subject to damage: GRC.
2. Exposed Conduit not subject to damage: EMT.
3. Concealed Conduit, Aboveground: EMT.
4. Underground Conduit: RNC, Type EPC-40-PVC.
5. 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 and Subject to Severe Physical Damage: GRC.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Damp or Wet Locations: GRC.

C. Minimum Pathway Size: 3/4-inch trade size for copper and aluminum cables, and 2 inch for optical-fiber cables.

### 3.2 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. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

1. 2-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
2. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
3. Utilize long radius ells for all optical-fiber cables.

C. Hooks:

1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.
2. Shall be supported by dedicated support wires or structural steel. 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.
  6. Separate communications, fire alarm, data and other systems by minimum spacing of 6 inches.
- D. Install Velcro one-hole straps for smaller cable runs (5 or less). Space no more than 5 ft on center.

END OF SECTION 270528

## SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Color and legend requirements for labels and signs.
2. Labels.

#### 1.2 ACTION SUBMITTALS

- A. Refer to the Standard General Conditions and Supplementary Conditions.
- B. Product Data: For each type of product

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Comply with CEC and TIA 606-B.
- B. Comply with ANSI Z535.4 for safety signs and labels.
- C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

#### 2.2 COLOR AND LEGEND REQUIREMENTS

A. Equipment Identification Labels:

1. Black letters on a white field.
2. Comply with TIA-606-A and UL969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
3. The size, color, and contrast of all labels should be selected to ensure that the identifiers are easily read. Labels should be visible during normal maintenance of the infrastructure.
4. Labels should be resistant to the environmental conditions at the point of installation (such as moisture, heat, or ultraviolet light), and should have a design life equal to or greater than that of the labeled component.

5. The text on labels shall be machine generated.

## 2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
- B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceway or cable they identify, that stay in place by gripping action.
- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, polyester or vinyl 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.
  2. Marker for Labels: Permanent, waterproof black ink marker recommended by tag manufacturer.
  3. Marker for Labels: Machine-printed, permanent, waterproof black ink recommended by printer manufacturer.

## 2.4 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

# PART 3 - EXECUTION

## 3.1 PREPARATION

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

## 3.2 INSTALLATION

- A. Install identifying devices before installing acoustical ceilings and similar concealment.
- B. Verify identity of each item before installing identification products.
- C. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.



- D. Apply identification devices to surfaces that require finish after completing finish work.
- E. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- F. Vinyl Wraparound Labels:
  - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
  - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
  - 3. Provide label 6 inches from cable end.
- G. Snap-Around Labels:
  - 1. Secure tight to surface at a location with high visibility and accessibility.
  - 2. Provide label 6 inches from cable end.
- H. 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.

### 3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.
- C. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation, numbered clockwise when entering room from primary egress, composed of the following, in the order listed on plans.
- D. Equipment Room Labeling:
  - 1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels.
  - 2. Patch Panels: Label individual rows and outlets, starting at top left and working down, with self-adhesive labels.
  - 3. Data Outlets: Label each outlet with a self-adhesive label indicating the following, in the order listed on plans.
- E. Backbone Cables: Label each cable with a vinyl-wraparound, label snap-around or label 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.
- F. Horizontal Cables: Label each cable with a vinyl-wraparound label, snap-around label or self-adhesive wraparound label indicating the following, in the order listed on plans.

G. Instructional Signs: Self-adhesive labels.

H. Equipment Identification Labels:

1. Indoor Equipment: Laminated-acrylic or melamine-plastic sign.
2. Outdoor Equipment: Laminated-acrylic or melamine-plastic sign.
3. Equipment to Be Labeled:
  - a. Communications cabinets.

END OF SECTION 270553

## SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Category 6 twisted pair cable.
2. Category 6A twisted pair cable.
3. Twisted pair cable hardware, including plugs and jacks.
4. Cable management system.
5. Cabling identification products.
6. Grounding provisions for twisted pair cable.
7. Source quality control requirements for twisted pair cable.

#### 1.2 DEFINITIONS

- A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- B. EMI: Electromagnetic interference.
- C. FTP: Shielded twisted pair.
- D. F/FTP: Overall foil screened cable with foil screened twisted pair.
- E. F/UTP: Overall foil screened cable with unscreened twisted pair.
- F. IDC: Insulation displacement connector.
- G. LAN: Local area network.
- H. Jack: Also commonly called an "outlet," it is the fixed, female connector.
- I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.
- J. RCDD: Registered Communications Distribution Designer.
- K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- M. S/FTP: Overall braid screened cable with foil screened twisted pair.
- N. S/UTP: Overall braid screened cable with unscreened twisted pairs.

- O. UTP: Unscreened (unshielded) twisted pair.

### 1.3 COPPER HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," 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 cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

### 1.4 ACTION SUBMITTALS

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

### 1.5 QUALITY ASSURANCE

- A. Installation shall comply with TIA/EIA-569-A standards. At the Architect's request, the Engineer of Record shall perform a walkthrough/checklist to ascertain whether installation complies with minimum TIA/EIA-569-A standards.

### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

### 1.7 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

## 1.8 WARRANTY

- A. The horizontal communications cabling system installed shall be eligible for coverage by a Limited Lifetime Warranty to the end user.
  - 1. Horizontal channels shall be completed with applicable to the cable manufacturer's qualifications for warranty with channel performance guarantees.
- B. Optimized Installer/Optimized Integrator shall provide labor, materials, and documentation in accordance with cable manufacturer requirements necessary to ensure that the Owner will be furnished with a Limited Lifetime Warranty.
- C. The installed structured cabling system shall provide a warranty guaranteeing installed channel performance above the ANSI/TIA 568-C requirements for Cat 5e, Cat 6, and/or Cat 6A cabling systems or ISO 11801 requirements for Class D, Class E, and/or Class Ea.
  - 1. Standards-compliant channel or permanent link performance tests shall be performed in the field with an approved cable manufacturer certification tester.
- D. Installer shall ensure that the Owner receives the manufacturer issued project warranty certificate within 60 calendar days of warranty registration.
- E. Workmanship: The installer shall issue the Owner a 20-year workmanship warranty on all installed products.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.
- B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- C. Grounding: Comply with TIA-607-B.

### 2.2 GENERAL CABLE CHARACTERISTICS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and CEC for the following types:
  - 1. Communications, Plenum Rated: Type CMP complying with UL 1685.
  - 2. Communications, Non-plenum: Type CMR complying with UL 1666.
- B. RoHS compliant.

## 2.3 CATEGORY 6 TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6A cable at frequencies up to 250MHz.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Commscope
  - 2. Belden Inc.
  - 3. Berk-Tek Leviton; a Nexans/Leviton alliance.
  - 4. General Cable; General Cable Corporation.
- C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568.2-D for Category 6 cables.
- D. Shielding/Screening: Unshielded twisted pairs (UTP).
- E. Cable Rating
  - 1. Indoor: Riser.
- F. Jacket:
  - 1. Data: White thermoplastic.

## 2.4 CATEGORY 6A TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6A cable at frequencies up to 500MHz.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Commscope
  - 2. Belden Inc.
  - 3. Berk-Tek Leviton; a Nexans/Leviton alliance.
  - 4. General Cable; General Cable Corporation.
- C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568.2-D for Category 6A cables.
- D. Shielding/Screening: Unshielded twisted pairs (UTP).
- E. Cable Rating
  - 1. Indoor: Riser.
- F. Jacket:
  - 1. Data: White thermoplastic.

## 2.5 TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. Manufacturer shall match cabling manufacturer. Obtain twisted pair cable hardware from same manufacturer as twisted pair cable, from single source.
- C. General Requirements for Twisted Pair Cable Hardware:
  - 1. Comply with the performance requirements of specified cabling.
  - 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.
- D. Patch Panel: Modular panels housing numbered jack units 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. Replaceable connectors.
    - d. 24 or 48 ports.
  - 2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.
  - 3. Number of Jacks per Field: One for each four-pair cable indicated, plus 25 percent spare.
- E. Patch Cords: Factory-made, four-pair cables in lengths as required in racks and cabinets. Patch cords shall be 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.
- 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. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
2. Metal Faceplate: Stainless steel in areas where the plate is susceptible to damage.
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.

2.6 IDENTIFICATION PRODUCTS

- A. 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.
- B. See specification section 270553, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS” for further information.

2.7 GROUNDING

- A. Comply with TIA-607-B.

2.8 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test cables on reels according to TIA-568-C.1.
- C. Factory test twisted pair cables according to TIA-568-C.2.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports and submit a digital copy in PDF format to the engineer of record upon completion.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays as directed in specification section 260533. Cabling may be routed as exposed above ceilings but shall be in raceways through inaccessible locations.



- B. Wiring within Enclosures: Comb, 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.

### 3.2 INSTALLATION OF TWISTED-PAIR 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. 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.
6. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. 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.
8. 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.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 10-foot-long service loop on each end of cable.
11. 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. Group connecting hardware for cables into separate logical fields.

E. 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.

### 3.3 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 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.

### 3.4 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. 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.
- 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.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. 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.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  - 3. 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.
    - a. 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.

G. Prepare test and inspection reports.

END OF SECTION 271513