

SECTION 27 05 29 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- D. BICSI ITSIMM - Information Technology Systems Installation Methods Manual (ITSIMM), 8th Edition.
- E. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition.
- F. MFMA-4 - Metal Framing Standards Publication.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- H. NFPA 70 - National Electrical Code.
- I. TIA-569 - Telecommunications Pathways and Spaces.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable supports, channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Comply with the following. Where requirements differ, comply with most stringent.
 - a. TIA-569.
 - b. NFPA 70.
 - c. Requirements of authorities having jurisdiction.
 - 2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of communications work.
 - 3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.

4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with minimum safety factor of 100%. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit Supports: Straps and clamps suitable for conduit to be supported.
 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 2. Conduit Clamps: Bolted type unless otherwise indicated.
- C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
- D. Metal Channel/Strut Framing Systems:
 1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
 2. Comply with MFMA-4.
- E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:
 1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install hangers and supports in accordance with NECA 1, BICSI ITSIMM, and BICSI N1.
- C. Provide independent support from building structure. 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:

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1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
 2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Secure fasteners in accordance with manufacturer's recommended torque settings.
- I. Remove temporary supports.

END OF SECTION

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SECTION 27 05 33.13 - CONDUIT FOR COMMUNICATIONS SYSTEMS

PART 2 PRODUCTS

1.01 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70 and TIA-569.
- B. Provide conduit, fittings, supports, and accessories required for complete communications pathway.
- C. Provide products listed, classified, and labeled as suitable for purpose intended.
- D. Where conduit size is not indicated, size to comply with NFPA 70, TIA-569, and BICSI TDMM, but not less than applicable minimum size requirements specified. Where specified standards differ, comply with most stringent.

PART 3 EXECUTION

2.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1, BICSI ITSIMM, and BICSI N1.
- C. Conduit Support:
 - 1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction.
 - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Connections and Terminations:
 - 1. Use suitable adapters where required to transition from one type of conduit to another.
 - 2. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect cables.
 - 3. Secure joints and connections to provide mechanical strength and electrical continuity.
- E. 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 and/or slots for penetrations as indicated or as required to facilitate installation.
 - 4. Conceal bends for conduit risers emerging above ground.
 - 5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.

6. 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.
 7. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.
- F. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed cables or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where conduits are subject to earth movement by settlement or frost.
- G. Provide grounding and bonding.
- H. Through-Penetration Firestopping
1. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration firestop systems products.
 - a. Seal all openings or voids made by penetrations to ensure an air and water-resistant seal.
 - b. Protect materials from damage on surfaces subjected to traffic.
 2. Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
 3. Provide components for each through-penetration firestop system that are needed to install fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
 4. Fire Rated Cable Pathways: Gangable device modules capable of being retrofitted around existing cables and comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill and requiring no additional action in the form of plugs, twisting closure, putty, pillow, or sealant to achieve fire and leakage ratings. Device's must be maintenance free having a corresponding Evaluation Services Report from a Nationally Recognized Third Party Laboratory. Maintenance free is defined as requiring no additional action in the form of plugs, twisting closure, putty, pillow, or sealant to achieve fire and leakage ratings. The following products are acceptable:
 5. Specified Technologies Inc. (STI) EZ-Path Fire Rated Pathway

6. Acceptable Manufacturer: Specified Technologies Inc., 210 Evans Way, Somerville, NJ 08876. Tel: (800) 992-1180, Fax: (908) 526-9623, Email: specseal@stifirestop.com, Website: www.stifirestop.com.

2.02 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Correct deficiencies and replace damaged or defective conduits.
- C. Inspections: Owner shall engage a qualified independent inspection agency to inspect through-penetration firestop systems in accordance with ASTM E2174, "Standard Practice for On Site Inspection of Installed Fire Stops".
- D. Keep areas of work accessible until inspection by authorities having jurisdiction.
- E. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

END OF SECTION

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SECTION 27 10 00 - STRUCTURED CABLING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Communications system design requirements.
- B. Communications pathways.
- C. Copper cable and terminations.
- D. Communications outlets.
- E. Communications grounding and bonding.
- F. Communications identification.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 36 - Cable Trays for Electrical Systems.
- B. Section 26 05 33.16 - Boxes for Electrical Systems.
- C. Section 27 05 33.13 - Conduit for Communications Systems.

1.03 REFERENCE STANDARDS

- A. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition.
- B. NFPA 70 - National Electrical Code.
- C. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set.
- D. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards.
- E. TIA-569 - Telecommunications Pathways and Spaces.
- F. TIA-606 - Administration Standard for Telecommunications Infrastructure.
- G. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
- H. UL 444 - Communications Cables.
- I. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
- J. UL 1863 - Communications-Circuit Accessories.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
 - 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
 - 3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.

4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
- D. Evidence of qualifications for installer.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
- F. Field Test Reports.
- G. Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
 1. Record actual locations of outlet boxes and distribution frames.
 2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
 3. Identify distribution frames and equipment rooms by room number on drawings.
- H. Contractor shall provide owner with label samples for project. Owner has the right to reject at no cost.
- I. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.06 PRODUCT DRAWINGS AND SPECIFICATIONS

- A. The Contractor shall carefully examine the Drawings and Specifications of all trades and report all discrepancies to the Technology Consultant in writing to obtain corrective action. No departures from the Contract Documents will be made without prior written approval from the Technology Consultant.
- B. Questions or disputes regarding the intent or meaning of Contract Documents shall be resolved by the interpretation of the Architect/ Technology Consultant. The Architects' interpretation is final and binding.
- C. The Drawings and Specifications are not intended to define all details, finish materials, and special construction, which may be required or necessary. The Contractor shall provide all installations complete and adequate as implied by the project documents.

- D. Drawings are diagrammatic only and do not show exact routes and locations of equipment and associated wiring. The Contractor shall verify the work of all other trades and shall arrange there work to avoid conflicts. In the event of a conflict, the Contractor shall obtain corrective action from the Technology Consultant.
- E. The Contractor shall verify all site conditions and upon acceptance of the project takes responsibility for the entire scope of work.
- F. If there is a conflict between contract documents, the document highest in precedence shall control. The precedence shall be: first; permits from agencies as required by law, second; special provisions, third; specifications, fourth; drawings, fifth; reference specifications and sixth; vendor submittals.

1.07 QUALITY ASSURANCE

- A. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- B. Manufacturer Qualifications: At least 3 years experience manufacturing products of the type specified.
- C. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:
 - 1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
 - 2. The bidder shall have a fulltime on staff Registered Communication Distribution Designer (RCDD) with three (3) years' experience with projects of this size or, on staff. Submit the RCDD Certificate and project information with bid.
 - 3. Supervisors and installers factory certified by manufacturers of products to be installed.
 - 4. Employing a full-time on-staff BICSI Registered Cabling Installation Technicians (RCIT) for supervision of all work.
 - 5. The Contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data and voice network systems.
 - 6. Those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
 - 7. The Contractor shall provide proof of current certification for the installed systems.
 - 8. Personnel must be knowledgeable in local, state, and national codes, and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall apply.
 - 9. The Contractor must possess and maintain current liability insurance certificates.
 - 10. Contractor is to field verify all conditions of the project.
- D. Products: Listed, classified, and labeled as suitable for the purpose intended.
- E. Contractor must attend all construction weekly meetings.

1.08 MOCKUPS

- A. Provide on request at no cost to the owner, mockups for Equipment Outlet configurations, especially those for Wireless Access Points, surface-mounted, harsh environment and other unique conditions as applicable to verify selections made under Sample submittals, to demonstrate configuration, capacity and aesthetics and to set quality standards for fabrication and installation. Coordinate with Division 26 and other Division 27 requirements as applicable to include all power and communications devices.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Keep stored products clean and dry.
- C. Storage of materials off site shall be no cost to the owner.

1.10 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a 1 week period after Date of Substantial Completion.
- C. Any material, equipment or appurtenance whose operation or performance does not comply with the requirements of the Contract or any equipment which is damaged prior to acceptance will be held as defective and shall be removed and properly replaced at no additional cost to the Owner.

1.11 USE OF SITE

- A. Where the Owner deems it necessary to place restrictions, use the site as directed by the Owner.
- B. When proceeding with the work, do not interfere with the ordinary use of streets, aisles, passages, exits, or operations of the Owner. During the day, set up cones and barriers in hallways and walkways. Do not string cable down the hallways during normal hours.
- C. Request a hazardous materials worksheet that identifies potentially-hazardous locations. Do not proceed with any work in locations where hazardous materials are known to be. Obtain instructions from the Owners Project Manager on and when to work in these areas.
- D. Multiple times each day, each contractor shall remove all trash and debris from the site. Before leaving the room each day:
 - 1. The Contractor shall replace all ceiling tiles that they have removed. Ceiling tiles that have been damaged are to be replaced at no cost to the owner.
 - 2. In occupied areas ceiling tiles are to be placed back into the grid after work has been conducted for the day.
 - 3. The Contractor shall place all furniture and equipment that they have moved back into its original location.

4. The contractor shall verify with the owner in writing before any equipment is to be taken off line.
5. The Contractor shall return any equipment that they have disconnected to working order. When work is completed and equipment is connected the Contractor shall verify with the Owner that all equipment is operating properly.
6. The Contractor's Job Foreman shall inspect all work locations to ensure that the rooms are clean and that all of the tasks described above have been done.
7. It is recommended that the Contractor inspect the site and take pictures to document the condition of the ceilings and walls before and after work has been completed.

1.12 CONTINUITY OF SERVICES

- A. Take no action that will interfere with or interrupt existing building services unless previous arrangements have been made with the Owner's representative. Arrange all work to minimize shutdown time.
- B. The Owner's personnel shall perform shutdown of operating systems. When shutdown of systems is required, the Contractor shall give three (3) days advance notice.
 1. Should building services be inadvertently interrupted:
 2. The Job Foreman shall immediately notify the Project Manager of the accidental disruption of services, the remedy, and how long it will take to restore services.
 3. The Contractor shall immediately furnish the labor, including overtime, the material, and the equipment necessary to promptly restore the interrupted service at no cost to the Owner.

PART 2 PRODUCTS

2.01 SYSTEM DESIGN

- A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
 1. Comply with TIA-568 (SET) (cabling) and TIA-569 (pathways) (commercial standards).
 2. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
 3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
 4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.
- B. System Description:
 1. Offices and Work Areas: Provide one data outlet in each work area.

- C. Main Distribution Frame (MDF): Centrally located support structure for terminating horizontal cables that extend to telecommunications outlets, functioning as point of presence to external service provider.
 - 1. Locate main distribution frame as indicated on the drawings.
- D. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.02 PATHWAYS

- A. Conduit: See section 27 05 33.13.
- B. Cable Trays: See Section 26 05 36.
- C. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
 - 1. Products:
 - a. STI Fire Stop.
 - b. HILTI.

2.03 COPPER CABLE AND TERMINATIONS

- A. Manufacturers:
- B. Copper Horizontal Cable:
 - 1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.
 - 2. Cable Type - Data: TIA-568.2 Category 6 UTP (unshielded twisted pair); 23 AWG.
 - 3. Cable Capacity: 4-pair.
 - 4. Cable Applications: Use listed NFPA 70 Type CMP plenum cable unless otherwise indicated.
 - 5. Cable Jacket Color -Data Cable: Blue.
 - 6. Product(s):
 - a. Panduit Cat 6A Plenum PUP6AM04*UG
 - b. Panduit Cat 6A Non Plenum PUP6AS04*CG
 - c. General Cat 6A Plenum 7141849
 - d. General Cat 6A Non Plenum 7143849
 - e. CommScope Giga Speed Cat 6A Plenum 760107201
 - f. Comm Scope Giga Speed Cat 6A Non Plenum 760107094
 - g. CommScope Uniprise Cat 6A Plenum CS34P
 - h. CommScope Uniprise Cat 6A Non Plenum
- C. Conduits for data embeded in concrete or on grade below slab, indoor/outdoor shall be installed. Plenum Cat 6.
 - 1. Product(s)

- a. Hubbell Cat 6A Indoor/Outdoor Plenum C6A1OSPBK or equal.
 - b. Hubbell Cat 6 Indoor/Outdoor Plenum C61OSPBK or equal.
-
- A. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.
 - B. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
 1. Performance: 500 mating cycles.
 2. Data Jacks: 8-position modular jack, color-coded for T568B wiring configurations.
 3. Product(s):
 - C. Copper Patch Cords:
 1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.
 2. Patch Cords for Patch Panels:
 - a. Quantity: One for each pair of patch panel ports.
 - b. Length: _____ feet.
 3. Patch Cords for Work Areas:
 - a. Quantity: One for each work area outlet port.
 - b. Length: _____ feet.
 4. Product(s):

2.04 COMMUNICATIONS OUTLETS

- A. Manufacturers:
 1. Panduit.
- B. Outlet Boxes: Comply with Section 26 05 33.16.
 1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
 2. Minimum Size, Unless Otherwise Indicated:
 - a. Data Outlets: 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.
- C. Wall Plates:
 1. Comply with system design standards and UL 514C.
 2. Accepts modular jacks/inserts.
 3. Capacity:
 - a. Data Outlets: four ports.

2.05 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), BICSI N1, NFPA 70, and SYSTEM DESIGN as specified in PART 2.
- B. Comply with Communication Service Provider requirements.
- C. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

3.02 INSTALLATION OF EQUIPMENT AND CABLING

- A. Cabling:
 - 1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
 - 2. Do not over-cinch or crush cables.
 - 3. Do not exceed manufacturer's recommended cable pull tension.
 - 4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.
 - 5. Manufacturer approved conduit bushings **MUST** be in place on every conduit opening that cable will be installed in prior to running the cable. Confirm before cable installation.
 - 6. Hook and loop straps (Velcro) will be used to prevent changes in the physical geometry of the cable. **Cable ties and black electrical tape is not permitted.**
- B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
 - 1. At Distribution Frames: 120 inches.
 - 2. At Outlets - Copper: 12 inches.
 - 3. At Outlets - Optical Fiber: 39 inches.
- C. Copper Cabling:
 - 1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
 - 2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
 - 3. Use T568B wiring configuration.
- D. Identification:
 - 1. Use wire and cable markers to identify cables at each end.
 - 2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.
 - 3. Access Control
 - a. Contractor to provide access control cabling, and install owner provided devices..
 - 1) Access control cabling shall be installed in separate pathway, sleeves and properly firestopped.

- 2) Contractor will verify with owner on cable types and quantities.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Comply with inspection and testing requirements of specified installation standards.
- C. Visual Inspection:
 1. Inspect cable jackets for certification markings.
 2. Inspect cable terminations for color coded labels of proper type.
 3. Inspect outlet plates and patch panels for complete labels.
- D. Testing - Copper Cabling and Associated Equipment:
 1. Test operation of shorting bars in connection blocks.
- E. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION

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