

SECTION 27 13 23

~~~ PROJECT NOTE ~~~~~

ARCHITECT OF RECORD/ENGINEER OF RECORD IS RESPONSIBLE FOR REVIEWING THIS SPECIFICATION SECTION IN DETAIL FOR COORDINATION WITH THE PROJECT SCOPE OF WORK.

ALL "PROJECT NOTE" TEXT IS TO BE REMOVED FOLLOWING REVIEW OF THE CONTENT OF EACH NOTE BY THE ARCHITECT OF RECORD/ENGINEER OF RECORD.

EDIT THE DOCUMENT FOOTER TO INCLUDE THE PROJECT NAME AND NUMBER.

EDIT THE DOCUMENT HEADER TO INDICATE THE ARCHITECT OF RECORD PROJECT ISSUE" DATE. THE "CPS CONTROL" DATE SHOULD NOT BE EDITED.

ANY MODIFICATIONS TO THE TECHNICAL STANDARDS IN THIS SECTION - INCLUDING THE REMOVAL OR ADDITION OF MANUFACTURERS - MUST BE APPROVED BY CPS.

REQUESTS FOR MODIFICATION ARE TO BE SUBMITTED TO THE DESIGN MANAGER DURING THE DESIGN PHASE FOR REVIEW AND APPROVAL.

~~~ END OF PROJECT NOTE ~~~~~

COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

~~~ PROJECT NOTE ~~~~~

UTILIZE THE TERM "IDF" ONLY FOR PROJECTS FEATURING A SEPERATE IDF ROOM.

~~~ END OF PROJECT NOTE ~~~~~

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Optical Fiber Backbone Cabling.
 - 1. 50/125-micrometer, optical fiber cabling.
- B. Fiber optic cable interconnecting devices.
 - 1. Cable connecting hardware, termination panels, and cross-connects.

1.02 DEFINITIONS

- A. Refer to Section 27 05 03 - Communications General Requirements for definitions.

1.03 REFERENCE STANDARDS

- A. City of Chicago Building Code - Municipal Code of Chicago for the Building Industry; 2017.
- B. City of Chicago Electrical Code - National Electrical Code with Chicago Amendments; 2017.
- C. ICEA S-104-696 - Indoor-Outdoor Optical Fiber Cable; 2013.
- D. ICEA S-83-596 - Indoor Optical Fiber Cables; 2016.
- E. NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling; 2006.
- F. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces; 2015.
- G. NFPA 70 - National Electrical Code; 2017.

- H. TIA/EIA-604-12 - FOCIS 12 Fiber Optic Connector Intermateability Standard Type MT-RJ; 2000.
- I. TIA-455-204 - FOTP-204 Measurement of Bandwidth on Multimode Fiber; 2013.
- J. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; Rev A, 1988 (R2012).
- K. TIA-455-220 - FOTP-220 Differential Mode Delay Measurement of Multimode Fiber in the Time Domain; 2003.
- L. TIA-492AAAC-B - Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; Telecommunications Industry Association; 2009.
- M. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2016.
- N. TIA-568-C.3 - Optical Fiber Cabling Components Standard; Rev C, 2008 (with Addenda; 2011).
- O. TIA-569-D - Telecommunications Pathways and Spaces; Rev D, 2015.
- P. TIA-598-D - Optical Fiber Cable Color Coding; Rev D, 2014.
- Q. TIA-604-2 - FOCIS-2 Fiber Optic Connector Intermateability Standard, Type ST; 2004.
- R. TIA-604-3 - FOCIS 3 Fiber Optic Connector Intermateability Standard- Type SC and SC-APC; 2004.
- S. TIA-606-B - Administration Standard for Telecommunications Infrastructure; Rev B, 2012 (with Addenda; 2015).
- T. TIA-607-C - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; Rev C, 2015.
- U. UL 1666 - Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts; Edition 5, 2007.
- V. UL 444 - Communications Cables; Current Edition, Including All Revisions.
- W. UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.

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/Engineer of Record of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each type of product.
- B. 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).
 - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format.
 - 2. Cabling administration drawings and printouts.
 - 3. Wiring diagrams to show typical wiring schematics including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
 - 4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
- C. Evidence of qualifications for installer.
- D. Source quality-control reports.
- E. Field Test Reports.
- F. 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 all splices and connectors.
 - 4. Identify distribution frames and equipment rooms by room number on contract drawings.
- G. 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 QUALITY ASSURANCE

- A. Installer Qualifications: Comply with requirements of Section 27 05 03 - Communications General Requirements Article "Quality Assurance," paragraph "Installer Qualifications."
- B. Regulatory Requirements:
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the City of Chicago Electrical Code, by UL or another qualified testing agency, acceptable to the authorities having jurisdiction, and marked for intended location and application.
 - 2. Comply with the City of Chicago Building Code.
- C. Grounding: Comply with TIA-607-C.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 27 05 03 - Communications General Requirements for delivery, storage and handling of materials.
- B. Immediately upon receipt of fiber optic cables at Project site, test cables for continuity end to end. Use optical fiber flashlight or optical loss test set.

1.08 WARRANTY

- A. Comply with requirements of Section 27 05 03 - Communications General Requirements for system warranty and application assurance.

PART 2 - PRODUCTS

2.01 SYSTEM DESIGN

- A. Optical fiber backbone cabling system shall provide interconnections between the MDF, **[or the IDF,]** and Concentrator Enclosures in the telecommunications cabling system infrastructure. Cabling system consists of backbone cables, intermediate, mechanical terminations, and patch cords or jumpers used for backbone-to-equipment connections.
- B. 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-D (pathways), latest editions (commercial standards).
 - 2. Provide fixed cables and pathways that comply with City of Chicago Electrical Code and TIA-607-C 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.
 - 5.

~~~ PROJECT NOTE ~~~~~

CPS ITS MANDATES LISTING AND CROSS-LISTING OF CABLE AND CONNECTIVITY COMPONENTS AS INDICATED IN THIS SECTION, IN ORDER TO PROVIDE FOR CONTINUITY OF PRODUCT SELECTION ACROSS PROJECTS AND EXTENDED SYSTEM WARRANTY PROVISIONS FOR CPS.

DO NOT ALTER SELECTIONS WITHOUT WRITTEN APPROVAL FROM CPS ITS PERSONNEL.

~~~ END OF PROJECT NOTE ~~~~~

2.02 CROSS LISTING OF OPTIC FIBER MANUFACTURERS

- A. Cross listed solution products shall be selected and installed so as to provide the Board with warranty complying with requirements of Section 27 05 03 - Communications General Requirements for system warranty and application assurance. Manufacturers of Optical Fiber Backbone Cable and Manufacturers of Optical Fiber Connecting Hardware and Patch Cords must be selected and utilized together on project as follows:
 - 1. Belden Fiber Express Cable Product Solution; www.belden.com.
 - 2. Berk-Tek with Leviton solution; www.nexans.us.
 - 3. Commscope/Uniprise LaserCore solution; www.commscope.com.
 - 4. Corning Optical Communications; www.corning.com.
 - 5. General Cable Technologies Corp. with Panduit Corp.: PanGen Plus10GBE solution; www.generalcable.com.
 - 6. Mohawk with Hubbell Premise Wiring: SureBit SureLight solution; www.mohawk-cable.com.
 - 7. Superior Essex Inc. with Ortronics Voice & Data: solutions; www.spsx.com.
 - 8. Tyco Electronics/AMP Netconnect: XG System solution; www.te.com.

2.03 FIBER OPTIC CABLE AND INTERCONNECTING DEVICES

- A. Fiber Optic Backbone Cable:

1. Manufacturers: Subject to compliance with requirements of this Section, provide products by one of the following manufacturers:
 - a. Belden Fiber Express Cable Product Solution; www.belden.com.
 - b. Berk-Tek; a Nexans company, GIGAlite10(EB) series; www.nexans.us.
 - c. Uniprise LaserCore solution; www.commscope.com.
 - d. Corning Optical Communications; www.corning.com.
 - e. General Cable Technologies Corporation, Nextgen G10X (Type BI/BE) series; www.generalcable.com.
 - f. Mohawk; a Division of Belden CDT, AdvanceLite Grade 5 series; www.mohawk-cable.com.
 - g. Superior Essex Inc., TeraGAIN 10G series; www.spsx.com.
 - h. Tyco Electronics/AMP Netconnect; Tyco International Ltd., XG System series; www.te.com.
- B. Description: Tight buffered, non-conductive fiber optic cable complying with TIA-568-C.3, TIA-598-D, ICEA S-83-596 and listed as complying with UL 444 and UL 1651, and City of Chicago Electrical Code for the following types:
 1. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
 2. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
- C. Cable Type: Multimode, laser-optimized 50/125 um (OM3) complying with TIA-492AAAC-B.
 1. Comply with IEEE 802.3ae standard for 10 GB Ethernet transmission at 850nm window.
 2. Cable Capacity: Quantity of fibers as indicated on drawings.
- D. Cable Applications:
 1. Plenum Applications: Use listed NFPA 70 Type OFNP plenum cable.
 2. Riser Applications: Use listed NFPA 70 Type OFNR riser cable or Type OFNP plenum cable.
- E. Cable Jacket:
 1. Laser-Optimized Multimode Fiber (OM3/OM4): Aqua (unless otherwise indicated).
 2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-568-C.3.
 3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.
- F. Product(s):
 1. Indoor 10G/150M Multimode Fiber-Optic Cable: 50/125-micrometer, laser-optimized multimode optical fiber, capable of 10-Gigabit Ethernet transmission up to 492 feet (150 meters), for use in indoor-applications only.
 - a. Strand Count: 6 (MDF to enclosures)[, and 12 (MDF to IDF)].
 - b. Maximum Attenuation: 3.00 dB/km at 850 nm; 1.0dB/km at 1300 nm.
 - c. Minimum OFL Bandwidth: 700 MHz-km at 850 nm; 500 MHz-km at 1300 nm, as characterized by OFL (overfill launch) measurement per TIA-455-204.
 - d. Cable shall meet or exceed the OM3 standard.
 2. Indoor 10G/300M Multimode Fiber-Optic Cable: 50/125-micrometer, laser-optimized multimode optical fiber, optimized for VCSEL-based transmission of 10-Gigabit Ethernet up to 984 feet (300 meters), for use in indoor-applications only.
 - a. Strand Count: 6 (MDF to enclosures)[, and 12 (MDF to IDF)].
 - b. Maximum Attenuation: 3.0 dB/km at 850 nm; 1.0dB/km at 1300 nm.
 - c. Minimum Effective Modal Bandwidth: 2000 MHz-km at 850 nm; 500 MHz-km at 1300 nm, as characterized by DMD measurement per TIA-455-220.
 - d. Cable shall meet or exceed the OM3 standard.
 - e.

~~~ PROJECT NOTE ~~~~~

**RETAIN ITEM BELOW IF PROJECT REQUIRES CAMPUS CABLING, THROUGH AN EXTERIOR PATHWAY, FROM MDF TO IDF(S) LOCATED IN OTHER BUILDINGS ON PROJECT SITE.**

~~~ END OF PROJECT NOTE ~~~~~

3. Indoor-Outdoor 10G/300M Multimode Fiber-Optic Cable: 50/125-micrometer, laser-optimized multimode optical fiber, optimized for transmission of 10-Gigabit Ethernet up to 984 feet, with riser-rated jacket permitting cable to run from the outside plant environment to a building's first cross-connect point without a transition at the building entrance.
 - a. Strand Count: 12 (MDF to IDF).
 - b. Loose tube design, utilizing a dry water-blocking agent in the interstices between and/or around 250-micron fiber strands and tube(s), fitted with 900-micron buffer fan-out kit at termination.
 - c. Maximum Attenuation: 3.0 dB/km at 850 nm; 1.0dB/km at 1300 nm.
 - d. Minimum Effective Modal Bandwidth: 2000 MHz-km at 850 nm; 500 MHz-km at 1300 nm, as characterized by DMD measurement per TIA-455-220.
 - e. Comply with ICEA S-104-696 for mechanical properties.
 - f. Cable Jacket Color: Aqua.
- G. Fiber Optic Interconnecting Devices:
 1. Manufacturers: Subject to compliance with requirements of this Section, provide products by one of the following manufacturers:
 - a. Belden Fiber Express Product; www.belden.com.
 - b. Corning Optical Communications; www.corning.com.
 - c. Hubbell Inc., Hubbell Premise Wiring; www.hubbell-premise.com.
 - d. Leviton Manufacturing Co., Inc., Leviton Voice & Data Division; www.leviton.com.
 - e. Ortronics / Legrand, Inc.; www.legrand.us.
 - f. Panduit Corporation; www.panduit.com.
 - g. Tyco Electronics/TE Netconnect; Tyco International Ltd.; www.te.com.
 - h. Uniprise; www.commscope.com.
 2. Cable Connecting Hardware: Comply with the Fiber Optic Connector Intermateability Standards (FOCIS) specifications of TIA-604-2, TIA-604-3, and TIA/EIA-604-12. Comply with TIA-568-C.3.
 3. Fiber Optic Termination Housing: Rack-mounted, with multi-numbered, duplex connector insert adapter panels holding fiber optic strand connectors.
 - a. General: Housing shall be modular in design with management clips that provide slack storage to comply with optical fiber bend radius and the recommended slack storage length, and be equipped with pullout tray for front access to fiber terminations and rear of adapter panels. Housing shall have:
 - 1) Administrative labeling system for identification of individual fiber ports.
 - 2) Anchor points and strain relief for entry of optical cable into the unit.
 - 3) Recessed adapter panel face, with front-mounted door that is secured with a keyed cylinder lock, clasp, or tab insert.
 - b. Size - Concentrator Enclosures: One (1) rack unit high; sized to accommodate a total of two (2) adapter panels.
 - c. Size - MDF/IDF: Three (3) rack units high; sized to accommodate at least six (6) adapter panels.
 - d. Adapter Panels: Housing to be fitted out with adapter panels, each able to accommodate six (6) duplex LC-style quick-connect couplers (12 strands total), with blank adapter panels at all unused housing panel slots. Provide in quantity required to accommodate quantity of fiber optic cables served by housing.
 4. Fiber Patch Cords: Board to provide all patch cords, information below is for reference only.
 - a. Patch cords shall be factory-made, dual-fiber design, from the same manufacturer and consistent with components and performance level of cross-listed solutions indicated.
 - b. Specification of fiber optic patch cord shall match fiber optical backbone served by cord.
 - 1) Multimode, including 10 Gigabit Ethernet transmission requirements for laser-optimized 50/125 micrometer multimode fiber optic cabling.

- c. Connectorization: Type LC to Type LC.
 - d. Jacket Color: Aqua.
 - e. Quantity: Provide two (2) patch cords for each optical fiber backbone cable installed on Project, as follows:
 - 1) One (1) in 1-meter length.
 - 2) One (1) in 2-meter length.
5. Optical Cable Connectors:
- a. Field-terminated, quick-connect, simplex and duplex, Type LC connectors.
 - b. Connector Performance: 500 mating cycles, when tested in accordance with TIA-455-21.
 - c. Maximum Attenuation/Insertion Loss: 0.3 dB.
 - d. Color: Aqua.

2.04 PATHWAYS

- A. General: Comply with TIA-569-D.
- B. Cable Support: NRTL labeled, designed to prevent degradation of cable performance and pinch points that could damage cable. Use to train and manage communications cabling routed on backing panel. Include lacing bars, spools, and D-rings.
- C. Ladder Rack Runway: Comply with requirements of Section 27 11 16 - Communications Cabinets, Racks, and Enclosures. For routing of communications cabling within MDF **[and IDF]**.
- D. Conduit and Boxes: Comply with requirements in Sections 26 05 33.13 - Conduit for Electrical Systems, 26 05 33.16 - Boxes for Electrical Systems, and 26 05 33.23 - Surface Raceways for Electrical Systems. Flexible metal conduit shall not be used.
- E.

~~~ PROJECT NOTE ~~~~~  
**RETAIN ITEM BELOW FOR USE IN PLENUM SPACES WHEN NOT IN CONDUIT, WHERE PERMITTED.**  
~~~ END OF PROJECT NOTE ~~~~~

- F. Install fiber optic cabling in innerduct.
 - 1. Fiber Optic cables shall be installed in conduit, if the project allows for the fiber optic cables to not be installed in conduit and that project accepts innerduct as a solution then plenum or non-plenum innerduct shall be utilized to protect the fiber optic cables.
 - 2. Utilize orange innerduct for non-plenum spaces.
 - 3. Utilize white plenum -rated innerduct for plenum spaces.
- G. Ensure each fiber optic cable entering the termination unit is routed through innerduct secured to the termination unit entrance point. Each cable shall be neatly labeled at the secured point.
- H. Factory lubricated pull tape to reduce burn-through in innerduct.

2.05 GROUNDING AND BONDING COMPONENTS

- A. Comply with TIA-607-C.

2.06 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-B.
- B. Comply with requirements of Section 27 05 53 - Identification for Communication Systems.

PART 3 - EXECUTION

PART 4 -

~~~ PROJECT NOTE ~~~~~

**INCLUDE THE FOLLOWING FOR EXISTING BUILDINGS; DELETE FOR NEW CONSTRUCTION.**

~~~ END OF PROJECT NOTE ~~~~~

4.01 COMMUNICATIONS DEMOLITION

- A. Comply with requirements of Section 27 05 03 - Communications General Requirements for demolition of communications systems.

4.02 INSTALLATION - GENERAL

- A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569-D (pathways), TIA-607-C (grounding and bonding), NECA/BICSI 568, City of Chicago Electrical Code, 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-C and City of Chicago Electrical Code.

4.03 WIRING METHODS AND INSTALLATION OF PATHWAYS

- A. Wiring Method: Install cables in raceways dedicated to optical fiber backbone cabling. Conceal raceway except in unfinished spaces.
 - 1. Comply with requirements for raceways and boxes and their installation specified in Sections 26 05 33.13 - Conduit for Electrical Systems, 26 05 33.16 - Boxes for Electrical Systems, and 26 05 33.23 - Surface Raceways for Electrical Systems.
 - 2. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.
- B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points without exceeding manufacturer's limitations on bending radii. Provide service loop as specified. Provide and use lacing bars and distribution spools.
- C. Wiring within MDF **[and IDF]**: Bundle, lace, and train cables to terminal points without exceeding manufacturer's limitations on bending radii. Provide service loop as specified. Utilize overhead ladder rack runway for cable routing within room(s).
- D. Comply with requirements for ladder rack runway, cabinets, and racks specified in Section 27 11 16 - Communications Cabinets, Racks, and Enclosures. Drawings indicate general arrangement of pathways and fittings.

4.04 INSTALLATION OF EQUIPMENT AND CABLING

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA-568 (SET).
 - 2. Comply with BICSI ITSIM, Chapter 6, "Cable Termination Practices."
 - 3. Hook and loop (Velcro) style cable ties shall be used to bundle and secure exposed cables in the concentrator enclosures and MDF/IDF rooms. Use of plastic cable ties is not permitted. Do not over-cinch or crush cables.

4. Pulling Cable: Comply with BICSI ITSM, Chapter 4, "Pulling Cable". Monitor cable pull tensions, and do not exceed manufacturer's recommended cable pull tension.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radius than minimums recommended by manufacturer.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than 10 x outside diameter of cable under no load, installed conditions, and not less than 20 x outside diameter of cable during pulling.
7. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.
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 de-reeling. Heat lamps shall not be used for heating.
10. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated termination housings.
11. Cables may not be spliced. Secure and support cables at intervals not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
12. Service Loops: Provide the following minimum extra length of cable, dressed and routed neatly:
 - a. At MDF/[or IDF] frames: 60 inches, neatly installed in vertical wire manager or accommodated by additional routing around overhead ladder rack runway.
 - b. At Concentrator Enclosures - Terminated Cables: 24 inches, neatly secured inside housing.

C. Fiber Optic Cabling:

1. Comply with TIA-568-C.3.
2. Prepare for pulling by cutting outer jacket for 10 inches from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
3. Support vertical cable at intervals as recommended by manufacturer.
4. Cables shall terminate with LC-type connectors secured in connecting hardware that is rack or enclosure mounted.
5. Concentrator Enclosures: No cabling is to be routed down through the center area of the enclosure so as to inhibit the installation of network electronics.
6. MDF/IDF: Install and route cabling on overhead ladder rack runway and within horizontal and vertical cable guides to terminating hardware.

D. Group connecting hardware for cables into separate logical fields.

4.05 FIRESTOPPING

- A. Comply with requirements in Section 07 84 00 - Firestopping.

4.06 IDENTIFICATION

- A. Comply with requirements in Section 27 05 53 - Identification for Communication Systems.

4.07 CLEANING

- A. Comply with requirements in Section 27 05 03 - Communications General Requirements for cleaning.

B.

~~~ PROJECT NOTE ~~~~~

**ALL TESTING AND VERIFICATION REQUIREMENTS ARE DEFINED IN RELATED DIVISION 27  
SECTION NOTED BELOW.**

**~~~ END OF PROJECT NOTE ~~~~~**

**4.08 COMMISSIONING AND DEMONSTRATION**

- A. Comply with requirements in Section 27 08 00 - Commissioning of Communications for performance tests, inspections, correction of deficiencies, and preparation of test and inspection reports.

**END OF SECTION 27 13 23**