

SECTION 27 13 13

~~~ 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 COPPER 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. Copper cable and terminations.
 - 1. Copper UTP cabling for backbone applications.
 - 2. Cable connecting hardware, termination panels, and cross-connects for copper UTP backbone cabling.

1.02 DEFINITIONS

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

1.03 REFERENCE STANDARDS

- A. 7 CFR PART 1755 - Telecommunications Policies on Specifications. Acceptable Materials and Standard Contract Forms; 2016.
- B. City of Chicago Building Code - Municipal Code of Chicago for the Building Industry; 2017.
- C. City of Chicago Electrical Code - National Electrical Code with Chicago Amendments; 2017.
- D. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; Revision E, 2005.
- E. ICEA S-84-608 - Telecommunications Cable Filled, Polyolfin Insulated, Copper Conductor Technical Requirements; 2017.
- F. ICEA S-90-661 - Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cables (With or Without An Overall Shield) For Use in General Purpose and LAN Communications Wiring Systems Technical Requirements; 2012.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- H. NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling; 2006.
- I. NFPA 70 - National Electrical Code; 2017.
- J. TIA/EIA-568 - Commercial Building Telecommunications Cabling Standard. (consists of 3 Parts, listed below); Rev C, 2012, and latest addenda.
- K. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2016.

- L. TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; Rev C, 2009 (with Addenda; 2016).
- M. TIA-569-D - Telecommunications Pathways and Spaces; Rev D, 2015.
- N. TIA-606-B - Administration Standard for Telecommunications Infrastructure; Rev B, 2012 (with Addenda; 2015).
- O. TIA-607-C - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; Rev C, 2015.
- P. UL 1666 - Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts; Edition 5, 2007.
- Q. UL 444 - Communications Cables; Current Edition, Including All Revisions.
- R. UL 1863 - Communications-Circuit Accessories; 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 layout and installation of pathways for communications backbone cabling with location of communications rooms, enclosures, site entrances, etc. and termination frames and hardware therein.
 - 3. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
 - 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 selected by Board.
 - 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 quality-control reports.
- F. 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. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Comply with requirements of Section 27 05 03 - Communications General Requirements for installer qualifications as noted in "Quality Assurance" Article.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in City of Chicago Electrical Code, by a qualified testing agency, and marked for intended location and application.
- C. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- D. Comply with City of Chicago Building Code.
- E. 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 provided under this Section.
- B. Test cables upon receipt at Project site.
 - 1. Test each pair of UTP cable for open and short circuits.

1.08 WARRANTY

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

1.09 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Connecting Blocks: One of each type.

PART 2 PRODUCTS

2.01 SYSTEM DESIGN

- A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.
- C. 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. Comply with Communications Service Provider requirements.
 - 3. Provide fixed cables and pathways that comply with City of Chicago Building Code and TIA-607-C and are UL listed or third party independent testing laboratory certified.
 - 4. 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.
 - 5. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

2.02 COPPER CABLE AND TERMINATIONS

- A. Copper Backbone Cable:
 - 1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568-C.2, ICEA S-90-661, and listed and labeled as complying with UL 444; arranged in 25-pair binder groups.
 - 2. Cable Type: TIA-568-C.2 Category 3 UTP (unshielded twisted pair); No.24 AWG.
 - 3. Cable Capacity: Quantity of pairs as indicated on drawings.
 - 4. Cable Applications:
 - a. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.

- B. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

2.03 INDOOR CATEGORY 3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 1. Berk-Tek; a Nexans company; www.nexans.us.
 2. General Cable Technologies Corporation; www.generalcable.com.
 3. Mohawk; a Division of Belden CDT; www.mohawk-cable.com.
 4. Superior Essex Inc.; www.spsx.com.

~~~ **PROJECT NOTE** ~~~~~  
*VERIFY THAT PAIR SIZE FOR INDOOR CATEGORY 3 UTP CABLE HAS BEEN INDICATED IN DRAWINGS OR ELSE EDIT LINE 1 FOR REQUIREMENT.*  
~~~ **END OF PROJECT NOTE** ~~~~~

- B. Description:
 1. Conductors: No. 24 AWG, 100-ohm, solid annealed copper; **[100] [200] [300] -Pair; [Pair size as indicated in Contract Drawings].**
 2. Insulation: Polyolefin or flame-retardant semi-rigid PVC, color coded in accordance with telephone industry standards.
 3. Core Assembly: Cables 25-pairs and less assemble pairs in a single group. Cables larger than 25-pairs arrange pairs in 25-pair units with color-coded unit binders.
 4. Jacket: Flame-retardant PVC.
 5. Jacket Markings: Include manufacturer's identification, pair count, AWG, product identification at 2-foot intervals along cable jacket.
 6. Comply with ICEA S-90-661 and TIA/EIA-568, Category 3.
 7. Listed: Type CMR complying with UL 1666.
 8. Cable Jacket Color: Gray, Natural, or White.

~~~ **PROJECT NOTE** ~~~~~  
*OSP CABLE USED IN CAMPUS FACILITIES FOR MDF TO IDF CONNECTIONS.*  
~~~ **END OF PROJECT NOTE** ~~~~~

2.04 OUTSIDE-PLANT UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 1. General Cable Technologies Corporation; www.generalcable.com.
 2. Superior Essex, Inc.; www.spsx.com.
 3. Or Equal.
- B. Backbone OSP Foam Skin Filled Copper Cable: Permits extension of telecommunication services in a multi-building environment, extending from the main cross-connect to the intermediate cross-connect in each building being served.
 1. Conductors: No. 24 AWG, 100-ohm, solid annealed copper; **[100] [200] [300] -Pair; [Pair size as indicated in Contract Drawings].**
 2. Insulation: Dual insulated conductors with inner layer of foamed polyolefin covered by an outer solid, colored polyolefin skin. Color coded in accordance with telephone industry standards.
 3. Core Assembly: Cables 25-pairs and less assemble pairs in a single group. Cables larger than 25-pairs arrange pairs in 25-pair units with color-coded unit binders.
 4. Filling Compound: Entire core assembly completely filled with ETPR compound, completely filling interstices between the pairs and under the core wrap.
 5. Core Wrap: Non-hygroscopic dielectric tape applied longitudinally.
 6. Shielding: Corrugated, copolymer coated 8-mil aluminum tape applied longitudinally with an overlap. Shield interfaces to be flooded.
 7. Jacket: Black, linear low-density polyethylene.

8. Jacket Markings: Include manufacturer's identification, pair count, AWG, product identification at 2-foot intervals along cable jacket.
9. Comply with ICEA S-84-608 and 7 CFR PART 1755 (PE-89).

2.05 INDOOR 25-PAIR CATEGORY 5E UTP CABLE

- A. Manufacturers of Cable: Subject to compliance with requirements, provide products by one of the following manufacturers:
 1. Belden IBDN Plus; www.belden.com.
 2. Berk-Tek; a Nexans company; www.nexans.us.
 3. General Cable Technologies Corporation; www.generalcable.com.
 4. Mohawk; a Division of Belden CDT; www.mohawk-cable.com.
 5. Superior Essex Inc.; www.spsx.com.
 6. Uniprise PowerSUM61 Series/Commscope; www.commscope.com.
- B. Cable Description: 100-ohm, 25-pair UTP, minimum No.24AWG, with all pairs grouped in a single bundle, covered with a thermoplastic jacket.
 1. Comply with ICEA S-90-661 for mechanical properties.
 2. Comply with TIA/EIA-568 for performance specifications.
 3. Comply with TIA-568-C.2, Category 5e.
 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and City of Chicago Electrical Code for the following types:
 - a. Communications, Riser Rated: Type CMR, complying with UL 1666.
 - b. Jacket color: Gray.

2.06 BACKBONE UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 1. Belden IBDN Plus; www.belden.com.
 2. Commscope; www.commscope.com.
 3. Hubbell Inc., Hubbell Premise Wiring; www.-hubbell-premise.com.
 4. Leviton Manufacturing Co., Inc., Leviton Voice & Data Division; www.leviton.com.
 5. Ortronics / Legrand Inc.; www.legrand.us.
 6. Panduit Corporation; www.panduit.com.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA-568-C.2, Category 5e. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools. Wire to TIA/EIA T568B pin configuration.

~~~ PROJECT NOTE ~~~~~
110 BLOCKS USED FOR COPPER BACKBONE CABLE TERMINATIONS ON MDF/IDF BACKBOARDS AT ALL NEW AND EXISTING FACILITIES (EVEN IF LEGACY CABLING TERMINATED TO 66-TYPE BLOCKS). COORDINATE QUANTITY AND SIZE WITH CONTRACT DRAWINGS.
~~~ END OF PROJECT NOTE ~~~~~

- C. 110A Termination Block: 110-style frame assembly, with legs, used for termination of all horizontal UTP cabling for voice communications.
 1. Be constructed of flame-retardant thermoplastic, with strips for terminating a series of individual four-pair cable conductors, with legs for offset mounting.
 2. Have access openings for rear to front cable routing to the point of termination.
 3. Accommodate termination of wire sizes: Solid No.22-26 AWG.
 4. Size: Standard 100-pair or 300-pair footprint, as indicated in Contract Drawings.
 5. Capacity: Adjust quantity of blocks based on number of cables to be terminated plus 25 percent spare.
 6. Field-terminate, to facilitate future cross- and/or inter-connections, as follows:
 - a. For indoor and outside plant copper backbone multi-pair cables, utilize C5 clips terminated over all pairs.

- b. For 25-pair Category 5e UTP backbone cables, utilize C4 clips terminated over pairs 1 - 20 and one C5 clip terminated over pairs 21 - 25.
- 7. Be equipment with designations strip kits for administrative labeling system:
 - a. Designation strips (labels).
 - b. Plastic holders (brackets for labels).
- 8. UL Listed per UL 1863.
- 9. Concentrator Enclosure: Provide Rack Mounted 5e 110-Style Wiring Block: 24/25 Category 5e pair termination panel Leviton Part Number 010-41DR2-100.
- D. 110A Jumper Trough: 110-system trough, with mounting legs, for management of cross-connect jumper pairs routed between 110 termination blocks.
 - 1. Be constructed of flame-retardant thermoplastic.
 - 2. Have access openings to permit cable routing between points of termination.
 - 3. Width: To match 110 Termination Block.
 - 4. Provide above and below each 110 Termination Block. Provide with mounting legs.

~~~ PROJECT NOTE ~~~

CATEGORY 5e PATCH PANEL USED FOR TERMINATION OF 25-PAIR CATEGORY 5e COPPER BACKBONES AT CONCENTRATOR ENCLOSURES. COORDINATE WORK WITH CONTRACT DRAWINGS.

~~~ END OF PROJECT NOTE ~~~

- E. Patch Panel: Modular panel housing multiple-numbered units with integral front 8-position RJ45 modular opening and rear IDC-type connectors for each port, used for permanent termination of pair groups of installed cables.
 - 1. Number of Ports: 24.
 - 2. Capacity: Provide quantity of panels sufficient for number of cables to be terminated.
 - 3. Mounting: Rack-mount, complying with EIA/ECA-310 standard for 19 inch width.
 - 4. Identification: Permanently imprinted sequentially numbered identification of ports, and clear space above ports for an administrative labeling system to accommodate machine-labeled identification of individual jack ports.
 - 5. Horizontal cable termination on rear of panel. Provide incoming cable strain relief and routing guides on back of panel.
 - 6. Color: Black.
 - 7. Terminations of the 25-pair cable at the patch panel shall begin with port number one (1) and continue through port six (6):
 - a. Terminate binder group in 4 pair increments, in sequence, at ports 1 through 6. Wrap 25th pair around cable jacket and reserve for future use.

~~~ PROJECT NOTE ~~~

RETAIN 66 BLOCK FOR LEGACY APPLICATIONS WHERE COORDINATED WITH ITS DURING PROJECT DESIGN AND APPROVED BY ITS IN ADVANCE.

~~~ END OF PROJECT NOTE ~~~

- F. 66 Connecting Block: 50-pair termination block used for legacy termination of copper UTP cabling for voice communications.
 - 1. Be constructed of flame-retardant thermoplastic.
 - 2. 25-pair x 2 sided block (66M1-50), capable of terminating up to 50 cable pairs.
 - 3. Terminates No.22 - 26 AWG solid insulated cable.
 - 4. Provided with fanning strips for management for backbone cabling pairs and cross-connect jumper wires.
 - 5. Provided with S89B stand-off bracket.
 - 6. Provided with bridging clips for cross-connection of cable pairs.
 - 7. Be equipment with hinged snap-on cover providing for administrative labeling system:
 - a. Designation insert (label).

2.07 HINGED COVER (INTERIOR MOUNTING OF LABEL)PATHWAYS

- A. General Requirements: 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 plywood backboard.
 - 1. Lacing bars, spools, and D-rings.
- C. Ladder Rack Runway: Comply with requirements of Section 27 11 16 - Communications Cabinets, Racks, and Enclosures.
 - 1. Used for routing of communications cabling within MDF [and IDFs].
- 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.

2.08 GROUNDING

- A. Comply with requirements in Section 26 05 26 - Grounding and Bonding for Electrical Systems for grounding conductors and connectors.
- B. Comply with TIA-607-C.

2.09 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-B.

PART 3 EXECUTION

*~~~ PROJECT NOTE ~~~~~
INCLUDE THE FOLLOWING ARTICLE FOR EXISTING BUILDINGS; DELETE FOR NEW
CONSTRUCTION.*

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

3.01 COMMUNICATIONS DEMOLITION

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

3.02 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 Building Code.
- D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00 - Firestopping.

*~~~ PROJECT NOTE ~~~~~
RETAIN ARTICLE FOR NEW FACILITIES, OR FOR A CHANGE/RELOCATION OF THE TELECOM
SERVICE ENTRANCE OF AN EXISTING FACILITY.*

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

3.03 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by telecommunications service provider.

~~~ PROJECT NOTE ~~~~~

RETAIN PARAGRAPH BELOW IF SERVICE ENTRANCE IS FROM A CAMPUS SYSTEM OR IF SPECIFIED PATHWAYS ARE REQUIRED BY TELECOMMUNICATIONS SERVICE PROVIDER.

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

- B. Install **[underground][buried][aerial]** pathways complying with recommendations in TIA-569-D, "Entrance Facilities" Article.
 - 1. Install **[underground][buried][aerial]** entrance pathway complying 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.

3.04 WIRING METHODS AND INSTALLATION OF PATHWAYS

- A. Wiring Method: Install cables in raceways dedicated to copper 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 per requirements of this Section. Provide and use lacing bars and distribution spools.
- C. Wiring within MDF **[and IDFs]**: Bundle, lace, and train cables to terminal points without exceeding manufacturer's limitations on bending radii. Provide service loop per requirements of this Section. Utilize overhead ladder rack runway for cable routing within room(s). Provide and use lacing bars and distribution spools for wire routing and management on plywood backboard.
- 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.

3.05 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. Terminate 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 not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals. Do not over-cinch or crush cables.
 - 6. Install lacing bars to restrain cables, to prevent straining connections, and to 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 4X cable diameter. Install lacing bars and distribution spools.
 - 8. 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.
 - 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 de-reeling. Heat lamps shall not be used for heating.

11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions, and do not exceed manufacturer's recommended cable pull tension.
 12. When installing in conduit, use only lubricant approved by cable manufacturer and do not chafe or damage outer jacket.
 13. Service Loops: Provide the following minimum extra length of cable, dressed and routed neatly:
 - a. At MDF/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. UTP Cable Installation:
1. Comply with TIA-568-C.2.
 2. Maintain pair twists as close as possible to point of termination, but do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.
 3. 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.
 4. MDF/IDF: Install and route cabling on overhead ladder rack runway and within horizontal and vertical cable guides to terminating hardware.
 5. Terminate backbone cables, using T568B pinout configuration, to termination hardware as follows:
 - a. Indoor Category 3 UTP and OSP UTP cables: to 110 termination block(s) at each end, mounted to plywood backboard.
 - 1) For indoor and outside plant copper backbone multi-pair cables, utilize C5 clips terminated over all pairs.
 - b. Indoor Category 5e UTP cables - MDF [**and IDFs**]:to 110 termination block(s), mounted to plywood backboard.
 - 1) For 25-pair Category 5e UTP backbone cables, utilize C4 clips terminated over pairs 1 - 20 and one C5 clip terminated over pairs 21 - 25.
 - c. Indoor Category 5e UTP cables - Concentrator Enclosures: to rack-mounted Category 5e patch panel. Terminate binder group in 4 pair increments, in sequence, at ports 1 through 6. Wrap 25th pair around cable jacket and reserve for future use.
- D. Group connecting hardware for cables into separate logical fields.
- E. Separation from EMI Sources: Comply with requirements of Section 27 05 03 - Communications General Requirements.

3.06 FIRESTOPPING

- A. Comply with requirements in Section 07 84 00 - Firestopping.
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.07 GROUNDING

- A. Comply with TIA-607-C.
- B. Bond metallic cable shields to the communications grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
- C. Bond metallic equipment to the communications grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.08 IDENTIFICATION

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

3.09 CLEANING

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

~~~ PROJECT NOTE ~~~~~
ALL TESTING AND VERIFICATION REQUIREMENTS ARE DEFINED IN RELATED DIVISION 27 SECTION NOTED BELOW.
~~~ END OF PROJECT NOTE ~~~~~

3.10 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 13