Appendix A-1
Division 27 Technical Guidelines

270000 – Communications General Requirements

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SECTION 270000 - COMMUNICATIONS GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes general requirements for the following:

1. Telecommunications Rooms and telecommunications room equipment

2. Telecommunications, structured, backbone cabling

3. Telecommunications, structured, horizontal cabling system for work area outlets

B. Definitions and Acronyms

1. Communications Equipment Room, Equipment Room (ER), or Telecommunications Room (TR): A generic term for a Main Distribution Frame, Intermediate Distribution Frame, Equipment Room, or Telecommunications Room

2. EF: Entrance Facility refers to entrance cable and termination for the District School Connectivity fiber optic network or a telecommunications service access provider.

3. District I.T. Staff: District I.T. Project Coordinator, Project Manager, or Quality Assurance / Quality Control staff.

4. IDF: Intermediate Distribution Frame

a. An environmentally enclosed architectural space designed to contain telecommunications equipment, cable terminations, or cross-connect cabling equipment.

b. In District facilities with previous construction the IDF may have been referred to as a Telecommunications Rooms (TR)

5. MDF: Main Distribution Frame

a. An environmentally controlled centralized space for telecommunications equipment and cable terminations that also usually houses a main or intermediate cross-connect, intercom/paging equipment, alarm panels, and security equipment.

b. In District facilities with previous construction the MDF may have been referred to as the Main IT Equipment Room (MITER)

6. School Connectivity Network: District-owned and operated dark fiber optic cable network.

7. Substantial Completion: Three (3) weeks to one (1) month prior to final inspections or date coordinated and agreed to between Contractor and District I.T. Staff.

8. TGB: Telecommunications Grounding Busbar

9. TMGB: Telecommunications Main Grounding Busbar

1.02 RELATED DOCUMENTS

A. Drawings, Contract Forms, Conditions of the Contract, including Construction Manager/General Contractor (CM/GC) Agreement, Exhibits and other Specification Sections that apply to this section.

B. Refer to the following District Division 27 Technical Guideline Sections for product and execution requirements related to communications equipment and installation.

1. 270529 – Hangers and Supports for Communication Systems

2. 270533 – Conduits and Backboxes for Communication Systems

3. 270536 – Cable Trays for Communications Systems

4. 270537 – Firestopping Systems for Communications Systems

5. 270539 – Surface Raceway and Boxes for Communications Systems

6. 270553 – Identification for Communications Systems

7. 270820 – Optical Fiber Testing and Measurements

8. 270830 – Copper Testing and Verification

9. 271100 – Communications Equipment Room Fittings

10. 271119 – Communications Termination Blocks and Patch Panels

11. 271323 – Communications Optical Fiber Backbone Cable

12. 271513 – Communications Copper Horizontal Cable

13. 271543 – Communications Faceplates and Modular Jacks

14. 271619 – Communications Patch Cords, Station Cords, and Cross Connect Wires

1.03 REGULATIONS AND CODE COMPLIANCE

A. References to regulations, codes, and standards mean the latest edition, amendment and revisions to the regulations, codes and standards in effect on the date of the Contract Documents.

B. All work and materials shall conform to and be installed, inspected, and tested in accordance with the governing rules and regulations of federal, state, and local government agencies.

C. The following glossary of terms is used throughout this specification:

1. ANSI – American National Standards Institute
2. ASTM – American Society of Testing and Materials
3. BICSI – Building Industry Consulting Services International
4. EIA – Electronic Industries Association
5. FCC – Federal Communications Commission
6. IEEE – Institute of Electrical and Electronics Engineers
7. ISO – International Organization for Standardization
8. NEC – National Electrical Code
9. NEMA – National Electrical Manufacturer’s Association
10. NESC – National Electrical Safety Code
11. NFPA – National Fire Protection Association
12. OSHA – Occupational Safety and Health Administration
13. TIA – Telecommunications Industry Association
14. UBC – Uniform Building Code
15. UFBC – Uniform Fire Prevention and Building Code
16. UL – Underwriter’s Laboratories, Inc.

D. Design, installation, materials, equipment and workmanship shall conform to the specifications and drawings and all applicable provisions of the following regulations, codes, standards, and guidelines, including all applicable addendum:

1. ANSI/TIA/EIA – Telecommunications Cabling Standards including, but not limited to, 568-B.1, 568-B.2, 568-B.3, 569-A, 569-B, 569-C, 598-A, 455 Series, 492 Series, 526 Series, 604 Series, 606, 607, 758, FIP 174, FIP 175, FIP 176, S-83-596, S-87-640
2. ASHRAE, Thermal Guidelines for Data Processing Environments, Third Edition, 2012
3. ASTM International – A 510, B 633, A 653, A 123, A 276-06, A 580, A580M-06
4. EIA/ECA-310, Cabinets, Racks, Panels and Associated Equipment

5. National Electric Code 70 – including, but not limited to, 250, 300, 645, 725, 780, 800

6. NESC (IEEE) – National Electrical Safety Code

7. National Life Safety Code (NFPA 101)

8. ASTM Standards

9. IEEE Standards

10. NEMA Standards

11. Underwriters Laboratories Inc. (UL) – Fire Resistance Directory

12. FCC Code of Federal Regulations (CFR)

13. BICSI, Telecommunications Distribution Methods Manual (TDMM)

14. BICSI, Information Transport Systems Installation Methods Manual (ITSIMM)

15. Applicable codes and regulations of other authorities having lawful jurisdiction pertaining to the work required.

E. All modifications required by the referenced codes, rules, regulations, and authorities shall be made by the Contractor without additional charge to District.

F. Report immediately to District in writing, any part of the design that does not conform to the requirements of these codes or requirements, or otherwise be held responsible to provide and install material that will comply with these codes and regulations.

G. Applicable codes and ordinances and local interpretations take precedence when they conflict with, or are more stringent than, the design indicated by the drawings and specifications. The drawings and specifications take precedence where the design is more stringent than codes and ordinances.

H. All materials, appliances, equipment, and devices shall conform to the applicable standards of Underwriters Laboratories (UL) and shall be listed by UL if a UL listing category has been established. Furnish products that have been tested and qualified to meet the rating criteria by UL or other testing firm acceptable to authority having jurisdiction.

1.04 DRAWINGS AND SPECIFICATIONS

A. All data cabling and data locations shall be coordinated with District and shown on the drawings.

B. The cable performance (e.g., Category 6A, OS2) shall be as specified on drawings and confirmed with the District.

C. It is the intent of these specifications and related project drawings to call for finished work, tested and ready for operation in complete accordance with all applicable codes, regulations, standards, and ordinances.

D. These specifications and the project drawings are complimentary, and what is called for in either of these shall be binding as though called for by both. Should any conflict arise between the drawings and specifications, such conflict shall be brought to the attention of District for resolution. These specifications take precedence over the drawings.

E. Omissions from the specifications and/or project drawings or the incorrect description of details of work which are evidently necessary to carry out the intent of the specifications and project drawings, or which are customarily performed, shall not relieve the Contractor from performing such omitted or incorrectly described detail of the work. All work shall be performed as verified in field measurements, field construction criteria, material catalog numbers and similar data checked and coordinated with each shop drawing by the Contractor.

F. All dimensions, measurements, and the location and existence of underground equipment must be verified in the field since actual locations, distance, and elevations will be governed by actual field conditions. Contractor shall be responsible to take all dimensions and measurements from the site and actual equipment to be furnished.

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

A. All materials and equipment shall be new, free from defects, installed in accordance with manufacturer’s current published recommendations in a neat manner and in accordance with standard practices of the industry.

B. Where no specific material, apparatus, or appliance is mentioned, any standard, first-class product made by reputable manufacturer regularly engaged in the production of such material may be used providing it conforms to the contract requirements and meets the approval of District.

C. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.

D. Materials shall meet or exceed the following minimum requirements:

1. Where applicable, all materials and equipment shall bear the label and listing of UL. Application and installation of all listed equipment and materials shall be in accordance with such labeling and listing.

2. Equipment shall meet all applicable FCC regulations.

3. Electrical equipment and systems shall meet UL standards and requirements of the NEC. This listing requirement applies to the entire assembly. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.

4. The listing of a manufacturer as “acceptable” does not include acceptance of a standard or catalogued item of equipment. All equipment and systems must conform to the specifications and meet the quality of the specified item.

5. Materials and equipment shall bear the manufacturer’s name or trademark and model/serial number permanently marked.

E. All UTP cable inside the building shall be UL listed and marked type CM, CMR, or CMP and shall be installed in accordance with NEC articles 300-22, 800-49, 800-50, 800-51, 800-52, and 800-53.

F. All fiber optic cable inside the building shall be UL listed and marked type OFN, OFNR, or OFNP and shall be installed in accordance with NEC articles 300-22, 770-49, 770-50, 770-51, 770-52, and 770-53.

G. Furnish all required materials, equipment, and tools necessary to properly complete the cable system installation including, but not limited to tools for pulling, terminating, splicing, and testing the cables, mounting hardware, cable ties, bolts, anchors, clamps, hangers, kits of consumables, lubricants, communication devices, stands for cable reels, cable winches, assembly, and adjustment devices, etc.

2.02 SUBMITTALS

A. Submit for review and approval a complete list of all materials, components, equipment, systems, and products proposed.

B. Product Data – Product submittals shall show, at a minimum, the following:

1. Manufacturer and complete model and part number

2. Dimensions

3. Complete technical specifications and performance data

4. Any other pertinent information necessary to determine adequacy for the intended application.

C. Substitutions – Requests for substitutions must be submitted with complete product data.

1. Requests to substitute for previously approved materials or equipment shall be submitted by the Contractor to the District for review. Substitution requests shall include all required submittals and shall be complete with reasons for substitutions and savings that will accrue to District if substitutes are approved. Substitutes will be considered only if equal or superior to that specified.

2. Approval of alternate or substitute equipment or material in no way voids the Contract Document requirements.

3. Under no circumstances shall the District be required to prove that an item proposed for substitution is not equal to the specified item. It shall be mandatory that the Contractor submits to District all evidence to support the contention that the item proposed for substitution is equal to the specified item. The District

decision as to the equality of substitution shall be final and without further recourse.

4. The Contractor shall be liable for Engineer’s costs for review and for incorporation of accepted substitutions if the proposed substitutions require design modifications. The Engineer will bill the Contractor standard hourly rates for the time used to review substitutions and to incorporate proposed substitutions into design documents.

5. It shall be the responsibility of the Contractor to assure that the substitute material and/or equipment fits into the space provided and the Contractor shall pay for all extra costs incurred by other trades for any and all changes necessitated by these substitutions.

D. Statement of Warranty

1. The Contractor shall provide statement(s) of warranty based on the manufacturers and Contractors warranties.

E. Project Record and As Built Drawings

1. Refer to District Technical Guidelines Section 017700, Contract Closeout and District Consultant Guidelines, Section 08, Record Drawing Submittals for requirements related to project record documents.

2. Project As Built Drawings

a. At the beginning of work and throughout the project, the Contractor shall maintain a set of project as-built drawings. The project as-built drawings shall record all station cabling numbering and jack symbol labeling, backbone cable labeling, installed cable footages for all backbone cable, and any changes in materials, cable routing, equipment placement, etc.

b. The project as-built drawings shall be maintained in a digital format and updated a minimum of every two weeks during the project. The District may request a PDF copy of the project as-built drawings at any time during the project. The final project as-built drawings shall be delivered to the District a minimum of three (3) weeks prior to substantial completion for District review and use for completion of patching documentation.

c. The project as-built drawings are in addition to the Record Drawings required in the District Technical Guidelines Section 017700, Contract Closeout and District Consultant Guidelines, Section 08, Record Drawing Submittals.

F. Test Results and Configuration Information

1. Upon completion of the work, but before final approval, the Contractor shall submit test results and configuration information for the fully installed cabling system.

PART 3 EXECUTION

3.01 GENERAL NOTES

A. All design, installation, materials, equipment, and workmanship shall conform to specifications, drawings, and all District Division 27 Technical Guidelines. All equipment to be installed per manufacturer’s instructions.

B. No exposed cabling is permitted except for cabling routed within Telecommunications Rooms. All cabling must be routed concealed in conduit or installed above accessible ceiling spaces. All cabling installed in accessible ceiling spaces shall be properly supported. Any damaged or soiled ceiling tiles must be replaced with new ceiling tiles that match existing tiles.

C. Coordinate removal of all abandoned cable with District I.T. staff. All abandoned cabling, including cable that is not terminated at both ends, shall be removed. If it is not feasible to remove abandoned cable, it shall be clearly tagged at both ends as abandoned, with appropriate labeling and shall be reported to District I.T. staff.

D. Coordinate all work inside Telecommunications Rooms with District I.T. Staff. A meeting with District I.T. Staff is required prior to any work being performed inside the Telecommunications Rooms. Telecommunications Rooms shall be kept clean during the project and thoroughly cleaned upon completion or work. Absolutely no work shall be performed to new or existing patch panels without coordination with District I.T. Staff.

E. If required, the contractor is responsible for contacting the Utility Notification Center of Colorado (Call before you dig), 811. Call two business days prior (not including the day of the call) to digging, grading or excavating for the marking of underground utilities, including the District-owned School Connectivity fiber optic cable network.

3.02 COMMUNICATION GUIDELINES

A. All project-related communication shall be documented in writing, including emails, meeting minutes, and change requests.

B. The Contractor shall assign a single point of contact for all communications with District I.T. Saff.

C. The Contractor and the District shall coordinate and hold regular status meeting updates throughout the project, including:

1. Project schedule review including work completed and upcoming planned work.

2. Upcoming tasks and milestones.

3. Identified issues, potential delays, project risks, and proposed resolutions.

3.03 SAFETY OF PERSONS AND PROPERTY

A. Initiate, maintain, and supervise all safety precautions and programs in connection with the project work. Comply with all safety precautions and programs of District and the Contractor.

B. Take all reasonable precautions for safety of, and provide reasonable protection to prevent damage, injury, or loss to:

1. personnel conducting project work and other persons who may be affected thereby; and

2. project work and all materials and equipment to be incorporated therein, whether in storage or off site, under care, custody, or control of the Contractor; and

3. installed equipment and existing construction; and

4. other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, fences, roadways, structures, and utilities not designed for removal, relocation, or replacement in the course of construction.

C. Trucks and other equipment shall not drive on lawns, concrete sidewalks, or concrete curbs unless approved in writing by District. All lawns, shrubs, walks, irrigation equipment, curbs, or other property damaged in such a manner by the Contractor shall be replaced or repaired in a timely manner by the Contractor to the satisfaction of District.

D. Comply with all applicable laws, ordinances, rules, regulations, policies of District, and lawful orders of any public authority having jurisdiction for safety of persons or property to protect them from damage injury or loss.

E. Always assume responsibility for construction safety and provide, as part of contract, all trench or building shoring, scaffolding, shielding, dust/fume protection, mechanical/electrical protection, special grounding, safety railings, barriers, and other safety features required to provide safe conditions for all workers and site visitors.

F. Moderate public pedestrian traffic should be expected around all work locations. Ladders, scaffold, installation materials, and all other hazardous conditions must be fully always protected. Warning cones, barricades, warning tapes, etc. shall be used to always warn and protect persons and property in public corridors.

G. All ladders used for installation shall be padded on both ends and shall be carried by two people when moved within the building.

H. Work shall not interfere with legal fire exits. Corridors, areas of egress, fire protection standpipes, hydrants, and exit stairs shall be always maintained.

I. Comply with all code related and District specific safety requirements for work to be performed in confined spaces. District requires appropriate safety training, physical examination and fit testing for employees working in confined spaces. This shall be provided to Contractor employees at the expense of the Contractor and at no cost to District.

J. Always maintain free access to fire lanes and emergency and utility control facilities such as fire hydrants, fire alarm boxes, utility vaults, manholes, junction boxes, etc.

3.04 EXAMINATION OF PROJECT SITE

A. Prior to any project work, examine the project site carefully, including all project drawings. The Contractor shall be fully informed of and shall identify all utility requirements that will affect the installation work at the project site.

B. The Contractor shall become familiar with the local conditions under which the work is to be performed and correlate the on-site observations with the requirements of the specifications and project drawings. No allowance will be made for claims of concealed conditions which the Contractor, in exercise or reasonable diligence in examination of the site, observed or should have observed.

C. Before ordering any materials or doing any project work, verify all measurements and be responsible for correctness of same. No extra charge or compensation will be allowed for duplicate work or material required because of unverified differences between actual dimensions and the measurements indicated on the project drawings. Any discrepancies found shall be submitted in writing to District for consideration before proceeding with the project work.

3.05 TELECOMMUNICATION ROOMS GENERAL REQUIREMENTS

A. Will house only equipment directly related to the telephone system, LAN / WAN data network systems, IT School-based servers, video distribution system, intercom system, clock system, security system, and environmental support for these systems.

B. Pathways

1. Telecommunications rooms shall accommodate double the pathway (e.g., slot, sleeves, etc.) of the anticipated cable volume from cable racking within the room to the pathway’s exterior to the room.

a. A slot or slots and sleeves shall be installed with an approved fire-rated assembly.

b. The formed slot and sleeves shall not have burrs or sharp edges.

2. Cables shall not enter the MDF over the doorway and overhead ladder cable tray shall be installed over the center of the racks with at least one cable tray perpendicular to racks and cable tray along the walls of the MDF/IDF as required.

3.06 QUALITY ASSURANCE

A. All installation work shall be performed in a neat and professional manner. All methods of construction that are not specifically described or indicated shall be subject to the control of District.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based on the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval of District based on submittals provided.

C. Materials and work specified herein shall comply with the applicable requirements of:

1. ANSI/TIA/EIA-568-B.1 – Commercial Building Telecommunications Cabling Standard – Part 1: General Requirements

2. ANSI/TIA/EIA-568-B.2 – Commercial Building Telecommunications Cabling Standard – Part 2: Balanced Twisted-Pair Cabling Components

3. ANSI/TIA/EIA-568-B.3 – Optical Fiber Cabling Components Standard

4. ANSI/TIA/EIA-492 Series – Specifications for Optical Waveguide Fibers

5. TIA/EIA-455 Series – Fiber Optic Test Procedures

6. TIA/EIA-426 Series – Optical Fiber Systems Test Procedures

7. ANSI/TIA/EIA-569-A – Commercial Building Standard for Telecommunications Pathways and Spaces and applicable addendum

8. ANSI/TIA/EIA-598-A – Optical Fiber Cable Color Coding

9. ANSI/TIA/EIA-604 Series – Fiber Optic Connector Intermateability Standard

10. ANSI/TIA/EIA-606 – Administration Standard for Telecommunications Infrastructure of Commercial Buildings

11. ANSI/TIA/EIA-607 – Commercial Building Grounding and Bonding Requirements for Telecommunications

12. BICSI Telecommunications Distribution Methods Manual

13. ANSI/ICEA S-83-596 – Fiber Optic Premises Distribution Cable

3.07 WORKMANSHIP, WARRANTY, AND SUPPORT

A. Materials and workmanship shall meet or exceed industry standards and be fully guaranteed for two full years from final acceptance for the project. Cable integrity and associated terminations shall be thoroughly inspected, fully tested, and guaranteed as free from defects, transpositions, opens/shorts, tight kinks, damaged jacket insulation, etc.

B. Furnish a written warranty to District for a minimum of:

1. Fifteen-year manufacturer’s materials performance warranty on parts and labor to repair/replace defective materials.

2. Two-year warranty on parts and labor to resolve problems related to installation workmanship.

C. The Contractor shall be responsible for and make good, without expense to District, all defects arising during this warranty period that are due to imperfect materials, appliances, improper installation, or poor workmanship.

1. During the warranty period, provide new materials to repair or replace defects, as well as any retesting required, at no cost to the District.

D. All labor must be thoroughly competent and skilled, and all work shall be executed in strict accordance with the best practice of the trades.

E. Good workmanship and appearance shall be considered of equal importance with telecommunications operation. Lack of quality workmanship shall be considered sufficient reason for rejection of a system in part or in its entirety. Carefully lay out all work in advance and install in a neat and workmanlike manner in accordance with recognized good practices and standards. Provide workmen who are skilled in their craft and a competent Project Manager who will be on the job at all times.

END

SECTION 270529 – HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section covers hangers and supports for data, and telecommunication systems, including but not limited to structured cabling.

PART 2 PRODUCTS

2.01 CABLE HOOKS (J-HOOKS)

A. Cable hooks shall:

1. Be listed by a NRTL for installation into a plenum space.
2. Be specifically designed for telecommunications cables.
3. Bear a surface of sufficient width to comply with required bend radii of high-performance cables.
4. Have flared edges to prevent damage while installing cables.
5. Include a top latch to keep cable within the hook. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.

B. Cable support sling shall

1. Be constructed from steel and woven laminate.
2. Have a static load limit of 100 lbs.

C. Bridle Rings

1. The use of Bridle Rings is not allowed.

PART 3 EXECUTION

3.01 GENERAL

A. Follow all manufacturers’ instructions.

B. Coordinate with all other trades prior to installation.

C. All telecommunications cabling not routed through conduit or cable tray shall be supported every 60” or less.

D. Telecommunications cables shall not be supported by any other trades and shall be fully supported by independent methods.

3.02 CABLE HOOKS (J-HOOKS)

A. Cable hooks shall not be supported by ceiling grid support wires.

B. Where independent support wires are used, they shall be attached to the structural ceiling for load-bearing purposes, with the connection to the ceiling grid functioning solely as sway control.

C. Size cable hooks to allow for a maximum of 25% capacity to facilitate future installation of cables.

D. Cable hooks shall be installed such that cable slack between supports is a minimum of 6” above ceilings.

E. Provide adequate cable hooks to ensure telecommunications cabling is a minimum of 6” from light fixtures and power conduits.

F. Where telecommunications cabling is being supported with cable hooks, provide a cable hook at every change in direction.

G. Cable hooks shall be installed in a conveniently accessible location.

H. Route cabling such that a minimum of 48” is provided between cabling and electric motors or generators to minimize electromagnetic interference.

END

SECTION 270533 – CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies the products, installation methods, and requirements for conduits, backboxes, pull boxes, and related accessories used in telecommunications and low-voltage cabling systems.

PART 2 PRODUCTS

2.01 GENERAL

A. Refer to Division 26 Electrical Technical Guidelines on the Adams 12 website (Facility Technical Guidelines) for a list of approved manufacturers and any additional information.

2.02 CONDUIT

A. Refer to execution section for sizing and installation requirements.

2.03 BACKBOXES

A. Typical communications backbox shall have the following minimum dimensions: 4-11/16” x 4-11/16” x 2-1/2”

1. Refer to drawings for plaster ring size/opening.

2. 1” EMT conduit stub into ceiling space above.

3. For outlets in CMU wall, submit appropriate backbox for application.

2.04 INTERIOR TELECOMMUNICATIONS PATHWAYS

A. MDF to each IDF

1. Connect with two (2) 4” EMT Conduits.

2. Design with pull boxes as required.

2.05 PULL BOXES

A. Material shall be aluminum or steel.

B. Refer to execution section for sizing and installation requirements.

PART 3 EXECUTION

3.01 GENERAL

A. Follow all manufacturers’ instructions.

B. Coordinate with all other trades prior to installation.

3.02 CONDUIT

A. Conduits shall be reamed and bushed to prevent damage to cabling during pulling.

B. Minimum Bend Radius

1. Conduits with an inside diameter of 2" or less: Maintain a bend radius of at least six (6) times the conduits inside diameter.

2. Conduits with an inside diameter greater than 2": Maintain a bend radius of at least ten (10) times the conduits inside diameter.

C. No continuous section of conduit may exceed 100 feet. Utilize pull boxes as necessary.

D. No continuous section of conduit may include more than (2) 90-degree bends (or equivalent).

1. An offset is considered a 90-degree bend.

2. A pull box is required wherever a reverse (180 degree) bend is installed.

E. Conduit to Floor Boxes in Slab-on-Grade

1. Slab-on-grade conduits shall not be installed.

F. Refer to Division 26 Electrical Technical Guidelines for Flexible Conduit installation guidelines.

3.03 BACKBOXES

A. Backboxes installed into fire-rated walls shall include appropriate firestopping system.

B. Where back-to-back with outlet on opposite side of wall, off-set one of the backboxes and conduits to adjacent stud cavity or masonry block.

3.04 PULL BOXES

A. Size pull boxes according to the following chart: Ensure sufficient space for cable bends and terminations within the pull box.

Conduit Trade Size	Width	Length	Depth	Width Increase for Additional Conduit
1"	4"	16"	3"	2"
1-1/4"	6"	20"	3"	3"
1-1/2"	8"	28"	4"	4"
2"	8"	36"	4"	5"

Conduit Trade Size	Width	Length	Depth	Width Increase for Additional Conduit
2-1/2"	10"	42"	5"	6"
3"	12"	48"	5"	6"
4"	16"	60"	8"	6"

B. Install pull boxes in conveniently accessible locations.

C. Where identified on drawings as lockable, key all pull boxes the same for ease of maintenance.

END

SECTION 270536 – CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies the design, materials, installation, and testing requirements for cable tray systems used in telecommunications and low-voltage applications, including grounding and support requirements.

PART 2 PRODUCTS

2.01 GENERAL

A. The cable tray system shall be listed for its location and intended purpose.

B. All cable trays, including all parts, pieces and connections, shall be certified from a NRTL for the intended purpose.

C. The cable tray system shall be listed to allow for continuous grounding. Refer to execution section for additional grounding requirements.

D. Cable tray shall be complete with all materials and incidental and miscellaneous hardware required for a complete cable tray system, including but not limited to support hangers, connector assemblies, clamp assemblies, connector plates, splice plates and splice bars.

E. Cable tray shall have no sharp edges to avoid cable damage.

2.02 RIGID CABLE TRAY

A. To be utilized only where specifically called out on the drawings.

B. For excessively high structures, rigid cable tray may be utilized to minimize the number of ceiling supports. Requests for rigid cable tray usage must include justification, location details, and load calculations, submitted as part of the RFI process.

C. Material shall be aluminum or steel.

D. All bends, intersections, and changes in direction shall be modular (pre-manufactured). Field modifications are not acceptable.

2.03 CABLE TRAY (SPECIAL APPLICATION)

A. G-shaped Cable Tray

1. For areas where specifically identified on the drawings. For other areas, submit question during bid-window or as a construction RFI requesting use of G- shaped cable tray.

2.04 CABLE TRAY FITTINGS AND SUPPORTS

A. All fittings and supports shall be manufactured by the same manufacturer as the cable tray.

PART 3 EXECUTION

3.01 GENERAL

A. Minimum clearances for cable tray:

1. Maintain as much separation from EMI sources as practical. At a minimum, cable tray shall be installed at least:

a. 18” away from fluorescent light fixtures. Pathways shall cross perpendicular to fluorescent lighting and electrical power cables or conduits wherever possible.
b. 6” away from power lines (circuits) enclosed in a grounded metal conduit
c. 48” away from electrical motors and transformers

2. Install a minimum of 3” above accessible ceiling T-bars and 6” if the space exists.

3. Install with 12” headroom above cable tray (where space exists).

a. The final location of cable tray shall allow future cables to be easily installed, cables shall not have to be pulled through cable tray due to the top being inaccessible.

b. Where overhead space is restricted, consider relocation of cable tray or the use of G-shaped Cable Tray. Where G-shaped cable tray is desired, submit an RFI identifying the desired change/location and the reason.

4. Where this clearance is not possible, project must reroute cable tray at no cost to the District.

a. Cable tray may be relocated at the telecommunications sub-contractor discretion, provided it is within the footprint of the same room(s) as indicated on the construction drawings, and the sub-contractor notes the new routing on the Record Drawings.

b. Where cable tray needs to be relocated above different room(s) than indicated on the construction drawings, Telecommunications Subcontractor is to submit an RFI with proposed new location.

B. For planning cable tray pathways, the maximum pathway fill shall be 25% by calculation, which appears to be approximately 50% full. Where installed cable quantities are expected to exceed this ratio, submit question during bid-window or as a construction RFI requesting possible up-size of the cable tray.

C. Follow all manufacturers’ instructions.

D. Coordinate with all other trades prior to installation.

1. Coordination with other trades is imperative. It is the telecommunications sub-contractor and the general contractor’s responsibility to ensure all ductwork, piping, etc. of other trades is installed to allow successful installation of cable tray.

E. Telecommunications cables shall not be supported by any other trades and shall be fully supported by independent methods (e.g., 3/8” threaded rod).

F. Grounding and Bonding

1. Each cable tray section shall be properly bonded together with Listed splices or connections.

2. Bond the cable tray to the telecommunications bonding and grounding system every 50’-60’.

3.02 CABLE TRAYS

A. Support

1. Support cable trays every 5 feet or less unless manufacturer specifications allow longer distances. For extended distances, submit load calculations for approval. At a minimum, this support distance shall be maintained throughout the project.

B. Maintenance and Accessibility

1. Cable tray systems shall be installed to allow for future maintenance and cable additions without requiring disassembly of existing infrastructure. Reference applicable standards in ANSI/TIA-569-D and HFPA 70.

END

SECTION 270537 – FIRESTOPPING SYSTEMS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section governs the materials and installation of firestopping systems for communications cabling to maintain the integrity of fire-rated assemblies, prevent the spread of fire, smoke, and toxic gases, and ensure compliance with all applicable codes and standards.

1.02 RELATED DOCUMENTS

A. The latest versions of the following codes, standards, and guidelines shall be followed. Bring to District and IT Representatives’ immediate attention where construction documents or conditions differ from requirements in codes, standards, guidelines and specifications.

B. The following codes, as required by law:

1. National Electric Code (NEC)

2. National Fire Protection Association (NFPA) – NFPA 101: Life Safety Code.

C. The following standards:

1. ASTM E 84, “Surface Burning Characteristics of Building Materials”.

2. ASTM E 119, “Fire Tests of Building Construction and Materials”.

3. ASTM E 814, “Fire Tests of Penetration Firestop Systems”.

4. ANSI/UL263, “Fire Tests of Building Construction and Materials”.

5. ANSI/UL723, “Surface Burning Characteristics of Building Materials”.

6. ANSI/UL1479, “Fire Tests of Through Penetration Firestops”.

7. Underwriters Laboratories Inc. (UL) – Fire Resistance Directory

1.03 QUALITY ASSURANCE:

A. Provide firestopping systems that comply with the following requirements:

1. Firestopping material shall be tested by a qualified testing and inspection agency. A qualified testing and inspection agency is UL, or another comparable agency performing testing (as approved by UT ITS).

2. Only Firestopping products bearing the classification marking of qualified testing and inspection agency shall be used.

B. Installation craftsperson and / or technicians shall be by qualified and trained. Acceptable Installer qualifications are as follows:

1. FM Research approved in accordance with FM AS 4991.

2. Individuals or staff who are certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary training and experience. A minimum of 1 year experience in the installation of manufacturer's products is required.

3. The Installers shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures.

1.04 DEFINITIONS:

A. Firestop Assembly – a manufactured product from a reputable company that is delivered to the contractor fully- or partially-assembled and when installed is rated as meeting the UL 1479 or ASTM E814 standards for fire testing and becomes part of a Firestop System for that particular type of installation.

B. Firestop System – a product or series of products from a reputable manufacturing company that when installed properly by the contractor meets the UL 1479 or ASTM E814 standards for fire testing for that particular type of installation.

C. Zero maintenance firestop assembly – a firestop assembly with a self-contained sealing system which shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to adjust, remove or reinstall firestop material.

PART 2 PRODUCTS

2.01 GENERAL

A. Communications cable tray or ladder rack shall not be continued through a fire-rated wall. Stop the tray or ladder rack, install multiple zero-maintenance firestop assemblies, and continue tray or ladder rack on the other side. Ensure grounding of the cable tray is continuous through the wall.

B. Single Source: For all penetrations for communications openings through fire-rated walls and floors, install the same manufacturer’s product for that type of penetration throughout the project.

C. Identification

1. At all firestop locations, install a label on each side of the wall indicating the following information:

a. Manufacturer of Firestop

b. Name of product and UL System Number

c. Name of installing contractor and date of installation.

d. Rating of the wall/system.

2.02 ZERO-MAINTENANCE FIRESTOP ASSEMBLY

A. Shall meet or exceed the ratings of the wall or floor that it penetrates.

B. Shall be used for communications cabling at all interior wall penetrations through a single, fire-rated wall or floor.

C. Shall be a listed (UL and/or FM) firestopping assembly system tested to UL 1479 or ASTM E814. The assembly shall Assembly size and quantity shall be determined as follows:

1. For round openings, fill ratio of cabling-to-opening-size shall not exceed 40%, or as dictated by the manufacturer, whichever is more stringent.

2. For rectangular openings, fill ratio of cabling-to-opening size shall not exceed 50%, or as dictated by the manufacturer, whichever is more stringent.

3. Include in cabling cross-sectional area enough spare capacity to accommodate 50% growth. Upon commissioning, if adequate spare capacity is not observed, contractor shall install additional assemblies at their own cost to provide such spare capacity.

2.03 FIRESTOPPING FOR COMMUNICATIONS CONDUITS & OTHER APPLICATIONS

A. Required for all fire-rated wall penetrations where a communications pathway extends beyond a single fire-rated partition.

B. Required for all telecommunications outlets located on fire-rated walls. System shall be UL CLIV tested.

C. Shall be a listed (UL and/or FM) firestopping assembly system tested to UL 1479 or ASTM E814.

D. Shall meet or exceed the ratings of the wall or floor that it penetrates.

PART 3 EXECUTION

3.01 GENERAL

A. All penetrations through fire-rated walls, floors, ceilings, etc. shall be sealed to prevent of the spread of smoke, fire, toxic gas, or water through the penetration either before, during, or after a fire. The fire rating of penetration seal shall be at least that of the wall, floor, or ceiling into which it is installed, so the original fire rating is maintained. The installation shall provide an air and watertight seal.

B. All conduit and sleeve openings used for this project shall be waterproofed or fireproofed upon cable placement through such passageways in compliance with Colorado Building and Fire Codes.

C. Patch all openings remaining around and inside all conduit sleeves and cable penetrations to maintain the integrity of any fire-rated wall, floor, ceiling, etc.

D. Manufacturer’s installation standards shall be closely followed (minimum depth of material, use of ceramic fiber, procedures, etc.)

E. Do not install firestopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.

F. Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.

G. Maintain minimum temperature before, during, and for a minimum 3 days after installation of materials.

H. Do not use materials that contain flammable solvents.

I. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

J. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

K. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

L. Before beginning installation:

1. Examine effected surfaces, as they shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants, and any other substances that may inhibit optimum adhesion.

2. Provide masking and temporary covering to protect adjacent surfaces.

3. Do not proceed until unsatisfactory conditions have been corrected.

M. Install through-penetration firestop systems in accordance with the conditions of testing and classification as specified in the published design. Comply with manufacturer’s instructions for installation of firestopping products.

N. After installation:

1. Remove equipment, materials, and debris, leaving area in undamaged, clean condition.

2. Clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

3. Commissioning of Firestopping Systems for Communications Cabling is to be in conjunction with the above ceiling inspection (as outlined in Section 27 00 00). All firestop systems (including cabling through them) and identification labels shall be installed prior to the Design Engineer above-ceiling inspection.

END

SECTION 270539 – SURFACE RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies the materials, dimensions, and installation methods for surface raceway systems used in communications and low-voltage cabling to ensure a neat, secure, and code-compliant installation.

PART 2 PRODUCTS

2.01 METALLIC RACEWAY

A. Manufacturer shall be:

1. Wiremold, or equivalent

2.02 NON-METALLIC RACEWAY

A. Manufacturer shall be:

1. Panduit, LD5 and LD10 off-white Panduit series, or equivalent

2.03 SURFACE OUTLET BOXES

A. Single-gang

1. Minimum of 2-3/4” deep
2. Manufacturer shall be:
   a. Panduit, or equivalent

B. Double-gang

1. Minimum of 2-3/4” deep
2. Manufacturer shall be:
   a. Panduit, or equivalent

PART 3 EXECUTION

3.01 GENERAL

A. Follow all manufacturers’ instructions.

B. Coordinate with all other trades prior to installation.

C. Delivery, Storage, and Handling

1. Store products in manufacturer’s unopened packaging until ready for installation.

2. Store and handle in strict compliance with manufacturer’s written instructions and recommendations.

3. Protect from damage due to weather, excessive temperature, and construction operations.

D. Verify routing locations of raceway prior to installation.

E. Surface raceways shall be sized to accommodate 1 square in of space per work area.

F. Do not begin installation until substrates have been properly prepared. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

G. Clean surfaces thoroughly prior to installation.

H. Prepare surfaces, (e.g., removing grease or debris), using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

I. Non-metallic raceway must be screwed into wall (all wall types) in addition to use of adhesive sticker.

J. Install all components necessary to make a complete, code-compliant installation.

K. Sections of surface raceway less than 7’ in length shall be a single piece of raceway.

END

SECTION 270553 – IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies the materials, methods, and requirements for labeling and identifying all components of the communications cabling system to ensure efficient system management, maintenance, and future scalability.

PART 2 PRODUCTS

2.01 GENERAL

A. All labels or means of identification shall utilize machine-printed type.

2.02 HANDHELD LABELERS

A. To be utilized for ISP cable labels, OSP (horizontal) cables, racks, and grounding busbars.

B. Label size, type and color according to label location, cable diameter and readability.

1. Faceplates, patch panels and wall-block labels should be white labels with black text and fit to integral slots.

2. Biscuits labels should be white labels with black text and fit on top of biscuit.

3. Ceiling grid labels should be black labels with white text and be large enough to read from the floor.

4. Cable labels should be white cable wrap labels with black text and be labeled at both cable ends – back of patch panel and at the jack in the field.

C. Shall be thermal-transfer type, and utilize self-adhesive labels.

D. Alternatively, a thermal transfer desktop printer may be utilized with self-adhesive labels/rolls. Submit manufacturer and part number to be considered.

2.03 FACEPLACE, PATCH PANEL, AND WALL-BLOCK LABELS

A. Faceplates, patch panels and wall-blocks shall have integral slots for label inserts. Have identification machine-printed onto label inserts and populate the integral slots with these inserts.

B. Where the intended product does not have an integrated label insert, submit proposed labeling method.

2.04 GROUNDING AND BONDING CONDUCTORS

A. Warning Marker

1. Non-metallic, machine and pre-printed as a wrap-around marker (*not* a flag marker).

B. Label

1. Label shall be self-laminating, machine- and thermal-printed.

2. Size of label will vary with size of conductor:

a. For 18-14AWG, 1.00”x0.75” label

b. For 12-10AWG, 1.00”x1.25” label

c. For 8-4AWG, 1.00”x2.25” label

d. For 2-1AWG, 1.00”x4.00” label

e. For 1/0-250kcmil, 1.00”x6.50” label

PART 3 EXECUTION

3.01 GENERAL

A. Install labels in such a way as to be physically and visually accessible.

B. Remove any temporary labels and ensure no permanent labels are damaged during construction.

C. Replace all damaged or missing permanent labels prior to substantial completion.

3.02 LABELING OF CABLING SYSTEMS

A. General

1. Labeling of cabling systems is determined by the IT Representative. Coordinate with IT Representative to obtain labeling scheme, examples offered in this Section here are for preliminary purposes only. Final direction is to come from IT Representative during construction.

2. Pre-printed labels shall be used for faceplates, biscuits, cables, ceiling grid, and patch panels. Handwritten labels are not allowed.

B. Equipment Racks

1. Racks in each Telecommunication room are to be labeled (minimum text height of 3/8”).

2. Racks are to be numbered from the rack closest to the wall to the rack furthest from the wall.

3. Label shall also include the Telecommunications Room number before rack number.

    a. Example “MDF-1”, for Rack 1 in the MDF.

4. For any Telecommunications Room with more than 9 racks, rack 1-9 must include ‘0’ prefix.

    a. Example “MDF-01” for Rack 1 of 11 in the MDF.

C. Inside Plant (ISP) Horizontal Category Cable

1. MDF or IDF

    a. A, B, C, D, etc. - for the MDF and IDFs. The MDF and IDF letters will be assigned by the IT Representative.

    b. 1, 2, 3 - for the floor the jack is on, single story buildings will always reference floor 1.

    c. Dash (-).

2. Jack Number - If identified on the drawings, use the drawings to assign the jack numbers. If not identified on the drawings the numbers will be sequentially assigned by the Contractor.

    a. 001 for the first Data jack, 002, 003, etc. for remaining Data jacks.

    b. If the MDF or IDF services multiple floors of the building, restart the jack number sequence for the different floors.

3. Horizontal Category Cable Label Examples

    a. A1-001, A1-002, etc. – MDF 1st floor cables

    b. A2-001, A2-002, etc. – MDF 2nd floor cables

    c. B1-001, B1-002, etc. – IDF-B 1st floor cables

    d. B2-001, B2-002, etc. – IDF-B 2nd floor cables

D. Fiber Backbone (between Telecom Rooms)

1. Label all fiber optic cable terminations. Pre-printed labels shall be used for the fiber termination panels. Handwritten labels are not allowed. The number for the termination label will consist of the following:

    a. IDF where the fiber optic cable terminates – IDF-B, IDF-C, IDF-D etc.

3.03 PATHWAYS

A. Conduit

1. Label exterior of conduit as TELECOMMUNICATIONS (unless otherwise noted on the drawings) with text readable from a standing position on the finished floor.

    a. For wall stub-up locations, label overhead only.

    b. For strictly overhead conduits, label both ends.

    c. For long runs of conduits that stub directly up or into Telecommunications Room, label the end of the conduit in the Telecommunications Room with the destination room number or location.

2. Sleeves which pass through a single wall or floor need not be labeled.

B. Junction boxes and pull boxes.

1. Label exterior of junction boxes and pull boxes as TELECOMMUNICATIONS with text readable from a standing position on the finished floor.

3.04 GROUNDING

A. Label TMGB as FLOOR# - ROOM# - TMGB.

B. Label TGBs as FLOOR# - ROOM# - TGB.

C. Label grounding conductors within 12” of both ends with Warning Marker and Label.

1. Label is to include the source and destination of the grounding conductor.

END

SECTION 270820 – OPTICAL FIBER TESTING AND MEASUREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This section outlines the standards and procedures for testing and verifying the performance of installed optical fiber cabling systems.

PART 2 PRODUCTS

2.01 FIELD-TEST INSTRUMENT

A. The field-test instruments shall:

1. Be within the calibration period recommended by the manufacturer.

2. Contain the most recent software and firmware provided by the manufacturer prior to testing. If requested, provide the calibration certificate to the District for review.

PART 3 EXECUTION

3.01 GENERAL

A. Calibrate all test equipment prior to use and verify accuracy with reference cables. Tests performed on equipment without up-to-date calibration shall be rejected and shall be repeated at no additional cost to the District.

B. Notify the District seven (7) days in advance of each type of test to be conducted. The District, at its discretion, may witness all testing.

C. Perform a visual inspection of all fiber optic connectors, cables, and terminations for signs of damage, dirt, or misalignment prior to testing.

D. All terminations, connectors, cables, patch panels and associated components shall be fully assembled and labeled prior to field-testing. Any test measurements performed on incomplete systems shall be redone on completion of the work.

E. One hundred percent of the installed fiber strands shall pass the requirements of the referenced standards. Any failing fiber strand shall be diagnosed and corrected. The corrective action shall be noted and followed with a new test measurement to prove that the corrected fiber strand meets the performance requirements. The final and passing result of the tests for all fiber strands shall be provided in the test measurements results documentation.

F. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the test measurements.

3.02 PERFORMANCE TEST PPROCEDURES

A. Optical Loss Testing

1. Conduct insertion loss tests using an optical power meter and light source for singlemode fibers.

2. Document test results, including fiber strand identifiers, test conditions, and any anomalies observed, to ensure they meet the maximum allowable loss specified.

B. Optical Time Domain Reflectometer (OTDR) Testing

1. Use OTDR testing to verify the integrity of fiber splices, connectors, and overall cable continuity.

2. Identity and document any events such as high-loss splices or reflective faults.

3.03 PERFORMANCE CRITERIA

A. Insertion Loss

1. Singlemode fiber: Maximum allowable loss of 0.5 dB per connection (e.g., reference ANSI/TIA-568 or ISO/ICE standards).

B. Reflectance

1. Ensure reflectance values do not exceed -40 dB for singlemode fibers.

C. Splice Loss

1. Maintain splice losses below 0.3 dB for fusion splices and 0.5 dB for mechanical splices. Splice losses should be measured after proper alignment and cleaving, ensuring that measurements reflect optimal conditions.

3.04 DOCUMENTATION AND REPORTING

A. Test results documentation.

1. The test measurement result information for each link shall be recorded in the memory of the field-test instrument upon completion of the test.

2. The test result records saved within the field-test instrument shall be transferred into a Windows™-based file format (e.g., PDF, CSV, and/or Excel) that allows for the maintenance, inspection and archiving of these test records. These test records shall be uploaded to the PC unaltered, i.e., “as saved in the field-test instrument”.

3. The test results documentation shall be available for inspection by the District or the District’s representative during the installation period. The contractor shall retain a copy to aid preparation of as-built information.

4. The records for each test shall be provided to the District a minimum of three weeks prior to substantial completion in PDF format and the native format to the test instrument.

5. It is required that Circuit IDs reported by the field-test instrument shall match the label ID specified by the District. Any mismatches in Circuit IDs will result in rejection of test results and will require retesting.

END

SECTION 270830 – COPPER TESTING AND VERIFICATION

PART 1 GENERAL

1.01 SUMMARY

A. This section outlines the requirements for testing balanced twisted-pair cabling to ensure compliance with performance specifications, system reliability, and adherence to TIA standards.

PART 2 PRODUCTS

2.01 FIELD-TEST INSTRUMENT

A. The field-test instrument shall:

1. Be within the calibration period recommended by the manufacturer.

2. Contain the most recent software and firmware provided by the manufacturer prior to testing.

3. Be a Level IV accuracy (Or greater)

B. Administration

1. The test measurement result information for each link shall be recorded in the memory of the field-test instrument upon completion of the test.

2. The test result records saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records.

PART 3 EXECUTION

3.01 GENERAL

A. Test devices shall be in calibration throughout the testing period. Tests performed on equipment without up-to-date calibration shall be rejected and shall be repeated at no additional cost to the District.

B. Notify the District seven (7) days in advance of each type of test to be conducted. The District, at its discretion, may witness all testing.

C. All outlets, cables, patch panels and associated components shall be fully assembled and labeled prior to field-testing. Any test measurements performed on incomplete systems shall be redone on completion of the work.

D. The records for each cable test measurement shall be provided to the District a minimum of three weeks prior to substantial completion.

E. The installed twisted-pair links shall be tested from the patch cable in the telecommunications room through the patch cable at the telecommunication wall outlet in the work area for compliance with the ”Channel Test (+PoE)” performance specification.

F. One hundred percent of the installed cabling links shall pass the requirements of the referenced standards. Any failing link shall be diagnosed and corrected. The corrective action shall be noted and followed with a new test measurement to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test measurements results documentation.

G. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the test measurements. The field test instrument, including the appropriate interface adapter, shall meet Level IV accuracy requirements, as a minimum Level.

H. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests. Any Fail or Fail* result yields a Fail for the link-under-test. To achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*. The “*” shall not be turned off on the test instrument.

I. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field-test instrument manufacturer must provide documentation as an aid to interpret results marked with asterisks. To which extent '*' results shall determine approval or disapproval of the element under test shall be defined in the relevant detail specification or agreed upon as a part of a contractual specification.

3.02 PERFORMANCE TEST PARAMETERS

A. Test results documentation.

1. Test results saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., “as saved in the field-test instrument”.

2. The test results documentation shall be available for inspection by the District or the District’s representative during the installation period. The contractor shall retain a copy to aid preparation of as-built information.

3. The records for each test shall be provided to the District a minimum of three weeks prior to substantial completion in PDF format and the native format to the test instrument.

4. It is required that Circuit IDs reported by the field-test instrument shall match the label ID specified by the District.

END

SECTION 271100 – COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes basic communications rooms (i.e., equipment room [MDF], telecommunications room [IDF]) fitting requirements.

B. Provide all labor, materials, tools and equipment required for the complete and proper communications room installation.

C. The Contractor shall survey and coordinate the communications room installation with other trades.

D. The Contractor shall furnish and install all necessary items for a fully functional system at no additional charge.

E. Refer to “T” series drawings (telecommunications) for communications room layout and additional requirements.

PART 2 PRODUCTS

2.01 PLYWOOD BACKBOARD

A. Plywood backboards shall be urea formaldehyde-free, ¾” AC-grade and fire-resistant.

2.02 EQUIPMENT RACK AND CABLING ROUTING HARDWARE

A. Manufacturers

1. Chatworth, or equivalent – Equipment Racks and Ladder Rack

2. AMP NetConnect, or equivalent – Cable Routing Hardware

3. Eaton, or equivalent – UPS Equipment

B. Floor-Mount Equipment Rack

1. Standard 19” rack mounting space.

2. 84” high with 44 rack spaces (1 rack space = 1-3/4”).

3. EIA-310-D standard 5/8” 5/8” 1/2” hole pattern.

4. EIA channel width of 3” with double-sided 12/24 tapped screw holes.

5. Lightweight high strength aluminum construction with black finish.

6. 15” deep base with four (4) 3/4” bolt down holes and equipped with hardware for permanent mounting on concrete floor.

C. Vertical Rack Cable Management

1. 84” high and minimum 6” deep.
2. Lightweight high strength aluminum construction with black finish.
3. Specify 3-1/2” wide “narrow vertical” or 6” wide “wide vertical” as required.
4. Dual sided for running cables in both the front and back of the equipment racks.

D. Floor-Mount Equipment Cabinet

1. Front-to-back adjustable mounting rails with standard 19” rack mounting space.
2. EIA-310-D standard 5/8” 5/8” 1/2” hole pattern.
3. EIA channel width of 3” with double-sided 12/24 tapped screw holes.
4. 84” high with 44 rack spaces (1 rack space = 1-3/4”).
5. 30” usable depth.
6. 16 gauge steel construction with black finish.
7. Vented metal sides and top with punch-out holes for cabling access.
8. Lockable vented metal front and rear door.
9. Equipped with vertical cable management inside cabinet without protruding into 19” usable rack space.

E. Wall-Mount Equipment Cabinet

1. Equipped with mounting rails with standard 19” rack mounting space.
2. EIA-310-D standard 5/8” 5/8” 1/2” hole pattern.
3. 36” high with 20 rack spaces (1 rack space = 1-3/4”).
4. Position of mounting rack rails adjustable from front to back of cabinet.
5. Depth 20” minimum.
6. 16 gauge steel construction with black finish.
7. Vented top and bottom with punch-out holes for cabling access.
8. Equipped with 250 CFM fan for ventilation.
9. Plexiglas front door.

10. Hinged to provide access to back of equipment and patch panels mounted in rack.

11. Keyed locks for front door and rear hinge access.

12. Equipped with hardware for permanent mounting on wall with 150 lb load capacity.

F. Horizontal Rack Cable Management

1. Intrabay patch cord organizer for standard 19” rack with horizontal pathways for routing cables and cords between adjacent racks.

2. Interbay patch cord organizer for standard 19” rack with horizontal and vertical pathways for routing cords within a single rack.

3. Strain relief bars for standard 19” rack to provide for cabling to be wired perpendicular to the jacks in the patch panels and to prevent cable separation from the patch panel.

G. Rack Mount Equipment Shelves

1. Single-sided rack mount equipment shelf.

   a. 15” deep.

   b. Supports up to 50 lbs.

   c. Black color.

2. Double-sided heavy-duty rack mount equipment shelf.

   a. 20” deep.

   b. Supports up to 200 lbs.

   c. Black color.

H. Rackmount Utility Drawer

1. Fully enclosed sliding drawer.

2. Spring loaded latch.

3. Minimum 7” high by 14” deep.

4. Black color.

I. Spare Parts

1. Provide spare parts for the MDF and each IDF as described in this section.

2. Mounting Screws.

a. One (1) package of one hundred (50) screws for the MDF and one (1) package of fifty (50) screws for each IDF.

b. Threaded for double-sided 12/24 tapped screw holes.

c. 1/2” length.

d. Black color.

3. Faceplates

a. Ten (10) Modular Flush-Mount Faceplates for the MDF.

b. Twenty (20) Blank Covers for Faceplates.

4. Modular Jacks

a. Twenty (20) orange color and five (5) white color for the MDF.

5. Data Category 6A Patch Cords

a. Ten (10) five (5) foot length blue color in the MDF and each IDF.

b. Ten (10) fifteen (15) foot length blue color in the MDF and each IDF.

J. UPS Battery Backup

1. Eaton 11Kva 208v 60A UPS Bundle, or equivalent (includes Extended Battery Module, Maintenance Bypass Switch, and Environmental Sensor).

a. Two (2) or more for each MDF depending on equipment power load in MDF.

b. One (1) or more for each IDF depending on equipment power load in IDF.

2. Eaton 6kVA 208v 30A UPS Bundle (includes Extended Battery Module and Environmental Sensor).

a. Quantity as required in MDF depending on equipment power load.

b. Quantity as required in IDF depending on equipment power load.

3. Eaton Power Distribution Unit (PDU)

a. Eaton ePBZ79 PDU.

b. Three (3) per Eaton 11kVA UPS.

c. Two (2) per Eaton 6kVA UPS.

K. D-Rings wall-mount nominal 2” 4” or 6” as required for cable routing.

L. Ladder Cable Runway

1. Tube steel painted black.

2. 12” Wide.

3. Cross members welded at maximum 12” rung spacing.

4. Include support kits, brackets, splice kits, end caps, etc. as required for complete installation.

M. Ladder Rack

1. Ladder racks shall be manufactured from 3/8” W by 1½” H tubular steel with .065” wall thickness. The finish shall be black, epoxy-polyester hybrid powder coat (paint).

2. Straight sections of ladder rack (side stringers) shall be 9’-11½” long. Cross members shall be welded in between stringers on 12” intervals/centers beginning 5¾” from one end so that there are 10 cross members per ladder rack (the dimensions allow 10½” of open space in between each cross member).

3. Horizontal 90° turns shall have stringers (sides) formed in a 90° arc. Cross members shall be welded in between stringers on approximate 23° increments so that there are 5 cross members per turn. The welded assembly shall have a 15” inside radius and will create a smooth horizontal 90° turn.

4. Horizontal-to-vertical 90° turns (for either inside or outside radius bend) shall have stringers (sides) formed in a 90° arc with a 12½” outside radius. Cross members shall be welded in between stringers on approximate 23° increments so that there are 3 cross members per turn.

5. Corner brackets shall be formed at 90° with a small chamfer at the vertex. The outside stringer of the corner bracket will be formed in a 90° arc that is either 15” or 24” radius. A single cross member will connect the chamfered portion of the inside stringer to the outside stringer. The welded assembly will create a smooth 90° turn within the L-shaped corner created by two intersecting ladder racks.

6. Ladder rack splices shall be manufactured from steel and shall be zinc plate finished, gold in color.

7. Ladder rack supports shall be steel.

8. Ladder rack accessories.

   a. Cable retaining posts shall be manufactured from 1” by ½” tubular steel with .065” wall thickness. Cable retaining posts shall be 8” H and shall attach to the side stringer of the ladder rack. The top of the cable retaining posts shall be fitted with a rubberized end cap to protect cables.

   b. End closing kits used to cover the end of ladder rack shall be manufactured from 3/8” W by 1½” H tubular steel with .065” wall

thickness. Kits shall consist of a bar cut to match the width of the ladder rack and the hardware required to attach the bar to the end of a length of ladder rack.

c. Radius drops used to create a radius to form cables over as the cables exit or enter the ladder rack shall be manufactured from aluminum extrusion. The extrusion shall be formed in a 90° arc with a minimum bend radius of 3”. Radius drops shall be capable to be attached to either the side stringer or the cross member of the ladder rack using a clevis pin. Radius drops shall include 1½” H cable spools that attach to the top of the radius drop to guide cables.

PART 3 EXECUTION

3.01 PLYWOOD BACKBOARDS

A. Plywood backboards shall be placed with the smooth side (“A” side) of the plywood facing the interior of the room.

B. Plywood backboards shall be affixed to the studs in the walls with appropriately coated screws that penetrate the studs a minimum of 1” and are spaced no greater than 12” apart in each stud, with screws placement starting at 6” from the top and bottom of the plywood. Where wall material is other than studs and gypsum, appropriate anchors shall be used.

C. Screws or anchors used to mount the plywood shall not protrude past the face of the plywood.

D. Plywood seams shall be sealed.

E. Plywood backboards within communications rooms shall be painted on all sides with two coats of white, fire-retardant paint with exception of the verification stamp on the plywood indicating that it is fire-retardant.

F. Plywood shall be installed vertically side by side 12” AFF.

3.02 LADDER RACK

A. All components of the ladder rack system (ladder rack, turns, splices, supports, and accessories) shall be from a single manufacturer.

B. Ladder rack shall be installed with side stringers facing down so that the ladder forms an inverted U-shape and so that welds between the stringers (sides) and cross members (middle) face away from cables.

C. Ladder rack shall be secured to the structural ceiling, building truss system, wall, floor or the tops of equipment racks using the manufacturer’s recommended supports and appropriate installation hardware.

D. Ladder rack shall be supported every 5’ or less. Ladder rack shall be supported within 2’ of every splice and within 2’ on all sides of every intersection. Support ladder rack within

2’ on both sides of every change in elevation. Support ladder rack every 2’ when attached vertically to a wall.

E. Ladder rack shall be installed with a minimum clearance of 12” above the ladder rack. Leave a minimum of 12” between ladder rack and ceiling/building truss structure. Leave a minimum of 3” between ladder rack and the tops of equipment racks and/or cabinets. Multiple tiers of ladder rack shall be installed with a minimum clearance of 12” between each tier of ladder rack.

F. Ladder rack shall be bonded together, electrically continuous, and bonded to the TMGB or TGB. Ladder rack and turns shall be bonded across each splice. Remove paint from the ladder rack where bonding lugs or splices contact the ladder rack so that the lug or spice will contact bare metal. Use antioxidant joint compound in between the bare metal on the ladder rack and ground lug or splice.

G. Add 8” H cable retaining posts to the open sides of ladder rack every 18”.

H. When a single ladder rack supports different types of cable media, the cable media shall be separated within the pathway by cable spools that attach to the cross members on the ladder rack.

I. Use a radius drop to guide cables wherever cable exits overhead ladder rack to access a rack, frame, cabinet or wall-mounted rack, cabinet or termination field. If necessary, provide a moveable cross member also to attach and align the radius drop in between the welded cross members of a ladder rack.

J. Cover the exposed ends of cable runway that do not terminate against a wall, the floor or the ceiling with end caps or an end closing kit.

3.03 CABLE ROUTING ASSEMBLY

A. Cable routing assemblies shall be a minimum of 4” by 4” with a cover, installed according to the “T” drawings and manufacturer instructions. Channel and fittings shall be assembled using pre-assembled couplers. The assembly shall attach to ladder rack with spill-outs into each vertical manager. The assembly shall have channels, spill-outs, fittings and brackets. Fittings shall accommodate a 2” bend radius.

3.04 EQUIPMENT RACK

A. Assemble equipment racks according to manufacturer’s instructions.

B. Ladder rack shall be attached to the top of the rack to deliver cables to the rack. The rack shall not be drilled to attach ladder rack. Use appropriate hardware from the ladder rack manufacturer.

C. Equipment racks shall be bonded to ground through the communications room busbar (i.e., TMGB, TGB) using appropriate hardware provided by the contractor.

D. After floor covering is installed, all racks shall be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below.

3.05 VERTICAL MANAGER; DOUBLE-SIDED

A. Assemble vertical managers according to manufacturer’s instructions.

B. Vertical managers shall be placed between equipment racks and at the ends of the equipment rack row.

C. Attach vertical cable managers to the side of the rack/frame using the manufacturer’s installation instructions.

D. All vertical managers shall be of the same model number and manufacturer.

E. Doors shall be attached to the cable manager and in the closed position after cabling is complete.

END

SECTION 271119 – COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies the products and installation of telecommunications termination blocks and patch panels for copper twisted-pair and optical fiber cables.

B. The product performance (e.g., Category 6A, OM4, OS2) shall be as specified on drawings.

C. Manufacturer shall include the following (no substitutes will be allowed without prior written consent from District):

1. CommScope, or equivalent – Copper Patch Panels.

a. Provide documentation sufficient for District approval, demonstrating that the proposed product complies or surpasses the requirements specified in this Technical Guideline.

PART 2 PRODUCTS

2.01 COPPER BALANCED TWISTED-PAIR

A. Data Category 6A Patch Panels

1. Rack-mount, 48-port patch panel.

2. Equipped with mounting hardware and labeling.

3. 8-position, 8-conductor Jacks with T568B pin/pair assignment.

4. Jacks support minimum of 750 plug insertions.

5. Manufacturer certified and marked to meet or exceed all Category 6A mechanical and performance characteristics.

6. Manufacturer guaranteed for Category 6A channel performance when installed with the same category horizontal cable and patch cords proposed.

7. Shall meet the required performance of the specified category system.

2.02 OPTICAL FIBER

A. Backbone Fiber Termination Shelf

1. Rack-mountable shelf equipped with all brackets and hardware for mounting in universal 483mm (19”) rack.

2. Suitable for termination of single-mode fiber strands.

3. Equipped with duplex LC/APC single-mode adapters with pigtails.

4. Equipped with mounting hardware and labels for each fiber strand.

5. Sized and equipped for termination of fiber strands (ports) as required.

6. Equipped with all retainers, management drums, and routing accessories for holding fiber strands in place and for maintaining the minimum bend radius of the fiber strands.

7. Equipped with front jumper trough for orderly management and protection of fiber patch cords.

8. Provide means to identify circuits for administration and use standard colors in accordance with ANSI/TIA/EIA-606.

9. Shall have a front cover.

10. Labeling shall be integrated either on the fiber enclosure cover or on the fiber adapter panels.

PART 3 EXECUTION

3.01 GENERAL

A. Termination block and patch panel installation (copper and optical fiber) shall be in conformance to ANSI/TIA-568 standards, BICSI methods, industry standards and manufacturer’s instructions and guidelines.

B. Termination blocks and patch panels terminated in areas prior to final cleaning (e.g., painting, carpet installation, where dust may be created) shall be protected to ensure dust, debris, moisture and other foreign materials do not settle onto contacts or optical fiber end-faces.

C. Cables shall be terminated in consistent consecutive order.

D. Provide the quantity of connectors, patch panels, enclosures and inserts to support the necessary quantity of cable pairs and strands plus 10%.

3.02 COPPER BALANCED TWISTED-PAIR

A. Data Category 6A Patch Panels

1. Follow Section 27 15 43 Communications Faceplates and Modular Jacks for terminations.

2. Mount patch panels for horizontal data cables in the equipment racks/cabinets in the MDF and IDFs as shown on the drawings.

3. In the MDF and IDFs terminate all pairs of each horizontal data cable on the patch panel jacks with TIA/EIA T568B pin-pair assignments.

4. Coordinate with District to install patch cables in MDF and IDFs connecting patch panel jacks to network switching equipment provided by District. Install RJ45 Dust Covers in all patch panel jacks that do not have patch cables installed.

5. Do not untwist cable pairs more than 0.5 inches when terminating.

6. Cables shall be supported and loosely tied off by means of a strain relief bar on the back of patch panels.

3.03 FIBER

A. Backbone Fiber Termination Shelf

1. Follow Section 27 13 23 Communications Optical Fiber Backbone Cabling for terminations.

2. Furnish and install LC/APC adapters with pigtails (12-fibers per adapter panel) in each single-mode fiber enclosure.

END

SECTION 271323 – COMMUNICATIONS OPTICAL FIBER BACKBONE CABLE

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies the products and installation of optical fiber backbone cabling systems to support telecommunications and data infrastructure.

B. All optical fiber backbone cabling shall be coordinated with District IT staff and shown on the drawings, including:

1. Inside Plant Fiber Optic Cabling providing communications between Telecommunications Rooms (MDF/IDF) within buildings.

2. Indoor / Outdoor Fiber Optic Cabling providing communications between a building’s MDF and a Modular Classroom IDF.

3. Outside Plant Fiber Optic Cabling providing communications between District datacenters and a District school / facility MDF.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The Contractor shall utilize a single manufacturer brand for optical fiber cable.

B. All components (cable, connectors, etc.) shall exceed the transmission requirements for connecting hardware as specified in the TIA/EIA standards for the Category for which they are rated.

C. Manufacturer shall include the following (no substitutes will be allowed without prior written consent from District):

1. Commscope for Inside Plant Fiber Optic Cable, Commscope for Indoor / Outdoor Fiber Optic Cable, and Corning for Outside Plant Fiber Optic Cable, or equivalent.

a. Singlemode fiber, OS2, 9/125 µm, Compliant with ITU-T G.652.D.

b. Provide documentation sufficient for District approval, demonstrating that the proposed product complies or surpasses the requirements specified in this Technical Guideline.

2.02 FIBER OPTIC BACKBONE CABLE

A. Singlemode Fiber

1. OS2, 9/125 µm.

2. Compliant with ITU-T G.652.D / G.657.A1 to ensure compliance with specifications for both indoor and outdoor installations.

3. Cable shall be listed by a Nationally Recognized Testing Laboratory (NRTL).

B. Inside Plant Cable

1. Specifications

   a. Cable installed in buildings shall be CMP listed, Plenum Rated, per the NEC (Article 800).

   b. Stranded loose tube, gel free.

   c. Maximum Tensile Strength: Short-Term, 2700 N – Long-Term, 800 N

   d. Minimum Bend Radius: Loaded, 14.5 cm – Unloaded, 9.7cm

2. Fiber Strand Counts

   a. 24 fibers with 12 fibers per tube

3. Temperature Range

   a. Installation: -30℃ - 70℃

   b. Operation: -40℃ - 70℃

   c. Storage: -40℃ - 70℃

4. Transmission Performance

   a. Wavelengths (nm): 1310 / 1550

   b. Maximum Attenuation (dB/km): 0.36 dB (1310), 0.22 (1550)

   c. Typical Attenuation (dB/km): 0.33 dB (1310), 0.19 (1550)

C. Indoor / Outdoor Fiber Optic Cable

1. Specifications

   a. Cable installed in buildings shall be CMP listed, Plenum Rated, per the NEC (Article 800).

   b. UV Resistant Jacket

   c. Stranded loose tube, gel free.

   d. Maximum Tensile Strength: Short-Term, 2700 N – Long-Term, 800 N

   e. Minimum Bend Radius: Loaded, 14.5 cm – Unloaded, 9.7cm

2. Fiber Strand Counts

a. 24 fibers with 12 fibers per tube

3. Temperature Range

a. Installation: -30℃ - 70℃

b. Operation: -40℃ - 70℃

c. Storage: -40℃ - 70℃

4. Transmission Performance

a. Wavelengths (nm): 1310 / 1550

b. Maximum Attenuation (dB/km): 0.34 dB (1310), 0.22 (1550)

c. Typical Attenuation (dB/km): 0.33 dB (1310), 0.19 (1550)

D. Outside Plant Cable

1. Specifications

a. Manufactured for outdoor use.

b. Fully waterblocked loose tube, gel-filled.

c. Outer Jacket: Black Polyethylene.

d. Nominal outer diameter of 8.1mm, suitable for microduct installation in Duraline FuturePath 2” conduit with 18/14mm 4-way HDPE

e. Maximum Tensile Strength, Short-Term: 1334 N

f. Minimum Bend Radius: Installation, 164mm – Operation, 123mm

2. Fiber Strand Counts

a. 144 fibers with 12 or 24 fibers per tube

b. 288 fibers with 24 or 36 fibers per tube

3. Temperature Range

a. Installation: -15℃ - 60℃

b. Operation: -40℃ - 70℃

c. Storage: -40℃ - 70℃

4. Transmission Performance

a. Wavelengths (nm): 1310 / 1383 / 1550

b. Maximum Attenuation (dB/km): 0.34 dB (1310), 0.34 dB (1383), 0.22 (1550)

c. Typical Attenuation (dB/km): 0.32 dB (1310), 0.32 dB (1383), 0.18 (1550)

E. Connectors

1. Use factory-terminated LC/APC or SC/APC as specified in the drawings.

2. All connectors shall have insertion loss ≤ 0.3 dB and reflectance ≤ -40dB.

F. Cable lettering (marking) shall indicate the following:

1. Manufacturer name.

2. Performance rating.

3. Sequential length markings.

PART 3 EXECUTION

3.01 GENERAL

A. Cable installation shall be in conformance to ANSI/TIA-568 standards, BICSI methods, industry standards and manufacturer’s installation guidelines.

B. Cable installation shall not exceed the manufacturer’s cable bend radius while under load or no-load conditions.

C. All fiber optic backbone cabling shall be tested in accordance with section 27 08 20 Optical Fiber Testing and Measurements.

D. See Section 27 05 53 Identification for Communications Systems for labeling requirements.

3.02 SPLICING

A. Use fusion splices for all Inside Plant and Outside Plant Fiber Optic Backbone Cable. Splice losses shall not exceed 0.3 dB.

1. Splicing to be performed in a clean, controlled environment to minimize contamination and splice loss.

2. Splicing technicians must be certified and experienced in fusion splicing techniques.

B. Enclosures must be suitable for indoor or outdoor environments as required in the drawings.

3.03 INSIDE PLANT FIBER OPTIC BACKBONE CABLE

A. All fiber optic backbone cable shall have its own support structure. Support continuously (e.g., conduit, cable tray) or a maximum of every 5 feet with j-hooks that are UL-listed for the weight and type of cable being installed. Cable shall not contact suspended ceiling and should be installed such that it is a minimum of 6 inches above any portion of the suspended ceiling. The suspended ceiling nor the suspended ceiling support wire shall be used to support cable.

B. Cable shall be installed in a continuous length between telecommunications rooms, (e.g., MDF to IDFs).

C. Provide at the telecommunications room a minimum of two to three meters of service loop. The service loop length may vary based on the size of the telecommunications room.

D. Cable shall be installed with a minimum separation from EMI sources:

1. 6 inches from power lines enclosed in a grounded metal conduit.

2. 6 inches from fluorescent light fixtures.

3. 48 inches from electrical motors or transformers.

E. Coordinate pathways and installation with all other trades prior to installation.

F. Lubrication shall not be used on cable.

G. The cable shall not be painted for any length. Cable that is painted shall be replaced at no cost to the District project.

3.04 OUTSIDE PLANT FIBER OPTIC BACKBONE CABLE

A. Refer to project drawings for installation specifications for Outside Plant Fiber Optic Cable.

1. Installation specifications will include, but not be limited to, burial depth, fiber installation procedures, permit requirements, splicing requirements, material requirements for conduit, couplers, marker posts, handholes, enclosures, etc.

END

SECTION 271513 – COMMUNICATIONS COPPER HORIZONTAL CABLE

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies the products and installation of category copper horizontal cable.

B. The cable performance (e.g., Category 6A) shall be as specified on drawings.

C. All horizontal data cabling and data outlet locations, including office/instructional data, a/v projectors, building automation systems, security camera, wireless access points, etc. shall be coordinated with District and shown on the drawings.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The Contractor shall utilize a single manufacturer brand for copper horizontal cable.

B. Copper components (cable, connectors, etc.) shall exceed the transmission requirements for connecting hardware as specified in the TIA/EIA standards for the Category for which they are rated.

C. Manufacturer shall include the following (no substitutes will be allowed without prior written consent from District):

1. CommScope, or equivalent – Copper Cable.

a. Provide documentation sufficient for District approval, demonstrating that the proposed product complies or surpasses the requirements specified in this Technical Guideline.

2.02 BALANCED TWISTED-PAIR TELECOMMUNICATIONS CABLE

A. Cable shall be balanced twisted-pair, four-pair, unshielded, with an overall jacket.

B. Cable performance shall meet the performance of ANSI/TIA-568-C.2.

C. Cable shall be listed by a Nationally Recognized Testing Laboratory (NRTL).

D. Cable installed in buildings shall be CMP listed per the NEC (Article 800).

E. Un-listed cable shall only be permitted for entrance to a building and be limited to 50 feet (see NEC Article 800).

F. Cable sheath shall be blue with white or black lettering. The lettering (marking) shall indicate the following:

1. Manufacturer name.

2. Pair count.

3. American Wire Gauge (AWG).

4. Listing.

5. Performance rating (e.g., Category 6A).

6. Sequential length markings, in one-foot increments.

PART 3 EXECUTION

3.01 GENERAL

A. Copper horizontal cable shall have its own support structure. Support all horizontal cable continuously (e.g., conduit, cable tray) or a maximum of every 5 feet with j-hooks. Cable shall not contact suspended ceiling and should be installed such that it is a minimum of 6 inches above any portion of the suspended ceiling. The suspended ceiling nor the suspended ceiling support wire shall be used to support cable.

B. Cable shall be installed in a continuous length from communications room to outlet.

C. The maximum installed cable length (physical length) shall be 95 meters including service loops.

D. Cable installation shall be in conformance to ANSI/TIA-568 standards, BICSI methods, industry standards and manufacturer’s installation guidelines.

E. Cable installation shall not exceed 25 lb. pulling tension.

F. Do not splice or bridge tap the horizontal cable.

G. Cable installation shall not exceed a cable bend radius of 4-times the cable diameter while under load or no-load conditions.

H. Provide at the telecommunications room a minimum of two to three meters of service loop.

I. A minimum of a two-to-three-meter service loop shall be neatly coiled in the ceiling space above the outlet for each horizontal data cable. Service loops shall be 12 to 18 inches in diameter.

J. Modular furniture cables shall terminate on the wall behind the modular furniture and shall have a minimum of 2-3 meters of cable for service loop above the drop location. Service loops shall be 12 to 18 inches in diameter.

K. Cable shall be installed with a minimum separation from EMI sources:

1. 6 inches from power lines enclosed in a grounded metal conduit.

2. 6 inches from fluorescent light fixtures.

3. 48 inches from electrical motors or transformers.

L. Coordinate pathways and installation with all other trades prior to installation.

M. Lubrication shall not be used on cable.

N. The cable shall not be painted for any length. Cable that is painted shall be replaced at no cost to the District project.

O. All copper horizontal cabling shall be tested in accordance with section 27 08 20 Copper Testing.

END

SECTION 271543 – COMMUNICATIONS FACEPLATES AND MODULAR JACKS

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies the products and installation of communications faceplates and modular jacks.

B. The product performance (e.g., Category 6A) shall be as specified on drawings.

PART 2 PRODUCTS

2.01 GENERAL

A. Faceplates and modular jacks shall be by the same manufacturer except as noted on drawings and this specification.

B. Manufacturer shall include the following (no substitutes will be allowed without prior written consent from District):

1. CommScope, or equivalent – Faceplates and Modular Jacks.

a. Provide documentation sufficient for District approval, demonstrating that the proposed product complies or surpasses the requirements specified in this Technical Guideline.

2.02 FACEPLATE

A. Typical work-area outlets:

1. Single-Gang Faceplate.

a. Color and material shall meet requirements for environment and match electrical faceplates.

b. Shall have a recessed label field with high impact thermo-plastic cover.

2. Double-Gang Faceplate.

a. Color and material shall meet requirements for environment and match electrical faceplates.

b. Shall have a recessed label field with high impact thermo-plastic cover.

B. Above-ceiling outlets for wireless access points, security cameras, building automation systems, etc.:

1. Single-UTP Jack.

2. May include multiple jacks as indicated on drawings.

3. Space for adhesive label on each jack.

4. Plenum rated.

5. Place black label with white text on ceiling grid frame at location below Jack(s) location as specified in Section 27 05 53, Identification for Communications Systems.

6. Mount/connection to structure above ceiling as indicated on the drawings.

2.03 MODULAR JACK (INCLUDING SURFACE-MOUNT)

A. Category 6A Modular Jacks as indicated in the drawings.

1. Performance shall meet that of ANSI/TIA-568-C.2.

2. Color and material shall meet requirements indicated on drawings. Contractor shall confirm color prior to ordering modular jacks.

a. Typical Data Jack: Orange Color.

3. 8-position, 8-conductor Jacks with T568B pin/pair assignment.

4. Jacks support minimum of 750 plug insertions.

5. Fit in 24-port or 48-port patch panels specified for the project.

6. Manufacturer certified and marked to meet or exceed all 6A mechanical and performance characteristics.

7. Manufacturer guaranteed for Category 6A channel performance.

PART 3 EXECUTION

3.01 GENERAL

A. Follow all manufacturers’ instructions.

B. Faceplates and modular jack installation shall be in conformance to ANSI/TIA-568 standards, BICSI methods, industry standards and manufacturer’s guidelines.

C. Coordinate with all other trades prior to pre-construction submittals and installation.

3.02 FACEPLATE

A. Faceplates shall be installed straight and plumb in all directions.

B. Faceplates shall be installed with screws.

C. Should the faceplate not cover the entirety of the outlet box hole in the wall due to overcutting or rough workmanship, the wall shall be appropriately patched and painted for a neat and clean finished appearance.

D. Fill all module openings with blank modules.

3.03 MODULAR JACK (INCLUDING SURFACE-MOUNT)

A. All category modular jacks shall be terminated using the T568B termination scheme specified in ANSI/TIA-568-C.0.

B. Modular jacks terminated in areas prior to final cleaning (e.g., painting, carpet installation, dusty areas) shall be placed in a protective envelope to ensure dust, debris, moisture and other foreign materials do not settle onto modular jack contacts. Once final cleaning is complete, modular jacks shall be inserted into faceplates and screwed into place.

C. Pair-twist shall be maintained up to the point of termination.

D. Cable sheath shall be maintained up to within 0.5 inches of the modular jack termination.

END

SECTION 271619 – COMMUNICATIONS PATCH CORDS AND STATION CORDS

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies telecommunications patch cords (for use in telecommunications rooms) and station cords (for use at work area outlets).

1. Contractor shall supply a cable deployment record (spreadsheet) for all backbone and horizontal cabling links, which shall identify the cable type, the station identification of each cable, and the telecommunications room termination based on a template provided by the District.

a. The Contractor shall supply station cords for 100% of the installed work area outlet modular jacks that match the cabling performance (e.g., Category 6A, OM4, OS2).

b. The Contractor shall supply patch cords for 100% of the installed modular jack ports in all contract-installed patch panels or modules (e.g., balanced twisted-pair and optical fiber) that match the cabling performance (e.g., Category 6A, OM4, OS2).

2. The cable deployment record spreadsheet shall be maintained throughout construction and updated at a minimum of every two weeks during the project. The completed spreadsheet shall be delivered at a minimum of three (3) weeks prior to substantial completion. The District will provide an updated list of the type, quantity, color, and length of patch cords upon receipt of the completed spreadsheet.

PART 2 PRODUCTS

2.01 GENERAL

A. The manufacturer shall provide documentation, such as warranty certificates or compliance statements, confirming the product meets all conditions for the Manufacturer’s Warranty.

B. Product shall adhere to matching the environment to which they are installed (e.g., plenum-rated cords for plenum spaces).

C. Manufacturer shall include the following (no substitutes will be allowed without prior written consent from District):

1. CommScope, or equivalent – Copper Patch Cords.

a. Provide documentation sufficient for District approval, demonstrating that the proposed product complies or surpasses the requirements specified in this Technical Guideline.

2.02 COPPER PATCH CORDS FOR USE IN MDF AND IDF’S

A. Patch cords shall be four-pair, unshielded, balanced twisted-pair enveloped within a single jacket with factory-terminated RJ-45 plug-modules on each end and shall match the cabling performance (e.g., Category 6A).

B. Patch cords shall be a minimum of 24 AWG.

C. Cords shall meet the highest performance component of the cabling link (see ANSI/TIA-568-C.2).

D. The cord cable pairs shall meet the color code specified in ANSI/TIA-568-C.2 and ANSI/TIA-568-C.0.

E. The cord cable pairs shall be terminated to match the T568B wiring description in ANSI/TIA-568-C.0.

F. Length

1. Patch cord lengths and quantity to be provided by District upon receipt of Cable Deployment Record Spreadsheet.

2. Typical patch cord lengths will be one (1) foot in length but may also include a combination of five (5) foot and seven (7) foot lengths.

G. Color

1. Patch cord colors and quantity to be provided by District upon receipt of Cable Deployment Record Spreadsheet.

2. Typical patch cord colors will include the following:

a. Blue – Data jack ports including typical data station cables, A/V Projectors, and VoIP telephones.

b. Yellow – Security Cameras.

c. Purple – Wireless Access Points.

d. Black – Building Automation Systems (i.e., HVAC, irrigation, etc.).

e. White – Intercom Systems & IP Endpoints.

f. Orange – UPS Systems.

g. Red – Fire Alarm Systems.

2.03 COPPER PATCH CORDS FOR USE AT WORK AREA / STATION OUTLETS

A. Cords shall be four-pair, unshielded, balanced twisted-pair enveloped within a single jacket with factory-terminated RJ-45 plug-modules on each end and shall match the cabling performance (e.g., Category 6A).

B. Patch cords shall be a minimum of 24 AWG.

C. Cords shall meet the highest performance component of the cabling link (see ANSI/TIA-568-C.2).

D. The cord cable pairs shall meet the color code specified in ANSI/TIA-568-C.2 and ANSI/TIA-568-C.0.

E. The cord cable pairs shall be terminated to match the T568B wiring description in ANSI/TIA-568-C.0.

F. Length

1. Patch cord lengths and quantity to be provided by District upon receipt of Cable Deployment Record Spreadsheet.

2. Typical patch cord lengths will be ten (10) foot in length.

G. Color

1. Patch cord colors and quantity to be provided by District upon receipt of Cable Deployment Record Spreadsheet.

2. Typical patch cord colors will include the following:

a. Blue – Data jack ports including typical data station cables, A/V Projectors, and VoIP telephones.

b. Yellow – Security Cameras.

c. Purple – Wireless Access Points.

d. Black – Building Automation Systems (i.e., HVAC, irrigation, etc.).

e. White – Intercom Systems & IP Endpoints.

f. Orange – UPS Systems.

g. Red – Fire Alarm Systems.

2.04 FIBER OPTIC PATCH CORDS

A. Fiber Type

1. Single-mode fiber, compliant with ITU-T G.652.D standards.

2. Core diameter: 8.3 to 10 microns.

B. Connector Type

1. MDF to IDF Backbone: Duplex LC/APC to LC/APC.

2. MDF to Network Switch Equipment and IDF to Network Switch Equipment: Duplex LC/APC to LC/UPC.

C. Cable Jacket

1. Material: OFNR (riser-rated).

2. Outer Diameter: 2.0mm or 3.0mm nominal.

3. Jacket Color: Yellow for single-mode.

D. Performance Criteria

1. Insertion Loss: ≤ 0.3 dB per mated pair.

2. Return Loss: ≥ 55 dB for UPC and ≥ 65 dB for APC.

3. Operating Temperature: -40ºC to +75ºC.

4. Bend Radius: Minimum of 10 times the cable diameter under load.

E. Lengths

1. Coordinate with District IT staff for quantity and length.

PART 3 EXECUTION

3.01 GENERAL

A. Provide patch cords in advance of Substantial Completion.

B. IT Representative shall be notified of patch cord and wire delivery.

3.02 COPPER PATCH CORDS FOR USE IN MDF / IDF’S

A. Patch cords shall be distributed among telecommunications rooms and Contractor will coordinate with District to perform patching to District’s network switches.

1. Using the Cable Deployment Record spreadsheet provided by the Contractor, District will provide a patching list to the Contractor, including patch panel number, network switch port number, patch cable length, and patch cable color.

3.03 COPPER STATION CORDS (FOR USE AT WORK AREA OUTLETS)

A. Patch cords shall be distributed among telecommunications rooms according to the number of work area outlet ports fed by the MDF / IDFs.

B. Each box of patch cords shall be marked to identify the included length and as being for work area outlet use.

C. fiber optic patch cords

D. Single-mode

1. Patch cords shall be distributed among telecommunications rooms according to the number of patch panel ports in the telecommunications room or equipment room.

2. Each box of patch cords shall be marked to identify the use as being for patch panel use.

END