

SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 REFERENCES

- A. Division 26 Basic Electrical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

- A. This section describes the codes, standards, specifications, recommendations, and practices required for construction at The University of Colorado Denver | Anschutz Medical Campus for the Office of Information Technology (OIT) department. This document applies to all construction and renovation projects at the university as well as all installations including low-voltage cabling.
- B. The project general contractor (GC) is responsible for building telecommunications pathways and spaces as per the requirements described in this document. The project GC shall provide these specific items: spaces (telecommunications rooms, telecommunications entrance faculty, and equipment rooms), pathways (riser and horizontal distribution), grounding system, and fire suppression systems, as described below.
- C. The OIT department is responsible for coordinating the provisioning of low voltage cabling, data networking, and voice equipment.
- D. Coordinate project schedule, installation schedule, phasing and any other requirements deemed necessary with Construction Manager and/or General Contractor and all necessary trades to ensure successful completion of work.
- E. Phasing, temporary distribution/equipment, cutover and implementation shall be coordinated with the university and the Office of Information Technology (OIT), Construction Manager and/or General Contractor, Architect, and Engineer.

1.3 TELECOMMUNICATION (T) DRAWINGS

- A. Telecommunication Construction Drawings Specifications (T-drawings):
 - 1. Symbol Legend, Abbreviations, and Description: Provide drawings including descriptions of all abbreviations, symbols, typical mounting heights, project information, etc.
 - 2. One-Line Wiring Diagrams: Include one-line wiring diagrams indicating all backbone, copper pair and fiber strand counts, cable quantities, splice enclosures, etc.
 - 3. Site Plan: Provide complete site and exterior plans indicating all site and building façade mounted communication device outlets, equipment, and components proposed to be installed.
 - a. Additionally, manholes, pull-boxes, and all major raceway routing shall be indicated for conduits 2-inches and larger.
 - b. Site drawings shall represent final conduit routing and manhole and/or pull-box placement as coordinated and/or confirmed with Service Provider, Civil Engineer and other trades.
 - 4. Floor Plans: Indicating all communication device outlets, equipment, and components proposed to be installed. Floor plans shall indicate cable routing origin and labeling scheme for each cable and termination position.
 - a. Additionally, Electrical Construction Drawings shall indicate major raceway routing for cable trays and conduits 2-inches and larger, based on final coordination with all other trades.
 - b. Electrical Construction drawings shall clearly indicate areas with cable tray clearance limitations and/or other cable access limitations for review and approval by the university, Architect, and Engineer.

5. Enlarged Plans: Provide ¼" = 1'-0" enlarged plans of all Telecommunication, indicating the position of equipment cabinets, racks, wiring terminals, patch panels, grounding equipment, cable tray, fiber and copper terminations, and other low voltage systems equipment layout within the rooms. Additionally, T-drawings shall clearly indicate final conduit/riser (core drill and/or block-out) locations and sizes as coordinated and/or confirmed with Structural Engineer and any field conditions that impact proposed location. T-drawings shall clearly indicate areas where equipment clearances may be limited, for review and approval by the Office of Information Technology.
 6. Elevation Drawings:
 - a. Rack elevations indicating patch panels, fiber terminals and enclosures, vertical and horizontal cable managers, rack mounted power strips or distribution units, etc.
 - b. Wall elevations of distribution frame with block size, cable routing, cable management, pair counts, method of attachment, etc.
 7. Drawing Scale: T-drawings shall be drawn to scale and completely dimensioned as to clearly show construction detail.
- B. Planning Deliverables: To facilitate provisioning of telecommunications services, the architect/engineer shall provide OIT with drawings (as specified above) for new building construction and major renovation projects (greater than 10,000 sq. ft.) during design and at construction. CAD drawings of the Electrical/Communications plans and Telecommunications plans shall be provided to OIT upon release of construction documents through the university project manager.
1. At Schematic Drawing
 - OSP plans for connecting the building to the CU Denver | Anschutz Medical Campus Outside Plant conduit infrastructure for low-voltage cable.
 2. At Design Development Phase
 - OSP plans for connecting the building to the CU Denver | Anschutz Medical Campus Outside Plant conduit infrastructure for low-voltage cable.
 - Placement of Telecommunication Room (s) including size and position.
 3. At 50% Construction Drawing Phase
 - OSP plans for connecting the building to the CU Denver | Anschutz Medical Campus Outside Plant conduit infrastructure for low-voltage cable.
 - Telecommunication Room (s) including, size and location within the building
 - Detailed T-drawings, Vertical line drawings of telecommunications grounding and bonding work which indicate layout of ground rods, location of system grounding electrode connections, routing of grounding electrode conductors, and circuits and equipment grounding connections.
 - Detailed T-drawings of Telecommunication Room (s) including top-down view of rack arrangements, electrical outlet placement
 - Detailed T-drawings, Vertical line drawings of backbone cabling plans, cable composition, and placement
 - Detailed T-drawings, Initial plans for horizontal cable outlet positions on floorplans
 4. At 100% Construction Drawing Phase
 - OSP plans for connecting the building to the CU Denver | Anschutz Medical Campus Outside Plant conduit infrastructure for low-voltage cable.
 - Placement of Telecommunication Room (s) including size and position
 - Detailed T-drawings of Telecommunication Room (s) including top-down view of rack arrangements, electrical outlet placement, and rack elevation drawings of all racks
 - Detailed T-drawings, Vertical line drawings of backbone cabling plans, cable composition, and placement
 - Detailed T-drawings, Final plans for horizontal cable outlet positions on floorplans

5. The project's technology consultant shall meet with the building's projected occupants, OIT, and other interested parties to determine the information technology requirements of the occupants. Compliance with overall campus telecommunications plans will also be validated during these meetings. The technology consultant shall submit all findings to OIT for review and approval.

C. Closeout Deliverables: To facilitate operational support of OIT facilities, a number of documents will be required of at the end of a project. These documents to University Project Manager and are part of the final closeout requirements of project.

1. Fiber Optic Backbone Cable Installation
 - Attenuation reading for all strands, measured from both directions, with both applicable wavelengths as per TIA 568-C
 - Cable record including a minimum of cable name, strand count and type, termination type
2. Horizontal UTP Cable Installation
 - Test results for each individual cable, tested as per TIA 568-C and appropriate Category requirements
 - Horizontal cable record including cable name, cable type, building/floor/room of the remote termination point, as well as a comments field (see Appendix II, diagram #3)
 - As-built drawings for construction/renovation projects, and proper updates to CU maintained as-builds for individual cable installations contracted by CU.
3. Telecommunication Room
 - A laminated construction drawing printout to be affixed to the side of the wall of the Telecommunications room (TR) detailing the floor plan and locations of work area outlets. Include updates to existing drawing as appropriate. Consult with the Office of Information Technology for the following.

D. Workmanship. All materials and equipment shall be installed in accordance with recommendations of the manufacturer as approved by the architect, to conform to initial design requirements or specifications and contract documents.

1.4 SUBMITTALS

A. General Description and Requirements

1. In addition to the requirements noted herein, refer to Division 1 Specification for additional requirements. As a minimum, Contractor shall ensure all requirements listed here are met.
2. Submittals shall include all materials and component product data.
3. Submittals shall include shop drawings for project coordination and installation.

B. Prefabrication Shop Drawings:

1. Symbol Legend, Abbreviations, and Description: Provide drawings including descriptions of all abbreviations, symbols, typical mounting heights, project information, etc.
2. One-Line Wiring Diagrams: Include one-line wiring diagrams indicating all backbone and horizontal cabling, copper pair and fiber strand counts, cable quantities, splice enclosures, etc
3. Site Plan: Provide complete site and exterior plans indicating all site and building façade mounted communication device outlets, equipment, and components proposed to be installed. Additionally, manholes, pull-boxes, and all major raceway routing shall be indicated for conduits 2-inches and larger. Shop drawings shall represent final conduit routing and manhole and/or pull-box placement as coordinated and/or confirmed with Service Provider, Civil Engineer and other trades.
4. Floor Plans: Indicating all communication device outlets, equipment, and components proposed to be installed. Floor plans shall indicate cable routing origin and labeling scheme for each cable and termination position. Additionally, major raceway routing shall be indicated for cable trays and conduits 2-inches and larger, based on final coordination with all other trades. Shop drawings shall clearly indicate areas with cable tray clearance limitations and/or other cable access limitations for review and approval by the university, Architect, and Engineer.

5. Enlarged Plans: Provide ¼" = 1'-0" enlarged plans of all communication rooms including Telecommunications Entrance Facilities (TEF), Telecommunications Rooms (TR), and Equipment Rooms (ER), indicating the position of equipment cabinets, racks, wiring terminals, patch panels, grounding equipment, cable tray, fiber and copper terminations, and other low voltage systems equipment layout within the rooms. Additionally, shop drawings shall clearly indicate final conduit/riser (core drill and/or block-out) locations and sizes as coordinated and/or confirmed with Structural Engineer and any field conditions that impact proposed location. Shop drawings shall clearly indicate areas where equipment clearances may be limited, for review and approval by the university, Architect, and Engineer.
6. Details: Including method of attachment of racks to the floor and ladder tray systems, method of attachment of wall mounted distribution frames, grounding details indicating grounding method for cabinets, racks, cable tray, cable management, and power details for rack mounted power distribution.
7. Elevations:
 - a. Rack elevations indicating patch panels, fiber terminals and enclosures, vertical and horizontal cable managers, rack mounted power strips or distribution units, etc.
 - b. Wall elevations of distribution frame with block size, cable routing, cable management, pair counts, method of attachment, etc.
8. Drawing Scale: Shop drawings shall be drawn to scale and completely dimensioned as to clearly show construction detail.
9. Documentation: Provide a minimum of (1) hardcopy set of prints (in addition to electronic copies) for review or as indicated in Division-1 general conditions.

1.5 QUALITY ASSURANCE AND APPLICABLE STANDARDS

- A. Applicable Codes, Standards, and Specifications: The following list of codes, standards, specifications, recommendations, and methods and procedures (M&P) are applicable to the provisioning of telecommunications services for The University. They are incorporated by reference.
 1. ANSI/EIA/TIA-526: Standard Test Procedures for Fiber Optic Systems.
 2. ANSI/EIA/TIA-568-C.0: Generic Communications Cabling for Customer Premises.
 3. ANSI/EIA/TIA-568-C.1: Commercial Building Communications Cabling Standards, Part 1: General Requirements.
 4. ANSI/EIA/TIA-568-C.2: Balanced Twisted-Pair Communications Cabling and Components Standard.
 5. ANSI/EIA/TIA-568-C.3: Optical Fiber Cabling Components Standard.
 6. ANSI/EIA/TIA-569-E: Commercial Building Standard for Telecommunications Pathways and Spaces.
 7. ANSI/EIA/TIA-606-C: Administrative Standard for Commercial Telecommunications.
 8. ANSI/J-STD-607-C: Commercial Building Grounding and Bonding Requirements for Communications.
 9. TIA-758-B: Customer-Owned Outside Plant Communications Cabling Standard.
 10. ANSI/TIA-942: Telecommunications Infrastructure Standard for Data Centers.
 11. ASTM: American Society for Testing and Materials
 12. BICSI CO-OSP Design Manual (current edition): Customer-Owned Outside-Plant Design Manual.
 13. BICSI Electronic Safety and Security (ESS) Design Reference Manual (current edition).
 14. BICSI Network Design Reference Manual (current edition).
 15. BICSI TDM Telecommunications Distribution Methods Manual (current edition).
 16. BICSI Wireless Design Reference Manual (current).
 17. EIA/TIA TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling.
 18. ICEA: Insulated Cable Engineers Association
 19. ISO/IEC 11801: International Standard on Information Technology – Generic Cabling of Customer Premises.
 20. NESC: National Electrical Safety Code
 21. NEMA Stds Pub No. VE 1, Cable Tray Systems. Additionally, comply with current edition of NEC, as applicable to construction and installation of cable tray systems.

22. NEMA Std 250: Enclosures for Electrical Equipment (1000 Volts Maximum).
23. NFPA-70/NEC: National Electrical Code.
24. NFPA-72: National Fire Alarm and Signaling Code
25. UL Compliance: Provide products which are UL-listed and labeled.

B. Manufacturer and Product Qualifications

1. Provide products from manufacturers regularly engaged in the production of communications infrastructure components, including but not limited to, raceway, horizontal copper cabling, copper and fiber optic backbone cabling, and connecting hardware.
2. Provide products from manufacturers whose products of similar types, capacities, and characteristics have been in satisfactory use in similar type projects for not less than five years.
3. A list of approved low-voltage connectivity product manufacturers can be found below:
 - a. Commscope, www.commscope.com
4. A list of approved low-voltage UTP cabling manufacturers can be found below:
 - a. Commscope, www.commscope.com
 - b. Leviton, www.leviton.com
 - c. Berk-Tek, www.berk-tek.com
 - d. Belden, www.belden.com
5. A list of approved low-voltage fiber optic cabling manufacturers can be found below:
 - a. Commscope, www.commscope.com
 - b. Leviton, www.leviton.com
 - c. Corning, www.corning.com
 - d. OCC, www.occ.com
6. A list of approved blue light emergency phone manufacturers can be found below:
 - a. Talk-A-Phone, www.talkaphon.com

C. Contractor Qualifications:

1. Firms with at least seven (7) years of successful installation experience with projects utilizing communications, raceway and/or equipment similar to that required for this project.
2. The company shall have a fully staffed office with technical installations support personnel within the metropolitan area. (Exceptions to this shall be confirmed through approval by the university, Architect, and Engineer.)
3. The Low Voltage Cabling Contractor shall be a certified installer (current and in good standing with proven history) of the selected manufacturer's raceway systems.
4. For qualification purposes, having an RCDD on staff is preferred.
5. A list of pre-approved Low Voltage Contractors can be found below:
 - a. Gigaspan: Jon Getz jon.getz@gigaspan.com
 - b. National Network Services: Chris Lesser, chris.lesser@nnsi.net
 - c. Sturgeon Electric: Todd Frank, tfrank@myrgroup.com
 - d. Trulink LLC: Michael Landford, Michael.Lanford@trulinkllc.com

D. Low Voltage Designer Qualifications:

1. Firms with at least seven (7) years of successful design experience with projects utilizing communications, raceway and/or equipment similar to that required for this project.
2. The company shall have a fully staffed office with design support personnel within the metropolitan area. (Exceptions to this shall be confirmed through approval by the university, Architect, and Engineer.)
3. For qualification purposes, having an RCDD on staff is required.
4. All Low Voltage Design teams must be approved by OIT, unless already pre-approved. OIT reserves to right to reject any design team.

1.6 DEFINITIONS

- A. **Telecommunications.** Any transmission, emission, or reception of signs, signals, writings, images, and sounds, or information of any nature by wire, radio, visual, or other electromagnetic systems. Includes,

but is not limited to, voice communications networks, Local Area Networks (LAN), Wide Area Networks (WAN), and Local Exchange Carriers (LEC).

- B. **Telecommunications Room (TR).** A floor serving facility for housing telecommunications equipment, cable terminations, cross-connections, and network electronics. The TR is the recognized transition point between the building backbone and the horizontal pathway facilities.
 - C. **Equipment Room (ER).** A campus serving space. An ER houses primary system electronics, power, and media distribution for a campus or groups of buildings. The Communications Center in Building 500 is an example of a campus serving ER. ERs require extensive planning due to their size, nature, scope, and complexity. ERs are not typically required for most projects.
 - D. **Telecommunications Entrance Facility (TEF).** Serves as the entry point into a building for the campus backbone media. TEFs interconnect the building backbone to campus backbone. The TEF is where conductive copper media receives its primary protection from sustained hazardous voltages. Therefore, significant wall space in the TEF may be required for primary protection of copper circuits. Also called the Service Entrance (SE).
 - E. **Telecommunications Main Grounding Busbar (TMGB).** The building's main telecommunications grounding point. The TMGB is busbar placed in the TEF, ER, or a selected TR to provide interconnection to the building's power ground via a bonding conductor for telecommunications.
 - F. **Telecommunications Grounding Busbar (TGB).** A common point of connection for telecommunications systems and equipment for bonding to ground. TGBs are required in all TRs and ERs.
 - G. **Telecommunications Bonding Backbone (TBB).** A conductor that electrically interconnects the TMGB to all TGBs.
 - H. **Grounding Equalizer (GE).** A conductor used to interconnect two or more vertical TBBs in multistory buildings. Previously called a Telecommunications Bonding Backbone Interconnecting Bonding Conductor (TBBIBC).
 - I. **Network.** Backbone media and electronics for transport of electronic information between campus entities.
 - J. **Horizontal Distribution.** The facility used for installation of media from the TR to the work area. Usually consists of cable tray and J-hooks to the work area faceplate.
 - K. **Work Area (WA).** A building space where the occupant generally interacts with the telecommunications equipment. WAs are typically defined as 100 ft² of usable space.
 - L. **Building backbone.** The pathways between floors for distribution of media. Building backbone was previously called riser cabling.
 - M. **Campus backbone.** The pathways and media that provide connectivity between the Communication Center in Building 500 and all other buildings on the Anschutz Medical Campus (AMC). The campus backbone provides connectivity between buildings. The campus backbone represents the outside plant (OSP) infrastructure.
- 1.7 SEQUENCING AND SCHEDULING
- A. Coordinate installation with Structural, Electrical, HVAC, Plumbing, Fire Protection, and other trades to eliminate disruption and/or conflict with other systems.

- B. Sequence installation of communications systems and infrastructure with other work to minimize possibility of damage and soiling during remainder of construction.

1.8 PROJECT SITE CONDITIONS

- A. Prior to submitting a proposal, the Contractor shall inspect the Contract Documents, and shall become fully informed as to laws, ordinances, and regulations affecting the project. The Contractor shall immediately bring to the university, Architect, and Engineer's attention, in writing, any existing condition or statute that contradicts, is in conflict with, or negates the Contract Documents. Failure of the Contractor to become fully informed as to all above mentioned items shall in no way relieve the Contractor from any obligations with respect to their proposal.
- B. The Technology Drawings depict equipment locations, backboxes, conduit runs, cabling, etc. in a schematic manner. Field conditions and coordination with related trades may warrant relocations of field devices. No additional compensation will be allowed due to these revisions.

PART 2 - PRODUCTS

2.1 Refer to the following specification sections for additional requirements:

- A. 26 05 26 – Telecommunications Grounding and Bonding
- B. 27 05 28 – Pathways for Communication Systems

PART 3 - EXECUTION

3.1 GENERAL COMMUNICATIONS RACEWAY

- A. All communications raceway infrastructure shall be installed in an aesthetically pleasing fashion. All surface raceway in new buildings must be approved by the university, Architect, and/or Engineer.
- B. Construction within communication rooms must be substantially complete before the installation of telecommunications cabling. This includes, but is not limited to, the installation of plywood backboard, cable tray or ladder rack, electrical outlets, light fixtures, sprinklers and ductwork.

PART 4 - CHANGE LOG

1/18/2024 Multiple updates throughout the standard.

7/9/2021 Major Standard Update.

END OF SECTION 27 05 00