

SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 REFERENCES

- A. General provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections.
- B. Architectural, Electrical, and Technology Drawings. Other systems drawings may apply. Division 26 Basic Electrical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

- A. The term “provide” used throughout this specification and drawings shall mean “furnish, install, test, and certify”.
- B. 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.
- C. Phasing, temporary distribution/equipment, cut-over and implementation shall be coordinated with the university and the Office of Information Technology (OIT), Construction Manager and/or General Contractor, Architect, and Engineer.
- D. Extent of communications raceway infrastructure work is indicated by Division 27 specifications and Technology drawings and schedules and is hereby defined to include, but not by way of limitation, the provisions of:
 - 1. Raceway systems including but not limited to conduits, cable trays, sleeves, surface raceways, telecommunication services entrance, manholes, pull-boxes, junction boxes, back-boxes, etc. as required and specified in Division 27 sections and select Division 26 sections. The Construction Manager and/or General Contractor shall coordinate this with the Sub-Contractor performing work and determine how scope of work is assigned. The purpose of this specification is to establish design intent and general system scope.
 - 2. All communications raceway infrastructure (i.e. pathways and spaces) shall be provided as part of the Base Building Project including.
 - 3. Communication room hardware and component fit-out including cable tray, backboard, and raceways.
 - 4. Grounding and bonding of all metallic hardware components to the nearest telecommunications grounding bus (TGB) bar including but not limited to equipment racks, cabinets, cable trays, ladder rack, conduits, sleeves, metallic ductwork, and frames.
 - 5. Fire stopping as required. Contractor shall provide fire stopping for all low-voltage openings (including empty low voltage raceway) once cable installation is complete. Confirm specific fire stopping scope requirements with General Contractor and/or Construction Manager.
 - 6. Testing of the grounding systems as noted by specification, drawings, and applicable industry standards. Submit written testing results to OIT.
 - 7. Labeling of all communication infrastructure components with mechanically printed labels.
 - 8. Preparation and submission of product data, shop drawings, testing reports, as-built drawings, and cabling documentation as required in this specification.
 - 9. Construction and Installation warranties.
 - 10. Manufacturer components, channel and solutions warranties.
 - 11. Installation and testing of all system and components.
 - 12. Onsite administrative and user training.
 - 13. Manufacturer training of components.

1.3 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. Within 45 days after award of contract or as dictated by the construction schedule (whichever period of time is shorter), the Contractor shall submit prefabrication submittals consisting of product data and shop drawings for approval. Partial submittals will not be accepted without prior written approval from the Architect.
3. Review of the Prefabrication Submittals by the Architect is for purposes of tracking the work and contract administration and does not relieve the Contractor of responsibility for any deviation from the Contract Documents, or from providing equipment and/or services required by the Contract Documents which were omitted from the prefabrication submittals.
4. No portion of the project shall commence nor shall any equipment be procured until the prefabrication submittals have been approved in writing by the Architect. All installations shall be in accordance with the Contract Documents.
5. A detailed completion schedule shall be submitted with the prefabrication submittals.
6. Prefabrication submittals shall be accompanied by a letter of transmittal identifying the name of the project, Contractor's name, date submitted for review, and a list of items transmitted.

B. Product Data:

1. Compliance Matrix: Provide full specification compliance matrix as described in the Specification Response section of this specification section.
2. Warranty Information: Provide all warranty information as described in this specification section for review and approval.
3. Component List: Provide complete submittal component list at the beginning of the submittal package. Component list shall identify each component name, manufacturer, and specific product/part number. All part numbers shall clearly indicate special options, color, accessories, etc. Component list and manufacturer cut-sheets shall be compiled to match the order of each Appendix.
4. Cut-Sheets: Submit manufacturer's cut-sheets on all components listed within this specification and corresponding appendix. All components and parts being used shall be highlighted in color on cut-sheets to distinguish specific product/part numbers, options, colors, accessories, etc.
5. Product Substitutions: This specification is intended to be performance based, thus all products listed in Appendix 1: Equipment Schedule are benchmark products. The Contractor shall include the listed benchmark product lines in the initial bid as the "base" solution, unless noted otherwise. The Contractor may submit (as a proposed "alternate" solution) substitute manufacturers and models that may be more cost effective or readily available. All substitutions shall meet or exceed the minimum functional, physical, and technical specifications. Acceptance of such substitutions is at the discretion of the university, Architect, and Engineer. Additionally, the requirements of Division 1 Specifications shall apply and may supersede requirements noted herein.

C. 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 1/4" = 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. Labeling: Provide documentation of all labeling schemes for conduit, back-boxes, cables, outlets, wiring blocks and/or patch panels, device faceplates, etc.
 10. 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.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: All materials and installations shall comply with current applicable codes and standards, including but not limited to:
 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-A: Commercial Building Standard for Telecommunications Pathways and Spaces.
 7. ANSI/EIA/TIA-606-A: Administrative Standard for Commercial Telecommunications.
 8. ANSI/J-STD-607-A: Commercial Building Grounding and Bonding Requirements for Communications.
 9. TIA-758-A: 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. IEEE-802.11 a, g, n, a/c: Wireless Local Area Networks

20. IEEE-802.3: 10 Mb/s, 100 Mb/s, 1 Gb/s, and 10 Gb/s Ethernet Standards as applicable based on media types (twisted pair copper, fiber optics, etc.)
21. IEEE-802.3ak: 10 Gb/s Ethernet (evolving copper standard).
22. IEEE-802.3af: Power-over-Ethernet (PoE).
23. IEEE-1100-1999: Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.
24. IEEE-141: Recommended Practice
25. IEEE-241: Recommended Practice for Electric Power Systems in Commercial Buildings.
26. ISO/IEC 11801: International Standard on Information Technology – Generic Cabling of Customer Premises.
27. NESC: National Electrical Safety Code
28. 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.
29. NEMA Std 250: Enclosures for Electrical Equipment (1000 Volts Maximum).
30. NFPA-70/NEC: National Electrical Code.
31. NFPA-72: National Fire Alarm and Signaling Code
32. UL Compliance: Provide products which are UL-listed and labeled.
33. USDA Bulletin 1751F-643: Underground Plant Design.

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.

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 Raceway Contractor shall be a certified installer (current and in good standing with proven history) of the selected manufacturer's raceway systems and shall provide a 25-year warranty on installation and applications.

D. All materials shall be Underwriters Laboratories (UL) or Intertek Testing Services (ETL) Listed unless otherwise indicated.

E. Coordinate with electrical work and other trades to properly interface installation of communications raceway.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver equipment and components in factory-fabricated containers or wrappings, which properly protect equipment from damage.
- B. Store equipment and components in original packaging. Store inside in a well-ventilated space protected from weather, moisture, soiling, humidity, and extreme temperatures.
- C. Handle equipment and components carefully to prevent damage. Do not install damaged units or components; replace with new.

1.6 SEQUENCING AND SCHEDULING

- A. All work shall be reviewed and coordinated with the Construction Manager and/or General Contractor prior to commencing.
- B. Communication systems, infrastructure, raceway and equipment are sensitive to environmental conditions including but not limited to temperature, dirt, dust, and water. The contractor shall ensure the storage and installation of all communication components are sequenced and scheduled accordingly to prevent any damage, loss of performance, and warranty void of such systems. All mis-installed components shall be replaced with new parts and re-installed at the Contractor's expense.
- C. Coordinate installation with Structural, Electrical, HVAC, Plumbing, Fire Protection, and other trades to eliminate disruption and/or conflict with other systems.
- D. Sequence installation of communications systems and infrastructure with other work to minimize possibility of damage and soiling during remainder of construction.

1.7 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.

1.8 WARRANTY

- A. A one (1) year warranty on the work shall be provided by the Contractor. If, within one (1) year after the date of final acceptance of the installation or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents or provided by a manufacturer, any of the work or equipment is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly including all parts and labor after receipt of notice from the university to do so unless the university has previously given the Contractor a written acceptance of such condition. This obligation shall survive termination of the contract. The university shall give such notice promptly after discovery of the condition. Such notice shall be provided by the university representatives, to be identified, either verbally or in writing.
- B. Nothing contained in the Contract Documents shall be construed to establish a shorter period of limitation with respect to any other obligation which the Contractor might have under the Contract Documents or any manufacturer's warranty. The establishment of the time period noted above, after the date of final acceptance or such longer period of time as may be prescribed by law or by the terms of any warranty required by the Contract Documents, relates only to the specific obligation of the Contractor to correct the work or equipment, and has no relationship to the time within which his obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to his obligations other than specifically to correct the work or equipment.
- C. The university reserves the right to expand or add to the system during the warranty period using firm(s) other than the Contractor for such expansion without affecting the Contractor's responsibilities, provided

that the expansion is done by a firm which is an authorized dealer or agent for the equipment of system being expanded.

1.9 SPECIFICATION RESPONSE

A. Pricing

1. Instructions to Bidders

- a. The following is a partial list of instructions. Bidders are responsible to provide a complete proposal inclusive of all information requested in the Contract Documents.
- b. Do not assume anything. Clarify your position in writing with your bid concerning any areas that may not be clear to you.
- c. Copies of the bid proposal shall be submitted to the university, Architect, and Engineer for review and approval.
- d. Bidders shall prepare equipment lists showing each item included in the bid. Equipment Lists must include the quantity, model number, manufacturer and price of each item listed under the generic description.
- e. Provide a detailed description of any and all voluntary alternates and include cost changes in the Voluntary Alternate Bid forms. Bidders should submit voluntary alternates that will either provide for a better system or reduce costs without degrading the system. This includes alternate manufacturer and product substitution.
- f. In the instance where the Drawings and the Specifications do not directly coincide, or coincide individually, the item of better quality, greater quantity and/or higher cost shall be included in the base bid.

B. Compliance

1. Bidders shall submit a Statement of Qualifications with their bid proposal that shall include the following information:
 - a. Company name, address, telephone number and contact person.
 - b. Brief company history.
 - c. Resumes of key personnel.
 - d. Local staffing description (job descriptions and numbers of persons in each position).
 - e. Local service capabilities (hours of operation and parts availability).
 - f. Technician factory certifications.
 - g. Description of local engineering and project management capabilities.
 - h. Line sheet listing major suppliers of security equipment.
 - i. Annual dollar value of sales, installation and service of each product line carried.
 - j. List of references describing three (3) completed projects of similar size and complexity, including names and telephone numbers of the contact persons.
 - k. List of references describing similar projects completed in the area including names and telephone number of the customer's contact person.
 - l. List of similar projects currently under construction in the area including names and telephone numbers of the customer's contact person.
 - m. Licensing information.
2. Provide a specification compliance matrix indicating compliance or deviation for each item in the specification. The matrix shall be comprised of a list of all numbered paragraphs that appear in this Specification. Indicate compliance of the proposed equipment and/or services by the word "Comply" following each paragraph number. Indicate an exception to the requirement by the word "Exception" following the applicable paragraph number. Should the proposed equipment and/or services not entirely comply with the requirements specified, but ultimately achieve the intent, the Bidder shall explain fully the extent, or lack thereof, of compliance for the applicable equipment and/or services proposed. Instances where there is no indication of compliance or exception shall be considered non-compliant. This matrix is critical for proposal evaluation. Failure to submit may result in the disqualification of the bid. Contractor shall submit Compliance Matrix with the Bid Proposal AND at the time of Product Data submittal (as indicated previously in this specification) so that a complete security system submittal reviewed can be performed.

3. Additionally, as described in this Specification, bidders shall submit the following information with their bid proposal:
 - a. Manufacturer's literature sheets for all standard manufactured items included in the equipment list and as proposed in the Voluntary Alternate Bid form, if applicable.
 - b. Workload and capability statements. The statements shall detail projects that will be active during the completion of this project, and the manpower that would be available for this project.
 - c. Confidentiality and return statements. The statements shall guarantee that the Contract Documents shall not be copied or distributed physically or verbally. The Contractor shall also assure the university that the Contract Documents shall be returned in their entirety upon request. The successful Contractor will be provided with as many copies as requested.
 - d. Copy of manufacturer's certification certificate.
4. Certain paragraphs of the Specification require the Bidder to provide information (possibly not listed above) in the proposal to demonstrate compliance with a requirement. If the Bidder fails to provide detailed responses to these items, the proposal will be deemed to be non-compliant to the paragraphs stated.
5. Number all pages of the bid submittal.

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. Examine areas and conditions under which communications raceway systems are to be installed. Notify the university, Architect, and Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.
- B. The Contractor shall be knowledgeable of work to be performed by other trades and take necessary steps to integrate and coordinate their work with other trades.
- C. The Contractor shall be responsible for furnishing all materials indicated on the drawings or as specified herein for a complete communications raceway system.
- D. 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.
- E. All communications raceway infrastructure shall be installed to allow for easy adds, moves, and other changes in the future.
- F. 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.
- G. Floor to floor distribution shall be provided with concrete floor sleeves or conduits as noted on the drawings, and as required by the Architectural Design.

- H. Provide protective cable bushings on all conduits immediately after installation.
- I. Use only electrical 45° or 90° conduit elbows with long bend radii as follows:
 - 1. 6:1 bend radius of the inside conduit diameter for sizes 2" or less.
 - 2. 10:1 bend radius of the inside conduit diameter for sizes greater than 2".
- J. Do not place more than two 90° sweeps or exceed 100 ft. between pull boxes without providing a pull box.
- K. Fire seal all raceway penetrations and openings to maintain fire rating after communications cables are installed.

3.2 LABELING

- A. All communications components shall be clearly labeled using labeling devices (i.e. hand written labels are not acceptable) with white label and black text. All labels shall be consistent font type and size (for respective components).
- B. The final labeling scheme shall be coordinated with the university, Architect, and Engineer prior to finalizing and initiating any work. A sample scheme shall be submitted for approval.

END OF SECTION 27 05 00