

PART 1 - GENERAL

1.1 SUMMARY

This section of the Telecommunications Construction Guide Specification has references, products, procedures, processes, and work descriptions/summaries that are common to many Washington State University Pullman (WSUP) campus telecommunications projects. This information is provided in specification format to serve as a guide to the Designer in producing a CSI-compliant specification that will meet the unique requirements of WSUP Telecommunications projects. However, this document is not intended to be a Master Specification. The information included in this section is not intended to be all-inclusive for any given project.

The Designer shall edit this section (adding and/or removing content where required) to meet the requirements of a given project.

Prior to publishing the specifications for bid or construction purposes, all edits shall be made using the MS Word Tracking Changes feature. **When submitting the specifications for review at each progress milestone, print the specifications showing the revision markings.**

Text in shaded boxes (such as this text) is included to aid the Designer in understanding areas of this section that may require modification for a particular circumstance. Although this text is generally written in declarative form, the Designer shall consider it guidance only. The Designer shall not assume that the content of this specification section is suitable or sufficient for any given project in its current form, and shall remain responsible for developing a thorough and complete specification that meets the requirements of the project being designed.

- A. Provide all materials and labor for the installation of an inside plant telecommunication system. All materials shall be new, free from defects, of current manufacture, and of the quality specified or shown. Each type of material shall be of the same manufacture throughout the work. This section includes Inside Plant Communications cabling, termination, and administration equipment and installation requirements for the specified Structured Cabling System (SCS) and Television Distribution System.

1.2 SYSTEM DESCRIPTION

Review and edit the following statement(s) for applicability to this project, restricted to describing performance, design requirements and functional tolerances of a complete system.

- A. Furnish, install, test and place into satisfactory and successful operation all equipment, materials, devices, and necessary appurtenances to provide a complete ANSI/TIA/EIA, NECA/NEIS and ISO/IEC compliant communications system as hereinafter specified and/or shown on the Contract Documents. The system is intended to be capable of integrating voice, data, and video signals onto a common media.
 - 1. The Structured Cabling System shall be tested for and be capable of 1 Gigabit Ethernet operation as specified in IEEE 802.3z.
- B. The work shall include all materials, equipment and apparatus not specifically mentioned herein or noted on the plans but which are necessary to make a complete working ANSI/TIA/EIA and ISO/IEC compliant SCS.

1.3 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the work of this section and to all Division 27 Specification Sections.

1.4 STANDARDS AND CODES

Review and edit the following list of references. Check for completeness, currency and applicability to this project – include any other additional relevant references not already noted below. The Designer shall verify whether the latest edition and/or addenda of each required reference is appropriate and specify the edition and addenda below accordingly.

- A. Incorporate by reference the latest updates of the applicable portions of the following specifications, standards, codes into this specification section.
1. General:
 - a. National Fire Protection Association (NFPA) – NFPA 70: National Electrical Code (NEC)
 - b. National Fire Protection Association (NFPA) – NFPA 101: Life Safety Code.
 - c. National Fire Protection Association (NFPA) – NFPA 780: Standard for the Installation of Lightning Protection Systems
 - d. National Fire Protection Association (NFPA) – NFPA 75: Standard for the Fire Protection of Information Technology Equipment
 - e. National Electrical Safety Code (NESC)
 - f. Occupational Safety and Health Act (OSHA)
 - g. Washington Industrial Safety and Health Act (WISHA)
 - h. Washington State Rules and Regulations for Installing Electrical Wires and Equipment (RCW 19.28, WAC 296-46 and WAC 296-401A)
 - i. Washington State Department of Labor and Industries Safety Standards for General Safety and Health (WAC 296-24 Volume 1 Part L)
 2. Communications:
 - a. ANSI/TIA - 455: Fiber Optic Test Standards
 - b. ANSI/TIA - 526: Optical Fiber Systems Test Procedures
 - c. ANSI/TIA - 568-C.0: Generic Telecommunications Cabling for Customer Premises
 - d. ANSI/TIA - 568-C.1: Commercial Building Telecommunications Cabling Standard
 - e. ANSI/TIA – 569-B: Commercial Building Standard for Telecommunication Pathways and Spaces
 - f. ANSI/TIA – 606-A: The Administration Standard for Commercial Telecommunications Infrastructure
 - g. ANSI/TIA – 607-B: Commercial Grounding (Earthing) and Bonding for Customer Premises
 - h. ANSI/TIA – 862: Building Automation Systems Cabling Standard for Commercial Buildings
 - i. ANSI/TIA/EIA 942 – Telecommunications Infrastructure Standard For Data Centers
 - j. ANSI/TIA -TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems
 - k. ANSI/TIA -TSB75: Additional Horizontal Cabling Practices for Open Offices
 - l. ANSI/TIA/EIA 758 series – Customer-Owned Outside Plant Telecommunications Cabling Standard
 - m. NECA/FOA 301-1997: Standard for Installing and Testing Fiber Optic Cables
 - n. NECA/BICSI 568-2001: Standard for Installing Commercial Building Telecommunications Systems
 - o. IEEE 802.3 (series): Local Area Network Ethernet Standard, including the IEEE 802.3z Gigabit Ethernet Standard
 - p. ISO/IEC IS 11801: Generic Cabling for Customer Premises
 - q. BICSI: BICSI Telecommunications Cabling Installation Manual
 - r. BICSI: BICSI Telecommunications Distribution Methods Manual (TDMM)
 - s. BICSI: BICSI Outside Plant Design Reference Manual (OSPDRM)

- t. BICSI: BICSI Network Design Reference Manual (NDRM)
- 3. Firestopping:
 - a. Firestop Contractors International Association (FCIA), Manual of Practice
 - b. ASTM E 84, "Surface Burning Characteristics of Building Materials".
 - c. ASTM E 119, "Fire Tests of Building Construction and Materials".
 - d. ASTM E 814, "Fire Tests of Through Penetration Firestops".
 - e. ANSI/UL263, "Fire Tests of Building Construction and Materials".
 - f. ANSI/UL723, "Surface Burning Characteristics of Building Materials".
 - g. ANSI/UL1479, "Fire Tests of Through Penetration Firestops".
 - h. Underwriters Laboratories Inc. (UL) – Fire Resistance Directory

- B. In case of differences between building codes, state laws, local ordinances, utility company regulations, and the Contract Documents, the most stringent shall govern; this shall not be construed as relieving the contractor from complying with any requirements of the plans or specifications which may be in excess of code requirements and not contrary to same.

1.5 DEFINITIONS

Review and edit the following list of definitions for applicability to this project. Add and/or remove definitions for unusual terms that are not explained in the conditions of the Contract and that are used in ways not common to standard references.

NOTE: Furnish, provide and install are used repeatedly throughout this specification. The Engineer/Designer shall ensure that these terms are identified in the appropriate section of the project manual. The definitions of these terms shall be similar to the following:

Furnish - "Supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations".

Install - "Operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations".

Provide - "To furnish and install, complete and ready for the intended operation".

- A. "ITPM" shall mean the *IT Project Manager* representing Washington State University.
- B. "FSPM" shall mean the *Facilities Services Project Manager* representing Washington State University.
- C. "MCF" shall mean *Main Communication Facility*, a centrally located facility on campus that provides interbuilding cable feeds to the MDF in other buildings.
- D. "MDF" shall mean *Main Distribution Facility*, an area within a building where cabling from other buildings terminates and where intra-building cabling originates.
- E. "IDF" shall mean *Intermediate Distribution Facility*, one or more spaces within a facility that hosts telecommunications equipment, where horizontal cabling terminates and where this cabling cross-connects to backbone/riser cabling.
- F. Inter-building Feeder Cabling shall mean backbone cabling that connects two buildings, typically the MDF of one building with the MCF in another building.
- G. Intra-building Riser Cabling shall mean backbone cabling that connects the MDF and IDFs within a building.

- H. "SCS" shall mean *Structured Cabling System*. The SCS is defined as all required equipment and materials including (but not limited to) ANSI/TIA/EIA 568-B and ISO/IEC 11801 compliant copper station cable (Category 5E, Category 6, Category 6A, etc.) and fiber optic cable (multimode and singlemode), patch cables, stations and station connectors, termination blocks, patch panels, racks/enclosures (such as EIA standard equipment racks, enclosures, and vertical and horizontal cable management hardware), pathway/raceway materials (such as conduit, sleeves, D-rings, surface raceway, ladder rack, cable tray, etc.), and other incidental and miscellaneous equipment and materials as required for a fully operational, tested, certified, and warranted system, compliant with all applicable codes and standards.
- I. "UTP" shall mean *Unshielded Twisted Pair* cable.
- J. "TMGB" shall mean *Telecommunications Main Grounding Busbar*. There is typically one TMGB per building, located in the main telecommunications room. This busbar is directly bonded to the electrical service ground.
- K. "TGB" shall mean *Telecommunications Grounding Busbar*. There is typically one TGB per telecommunications room. The TGB is connected both to the TMGB and to building structural steel or other permanent metallic systems.
- L. "TBB" shall mean *Telecommunications Bonding Backbone*. The TBB is a conductor used to connect TMGBs to TGBs.
- M. "EMT" shall mean *Electrical Metallic Tubing*.
- N. "RMC" shall mean *Rigid Metal Conduit*.
- O. "BET" shall mean *Building Entrance Terminal*.
- P. "Raceway" shall mean any enclosed channel for routing wire, cable or busbars.
- Q. "Pullbox" shall mean a metallic box with a removable cover, used to facilitate pulling cable through conduit runs longer than 100 feet or in which there are more than 180 degrees of bends.
- R. "Junction box" shall mean a pullbox wherein a feeder conduit transitions to multiple distribution conduits.
- S. "Wire gutter" shall mean a metallic raceway with a square cross-section used for routing wire or cabling.

1.6 REQUIREMENTS OF REGULATORY AGENCIES

- A. The entire installation shall comply with the code requirements of all authorities having jurisdiction.
- B. Contractor shall arrange for all inspections and shall correct non-complying installations.

1.7 PERMITS AND FEES

- A. The Contractor, at their expense, shall obtain permits and inspections required for the electrical work on this project. Inspection certificates shall be included in the Operation and Maintenance Manuals. Deliver copies thereof to the Architect/Engineer prior to final acceptance of the work.

1.8 SUBMITTAL INFORMATION

Review and edit the following list of submittals as applicable to this project. Note that the submittals listed below are specific to this section only. Division 1, Section 01300 (or equivalent) – Submittals should include general administrative requirements (e.g. schedule, number of copies, distribution, etc.). Either Section 01300 or this section should include a statement similar to the following, “The Contractor shall apply Contractor’s stamp, sign, or initial certifying that review, verification of required Products, and coordination of information is in accordance with the requirements of the work and Contract Documents.

Any deviations from the Contract Documents or specified product data shall be clearly noted, and must be approved by the Designer prior to start of construction. The Designer shall obtain approval from WSUP prior to approving a Contractor-submitted deviation.

If the deviation is not approved by the Designer it remains the Contractor’s responsibility to provide what is required in the Contract Documents”.

- A. Product Data Submittals: Provide submittal information for review before materials are delivered to the job site. Combine product submittals for all products and submit together as a single submittal.
1. Submit a cover letter stating that the materials will be provided as specified, and specifically listing any items that will not be provided as specified. State in the letter that the Contractor has reviewed the specified items and agrees that they are applicable to this project in all respects.
 2. If (in the Contractor’s judgment) the system as designed will not meet the required performance specifications, submit a detailed written description of the reasons.
 3. Provide standard manufacturer’s cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These instructions shall detail how to install and service the equipment and shall include information necessary for rough-in and preparation of the building facilities to receive the materials.
 4. For those items noted as allowing “or equal,” and which are not being provided as specifically named, submit a written description detailing the reason for the substitution, along with standard manufacturer’s cut sheets or other descriptive information.
 5. Submit a list of proposed test equipment for use in verifying the installation of the SCS. Proposed test equipment shall meet the criteria as stated in PART 3 – TESTING.
 - a. Submit for each testing device:
 - 1) Manufacturer and product number
 - 2) Documentation from the manufacturer showing date and outcome of last re-calibration. Testing device shall have been re-calibrated within the manufacturer’s recommended calibration period, encompassing the period of time when the testing device will be used on this project.
 - 3) Documentation from the manufacturer showing software revision. Software revision shall be most current revision available for the device and shall be based upon the most current ANSI/TIA/EIA testing guidelines.
 - b. Submit proposed copper and fiber cable test forms (see PART 3 – TESTING for more detail).
- B. Quality Control Submittals: Provide submittal information for review as follows:
1. Prior to bidding, in accordance with the QUALITY ASSURANCE requirements below, submit the following contractor-qualifications documentation:
 - a. Documentation from the SCS manufacturers demonstrating that the Contractor is trained and certified by the Manufacturers to install, test, and maintain the SCS and is certified by the SCS Manufacturers to provide the SCS Manufacturer’s Warranty (see PART 1 - WARRANTY).
 - 1) TE NetConnect Design & Installation (ND&I) Contractor (for copper).
 - 2) Corning Network of Preferred Installers (NPI) Contractor (for fiber).

- 3) Zhone Expert Partner (for GPON).
 - b. Documentation indicating that the Contractor will have only manufacturer-trained and manufacturer-certified employees perform installation, testing, and firestopping work, as detailed below.
 - 1) A list of the personnel who will be assigned to the project, the type of work they will be performing, and copies of the manufacturers' training certifications for each. If personnel changes are made during the project, submit the above information for any new personnel prior to their commencement of work on the project.
 - c. Documentation demonstrating that the Contractor employs a minimum of one Registered Communications Distribution Designer (RCDD) certified by and in current good standing with BICSI. The document shall declare that the RCDD is a direct full time employee of the Contractor and that the Contractor will continue to employ a minimum of one RCDD throughout the duration of the project.
 - d. List of references for no less than five similar projects (in terms of size and construction cost) performed by the Contractor under the Contractor's current business name within the past four years. Detail the following for each project:
 - 1) Project name and location
 - 2) Construction cost
 - 3) A brief description of the project, the components involved, and the SCS manufacturer used on the project.
 - 4) Number of station drops
 - 5) Customer contact names, phone numbers, physical address and email address
- C. Closeout Submittals: Provide submittal information for review as follows:

A telecommunications-specific Operations and Maintenance (O&M) Manual for Communications shall be required for each project. O&M information submitted under other related communications sections (e.g. Conduits and Backboxes for Communications Circuits, Bonding and Grounding for Communications, etc.) shall be included in the O&M Manual and statements should be included in each section directing the Contractor to provide applicable information in the O&M Manual for Communications.

1. O&M Manual for Communications - At the completion of the project, submit O&M information from product data submittals (above), updated to reflect any changes during the course of construction, to the Designer in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description. Provide three bound copies of the O&M Manual for Communications.
2. Records - Maintain at the job site a minimum of one set of As-Built Drawings, Specification, and Addenda. As-Built Drawings shall consist of redline markups of changes to Contract Documents such as drawings, specifications and spreadsheets, including maintenance hole/handhole butterfly drawings.
 - a. At the beginning of the work, set aside one complete set of the drawings to be maintained as a complete As-Built Drawings set. Notations shall be done in a neat and legible manner as specified in Division 01 and in accordance with the Architect/Engineer's instructions
 - b. The As-Built Drawings shall be updated daily by the foreman to show every change from the original drawings and the exact locations, sizes and kinds of equipment. Clearly identify system component labels and identifiers on As-Built Drawings. This set of drawings shall not be used for any other purpose and shall be maintained at the job site.
 - c. The actual location and elevation of all buried lines, boxes, monuments, stub-outs and other provisions for future connection shall be shown on the As-Built Drawings and shall be referenced to the building lines or approved bench marks
 - d. Keep As-Built Drawings at the job site and make available to the Owner and Designer at any time.
 - e. Keep As-Built Drawings current throughout the course of construction. ("Current" is defined as not more than one week behind actual construction).
 - f. Show identifiers for major infrastructure components on As-Built Drawings.

- g. Upon completion of the job, deliver the marked-up As-Built Drawings to the Architect/Engineer.
- 3. Test Reports
 - a. Test reports shall be provided electronically on CDROM. The CDROM shall be labeled with the following information:
 - 1) "Test Results"
 - 2) Project Name
 - 3) Date of Completion
 - b. CDROM shall be organized with folders for each category of test results. Each folder shall be subsectioned for each portion of a building (for example, the portion served by each IDF).
 - c. Test results shall be presented sequentially.
 - d. Details about the test equipment shall be included on the CDROM, including:
 - 1) Manufacturer and model number
 - 2) Date of most recent calibration
 - 3) Test methodology
 - e. Test reports shall be submitted within 3 weeks of Substantial Completion.
 - f. Following a review of the test results by the Owner and Engineer, the Contractor shall resolve any unsatisfactory test results by correcting the installed infrastructure. The corrected infrastructure shall be retested, and the new tests shall be inserted into the overall set of tests.
 - 1) A new CDROM shall be submitted with the entire comprehensive content (described above) included.
 - 2) A new folder titled "Failed Test Results" shall be added to the CDROM and the original unsatisfactory test results shall be stored in this folder.
 - g. See each specification section for specific test requirements for each type of technology infrastructure.

1.9 QUALITY ASSURANCE

- A. All Division 27 Contractors:
 - 1. Contractor's employees whose duties include the application of firestopping material shall be trained and certified by the specified firestopping manufacturer. Training and certifications by employee type are required as shown below:
 - a. Supervisors/Project Foremen: All (100%) shall be trained/certified for installation.
 - b. Firestopping Technician: All (100%) shall be trained/certified for installation.
 - 2. Contractors shall be licensed and bonded as a low voltage contractor in accordance with State of Washington requirements, and shall obtain all required permits.
- B. Telecommunications Contractor Qualifications:
 - 1. Contractor shall be trained and certified by the Manufacturers to install, test, and maintain the SCS, and shall be certified by the SCS Manufacturers to provide the SCS Manufacturers' Warranties (see PART 1 - WARRANTY). Provide documentation from the SCS manufacturers demonstrating that the Contractor is trained and certified by the following:
 - a. TE NetConnect Design & Installation (ND&I) Contractor (for copper).
 - b. Corning Network of Preferred Installers (NPI) Contractor (for fiber).

If the project includes GPON, include the following paragraph. Otherwise, delete the Zhone Elite requirement.

 - c. Zhone Elite Certification (for GPON).Contractor shall maintain these certifications throughout the duration of the project.
 - 2. Contractor's employees directly involved with the supervision, installation, testing, and certification of the SCS shall be trained and certified by the selected SCS' manufacturers. Training and certifications by employee type are required as shown below. Provide documentation indicating that the Contractor will have only manufacturer-trained and

- manufacturer-certified employees perform installation, testing, and firestopping work, as detailed below. Provide a list of the personnel who will be assigned to the project, the type of work they will be performing, and copies of the manufacturers' training certifications for each. If personnel changes are made during the project, submit the above information for any new personnel prior to their commencement of work on the project. Except where specified otherwise, the following training and certification requirements shall be met by the Contractor at the time of bidding:
- a. Supervisors/Project Foremen: All (100%) shall be trained/certified for installation and testing.
 - b. Test Technicians: All (100%) shall be trained/certified for installation and testing.
 - c. Installation Technicians: Prior to bidding, half (50%) shall be trained/certified for installation. Upon award of the project, the remaining untrained installation technicians shall be trained and certified by the manufacturer at no cost to the Owner.
 - d. Other personnel: Personnel not directly responsible for installation supervision, installation, testing or certifying the SCS (i.e. project managers, cleanup crew, etc.) are not required to be manufacturer-trained and certified. Otherwise, personnel not manufacturer-trained and certified shall not be allowed on the job site.
3. Contractor shall employ a minimum of one Registered Communications Distribution Designer (RCDD) certified by and in current good standing with BICSI. The RCDD shall be a direct full time employee of the Contractor (i.e. an RCDD consultant/sub-contractor to the Contractor is not acceptable). Contractor shall continue to employ a minimum of one RCDD throughout the duration of the project.
- a. Provide documentation demonstrating compliance with this requirement.
4. Contractor shall have successfully completed no less than five similar projects (in terms of size and construction cost) under the Contractor's current business name within the past four years.
- a. Provide a list of references with the following details for each project:
 - 1) Project name and location
 - 2) Construction cost
 - 3) A brief description of the project, the components involved, and the SCS manufacturer used on the project.
 - 4) Number of station drops
 - 5) Customer contact names, phone numbers, physical address and email address
5. Contractor shall be capable of dispatching a qualified technician to the Owner's campus within four hours of a request for service during the installation, acceptance and warranty periods.
6. Firms desiring to have their qualifications reviewed pursuant to a determination of their qualifications shall submit documentation of the above requirements not later than ten days prior to the bid opening. Firms that have not been evaluated for qualification shall not bid. Bids from firms that have not been pre-qualified shall be discarded. The following firms have been pre-qualified:
- a. Interwest Technology Systems
 - b. Paramount Communications
 - c. Powercom
 - d. Evergreen

The Designer shall contact the WSUP ITPM and request a list of pre-qualified contractors who are currently in good standing with the University. The Designer shall list these companies, the name of a contact person, and a phone number for each.

C. Audio Visual Contractor Qualifications:

1. Contractor's employees directly involved with the supervision, installation, testing, and certification of the A/V System shall be full-time employees of the contractor for a minimum of one year, and shall have the experience detailed in this section. Provide documentation indicating that the Contractor will have only manufacturer-trained and manufacturer-certified employees perform installation, testing, and firestopping work, as detailed below. Provide a list of the personnel who will be assigned to the project, the type of work they will be performing, and copies of the manufacturers' training certifications for each. If personnel changes are

made during the project, submit the above information for any new personnel prior to their commencement of work on the project.

- a. Supervisors/Project Foremen: All (100%) shall be certified as InfoComm CTS-I.
- b. Technicians: All (100%) shall be certified as:
 - 1) AMX ACE Design Expert (ACE-D)
 - 2) AMX ACE Installation Expert (ACE-I)
 - 3) AMX ACE Programming Expert (ACE-P)
2. Contractor shall have successfully completed no less than three similar projects (in terms of size and construction cost) under the Contractor's current business name within the past four years. The Contractor's project history shall include installation of common audio/visual equipment such as speaker systems, video projection and audio/video routing in a campus-type environment.
 - a. Provide a list of references with the following details for each project:
 - 1) Project name and location
 - 2) Construction cost
 - 3) A brief description of the project, the components involved, and the main audio/visual equipment manufacturers used on the project.
 - 4) Equipment used for the project
 - 5) Customer contact names, phone numbers, and addresses
3. Contractor shall employ a minimum of one InfoComm CTS-I certified technician in current good standing with InfoComm. The CTS-I shall be a direct-full time employee of the Contractor (i.e. a consultant/sub-contractor to the Contractor is not acceptable). Contractor shall continue to employ a minimum of one CTS-I throughout the duration of the project.
 - a. Provide documentation demonstrating compliance with this requirement.
4. Firms desiring to have their qualifications reviewed pursuant to a determination of their qualifications shall submit documentation of the above requirements not later than ten days prior to the bid opening. Firms that have not been evaluated for qualification shall not bid. Bids from firms that have not been pre-qualified shall be discarded. The following firms have been pre-qualified:
 - a. None.

1.10 COORDINATION

- A. References to the "Owner" or "Owner's representative" throughout the Division 27 specification sections shall be interpreted to mean both the WSUP FSPM and the WSUP ITPM. All requirements to seek approval of the Owner require the involvement of the WSUP ITPM.
- B. The Division 27 Contractor shall coordinate work with that of the other contractors doing work in the building and shall examine all drawings, including the several divisions of mechanical, ventilating, structural and general, for construction details and necessary coordination.
- C. Coordinate and schedule connecting electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- D. Coordinate the interruption of electrical systems to any part of the facility in use by the Owner at least 48 hours before interruption of the system.
- E. Special attention is called for the following items and all conflicts shall be reported to the Architect/Engineer before installation for decision or correction:
 1. Location of fixtures, pipes, ducts and other mechanical equipment such that telecommunications and audio/visual outlets, wall-mounted telephone devices, equipment racks and panels and other electrical equipment are mounted in proper relationship to these items.

2. Location of cabinets and counters such that communications work is clear from and in proper relation to these items.
 3. Penetrations of building structure for communications work.
 4. Compliance to Section 110-26 of NEC.
 5. Coordination and provisions for maintaining telephone service to areas in use during construction, especially elevator equipment, fire alarm systems, security systems and emergency systems (comply with General Division Provisions).
 6. Communications equipment shall fit in the space provided on the plan drawings or as specified. Equipment heights shall not exceed those shown or specified. Larger equipment shall not be considered acceptable. Contractor shall be responsible for all clearances around the communications equipment.
- F. Telephone and Internet services required by the Contractor during construction shall be provided by the Contractor. The Owner does not provide any communications utility services for construction projects. At substantial completion, the Owner will assume responsibility for communications utility services to the building and will transfer services at that time. This includes (but is not limited to) the following:
1. Telephone and Internet service for the Jobsite Construction Trailers
 2. Elevator telephone
 3. HVAC system Internet or networking
 4. Internet or networking for other building services.
- G. When conduit, insert or sleeves for outlet boxes and/or conduits are required, Contractor shall fully coordinate the installation thereof with other trades.
- H. Contractor shall coordinate the Division 27 work in other campus buildings that may be required to support the project, such as the Main Communications Facility (MCF), Intermediate Distribution Facilities (IDF), tunnels, vaults, enclosures, etc.
- I. The communications contractor shall take full responsibility for furnishing, installing and troubleshooting all communications systems in the building. The communications contractor shall be responsible for overall coordination of all communications systems and ensuring correct and full operation of all systems and system interfaces. The communications contractor shall coordinate the interfaces between the communications systems and all other systems.

1.11 SEQUENCING

Include any requirements for coordinating work with potentially unusual or specifically required sequencing. WSUP may choose to construct a project under two bid packages - one for pathways and spaces (perhaps under a General Contract), and a second bid package for the Structured Cabling System (perhaps using the WA State DES Master Contract). The Designer must coordinate with WSUP to determine if two bid packages will be used and include verbiage in the appropriate specification sections requiring the contractors to coordinate construction phasing and schedules.

- A. Provide coordination with the cabling manufacturers to ensure that manufacturers' inspectors are available to schedule site visits, inspections, and certification of the system. Provide and coordinate any manufacturer-required modifications and have manufacturer re-inspect and certify the system prior to the scheduled use of the system by the Owner.
- B. The Contractor is solely responsible for all costs associated with scheduling the manufacturer inspection, the inspection itself and any manufacturer-required re-inspections, and for any modifications to the installation as required by the manufacturers.

1.12 WARRANTY

Coordinate this paragraph with the conditions of the contract and Division 1 requirements to ensure that no statements are made that will limit or void those conditions. The Designer is required to have a thorough understanding of the manufacturer warranties applicable on this project. The Designer shall consider, account for, and advise WSUP regarding any unique warranty situations that may arise from Owner-furnished equipment, Owner-installed equipment, or other situations that may conflict with warranty requirements.

A. Contractor Warranty:

1. Provide a Contractor-endorsed one-year service warranty against defects in materials and workmanship.
 - a. Provide all labor attributable to the fulfillment of this warranty at no additional cost to the Owner.
 - 1) The Contractor Warranty period shall commence upon Owner acceptance of the work.
 - b. This warranty shall not be voided by Owner's move, add and change activities. The resulting parts of any Owner-performed moves, adds and changes do not become part of the warranty. Nothing in this section shall be construed to terminate the warranty by performance of normal maintenance or service on the system or by expanding the system in any manner consistent with the original design and intent for the system.

B. SCS Manufacturer Warranties:

1. Provide SCS Manufacturer extended product, performance, application, and labor warranties that shall warrant all passive components used in the SCS. Additionally, these warranties shall cover components not manufactured by the SCS Manufacturers, but approved by the SCS Manufacturers for use in the SCS (i.e. "Approved Alternative Products"). The SCS Manufacturer warranties shall warrant:
 - a. That the products will be free from manufacturing defects in materials and workmanship.
 - b. That the cabling products of the installed system shall exceed the specification of ANSI/TIA/EIA 568-B and exceed ISO/IEC 11801 standards.
 - c. That the installation shall exceed the specification of ANSI/TIA/EIA 568-B and exceed ISO/IEC 11801 standards.
 - d. That the system shall be application independent and shall support both current and future applications that use the ANSI/TIA/EIA 568-B and ISO/IEC 11801 component and link/channel specifications for cabling.
2. Provide materials and labor attributable to the fulfillment of this warranty at no cost to the Owner.
3. The SCS Manufacturer Warranties shall be provided by the selected SCS Manufacturers and shall be:
 - a. TE 25-year System Warranty.
 - 1) Provide a copy of the warranty registration document to the Owner at the time of submittal to TE.
 - b. Corning 25-year System Warranty.
 - 1) Provide a copy of the warranty registration document to the Owner at the time of submittal to Corning.
4. The SCS Manufacturer Warranty period shall commence upon a Warranty Certificate being issued by the manufacturer. The Warranty Certificates shall be issued no later than three months after Owner acceptance of the work.

PART 2 - PRODUCTS

Ensure that products listed under the PART 2 – Products paragraphs have corresponding installation instructions in PART 3 – Execution, or in another specification section if furnished but not installed under this section.

WSUP has standardized on certain manufacturers and certain products for all new Structured Cabling Systems in WSUP facilities. Products shall be specified accordingly. The Designer shall ensure that the latest part numbers are used for specified products. Any substitutions require WSUP pre-approval before specification.

If the Designer wishes to use products that deviate from WSUP standards, a Standards Variance Request shall be made, as described in the Technology Infrastructure Design Guide (TIDG). If the alternative product is approved, the Designer shall adapt this to reflect the approved changes.

The products listed throughout Part 2 - Products below are not all-inclusive for any given project. The Designer shall ensure that all required products are specified. The Designer shall also verify that the most current part number of each specified product is listed in this section.

2.1 GENERAL

- A. Products and materials shall be as specified in the pertinent Sections of Division 27. Unless specifically stated as "Or equal", equivalent items are not acceptable. Provide items as specified.
- B. Wherever possible, all materials and equipment used in the installation of this work shall be of the same Manufacturer throughout for each class of material or equipment. Comply with ANSI, IEEE and NEMA standards, where applicable. Materials shall be new, in original manufacturer packaging, and bear the UL label. Material which has been damaged, removed from original packaging, or exposed to potential damage shall not be installed and shall be replaced at no additional cost to the Owner.
- C. Components shall be manufactured by the manufacturers listed in Division 27. Components shall not be intermixed between different manufacturers unless the manufacturer has listed (in writing) another manufacturer's component as an "Approved Alternative Product" and will warrant the "Approved Alternative Product" as part of the Manufacturer Warranty.
 - 1. Bid only the manufacturers for which the Contractor is certified.
- D. All copper-related components shall be part of the copper SCS product line and all fiber optic-related components shall be part of the fiber optic SCS product line – components shall not be intermixed between manufacturers' SCS product lines. The SCS product lines shall be engineered "end-to-end" – the system and all of its components shall be engineered to function together as a single, continuous transmission path.
- E. Physically verify existing site conditions prior to purchase and delivery of the materials, including but not limited to lengths of conduit and/or pathway to be used for routing backbone cabling. Pre-cut materials of insufficient length are the sole responsibility of the Contractor.
- F. Provide materials, devices, equipment or supplies of materials that are inherently non-corrosive or are coated or covered in a manner, acceptable to the Engineer, which renders them non-corrosive. Material that may cause rusting or streaking on a building surface shall not be used.
- G. All cabling and materials that could potentially be installed in ceiling spaces shall be manufacturer-labeled in accordance with NEC 800 to indicate their rating for plenum or non-plenum spaces. Use only plenum-rated materials in plenum-rated spaces.
- H. Provide all incidental and/or miscellaneous hardware (including equipment cables and connectors) not explicitly specified or shown on the Contract Documents that is required for a fully operational, tested, certified and warranted system.

- I. Provide cables of the same type or application in the same color throughout the project, unless otherwise indicated. Multiple colors of the same cable type are not acceptable.

2.2 TOUCH-UP PAINT

- A. Equipment: Provided by equipment manufacturer and selected to match equipment finish.
- B. Non-Equipment Surfaces: Matching type and color of undamaged, existing adjacent finish.
- C. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

2.3 TELECOMMUNICATIONS FIRESTOPPING

The Designer shall work with the Architect to coordinate the content in this paragraph with the content in Section 07 27 00 – Firestopping.

- A. Firestopping material: Conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions. Manufactured by:
 1. Specified Tech. Inc.
 2. Hilti
 3. or approved equal.
- B. Fire-Rated Cable Pathways: Device modules shall be comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill:
 1. Specified Technologies Inc. (STI) EZ-PATH Fire Rated Pathway
- C. Firestop Pillows: Pillows shall be re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag:
 1. Specified Technologies Inc. (STI) SpecSeal® Series SSB Pillows
 2. Hilti CP 657 Firestop Brick

Generally speaking, WSUP prohibits the use of Putty-type firestopping products. However, sometimes an application will require putty. Prior to including putty products in the project, first obtain the approval of the WSUP ITPM. Delete the following paragraph if putty will not be used in the project.

- D. Firestop Putty: Putty products shall be re-enterable, non-curing, moldable substances:
 1. Specified Technologies Inc. (STI)
 2. Hilti

2.4 GROUNDING AND BONDING

- A. As specified under Section 27 05 26 – "Grounding and Bonding for Communications Systems."

PART 3 - EXECUTION

Ensure that products incorporated into the project under PART 3 paragraphs have corresponding Product information in PART 2 – Products, or in another specification Section if installed but not supplied under this Section.

The following paragraphs include installation requirements written specifically for the Products listed in Part 2 above. If other products are approved, the Designer shall ensure that appropriate Part 3 installation requirements are added/removed or modified as applicable and described in equal or greater detail to the following paragraphs.

All installation requirements shall be consistent with the manufacturer's requirements.

3.1 GENERAL

- A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.
- B. All work shall comply with applicable safety rules and regulations including OSHA and WISHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.
- C. All work shall comply with the standards, references and codes listed in PART 1 – STANDARDS AND CODES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.
- D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.
- E. Equipment Dimensions and Clearances:
 - 1. Dimensions indicated for communications equipment and dimensions indicated for the installation of communications equipment are restrictive dimensions. Verify that equipment will fit within the indicated locations and spaces. Do not use equipment that impinges upon the required clearance, reduces actual clearance, or exceeds the indicated dimensions:
 - a. Except as approved in writing by the Engineer and the Owner.
 - 2. Do not use arrangements of equipment that impinge upon the required clearance, reduce actual clearances or exceed the space allocation.
- F. Equipment Access:
 - 1. Install equipment so it is readily accessible for operation and maintenance.
 - 2. Access to equipment shall not be blocked or concealed by conduits, supporting devices, boxes, or other items.
 - 3. Do not install electrical equipment such that it interferes with normal maintenance requirements of other equipment.
- G. Equipment shall be installed plumb, square and true with the building construction and shall be securely fastened.
- H. Do not provide materials which contain polychlorinated biphenyls, asbestos or other hazardous or detrimental materials. Do not install materials in a manner, location or construction that produces galvanic action or any other materials corroding or eroding action. Equipment fabricated from aluminum shall not be placed in direct contact with earth or concrete. Outdoor wall mounted equipment and indoor equipment mounted on earth or water bearing walls shall be provided with corrosion resistant spacers to maintain ¼ inch separation between the equipment and the wall. Screen or seal all raceways or other openings into equipment to prevent the entrance of moisture, rodents and insects.
- I. Drawings indicate the approximate location and arrangement of electrical equipment and the approximate location of other equipment requiring electrical work. The general arrangement of panelboards, outlets and other equipment is diagrammatic and approximate as to locations. To avoid interference with structural members and equipment of other trades, it may be necessary to adjust the intended location of electrical equipment. Where minor changes are required because of structural or finish conditions or for the convenience of the Owner, provide such changes without additional expense

to the Owner. Unless specifically dimensioned or detailed, the Contractor may, at his discretion, make minor adjustments in equipment location without obtaining the Engineer's approval. Minor adjustments are defined as a distance not to exceed:

1. 1 ft at grade, floor and roof level in any direction in the horizontal plane.
2. 1 ft for equipment at ceiling level in any direction in the horizontal plane.
3. 1 ft on walls in a horizontal direction within the vertical plane.
4. Changes in equipment location exceeding those defined above require the Engineer's approval.
5. Particular attention shall be paid to door swings, piping, radiation, ductwork, and structural steel:
 - a. In general, waste and vent lines and large pipe mains and ductwork shall be given priority for the locations and space shown.
 - b. No additional compensation will be allowed for the moving of misplaced outlets, wiring, or equipment

J. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

K. Remove surplus material and debris from the job site and dispose of legally.

3.2 SCHEDULE

A. At least one week prior to commencement of telecommunications-related work, a Pre-Installation Conference shall be held by the Contractor for the purpose of discussing and coordinating the scope of work with the Owner's IT representatives (ITPM).

B. Provide a time-scaled construction schedule indicating construction phases and deadlines associated with this work. At a minimum, the following tasks shall be shown on the schedule:

1. Start of outside plant ductbank and maintenance hole construction.
2. Dates of outside plant ductbank concealment (concrete and backfill).
3. Start of conduit and box rough-in
4. Start of main campus cable feed to building MDF
5. Start of MDF and IDF build out
6. Start of vertical riser cable installation
7. Start of horizontal cable installation
8. Start of horizontal cable termination
9. Date when elevator telephone service required
10. Date when building automation system (HVAC) will require network service
11. Start of outlet device termination and labeling
12. Start of installation testing – provide IT w/preliminary test results.
13. Start of final inspection process

C. Notify the ITPM if any changes to the schedule are anticipated.

3.3 INSTALLATION

A. Install the equipment and materials in a neat and workmanlike manner employing workmen skilled in the particular trade and in accordance with the manufacturer's instructions and industry standards. Maintain adequate supervision of the work by a person in charge at the site during any time that work under this division is in process or when necessary for coordination with other work.

B. Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated. Mount enclosures for individual units at fifty-four inches above floors to centerline of controls.

- C. Install items level, plumb, and parallel and perpendicular to other building systems and components, except where otherwise indicated, and shall be securely fastened.
- D. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- E. Fastening: Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the building structure. Attach enclosures with a minimum of three fasteners, and more if the manufacturer so recommends.
 - 1. Attach enclosures mounted on equipment with machine screws or clamps as required. Do not drill equipment frames or sheets without permission of supplier/manufacturer or the Engineer.
 - 2. Stand equipment off wall surfaces a minimum of one-quarter inch where enclosures are mounted on walls in wet areas (outdoors, below grades, etc.) with neoprene, or fiberglass or plastic shim washers.
 - 3. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or any other items.
- F. Select fasteners so the load applied to any fastener does not exceed 25 percent of the proof-test load.
- G. Give right of way to raceways and piping systems installed at a required slope.
- H. Make all penetrations of electrical work through walls and roofs water and weather tight.
- I. Install concrete pads and bases according to requirements of Division 03 Section "Cast-in-Place Concrete."

3.4 DEMOLITION

Review any demolition requirements for this project with the WSUP project manager and edit the following paragraph as applicable.

- A. Demolish existing telecommunications equipment, cable, materials, and incidentals no longer in use after installation of and cutover to the new SCS. Demolish all existing devices and cables which are noted for demolition. Demolition includes, but is not limited to:
 - 1. Remove all conduit, conductors, fittings, device boxes, hangers, panels, devices, etc., which are not concealed in the building structure or below grade/slab.
 - 2. Remove existing conductors from conduits, unless otherwise indicated, where existing work is to be abandoned in place. Cut and remove buried raceway indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap and patch surface to match existing finish.
 - 3. Do not remove or damage fireproofing materials. Repair or replace fireproofing removed or damaged.
- B. When demolishing existing surface plastic/metal raceway, patch and/or paint wall to match existing undisturbed wall finish after raceway is removed.
- C. Locate, identify, and protect equipment and materials to remain. Where existing work to remain is damaged in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality at no additional cost to the Owner.
- D. Remove demolished material from the Project site and legally dispose of demolished material.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation and/or reconnection.

- F. Coordinate demolition activities with those pertaining to other Divisions.

3.5 SEISMIC REQUIREMENTS

- A. General: Electrical equipment for emergency systems shall be braced to withstand lateral forces that result from earthquakes. The Electrical Contractor shall provide seismic calculations stamped and signed by a registered Structural Engineer confirming size, number and location of all required anchoring hardware. Electrical equipment vendors shall submit weights, dimensions and center of gravity location for all emergency electrical equipment for this purpose.

3.6 CUTTING AND PATCHING

- A. Cutting of Existing Structural Work: Holes in existing slabs and concrete walls shall be cored to the minimum size required. Contractor shall submit dimensioned drawings showing dimensioned sizes and locations for all holes to Architect/Engineer for approval before cutting. Where required for conduit installation, grade slabs shall be saw cut to minimum required width. Approval drawings shall be submitted to Architect/Engineer before cutting.
- B. Patching: All holes or chases shall be patched to match adjacent surfaces.

3.7 PAINTING

- A. General: All finish painting of electrical equipment shall be as specified in Division 9, unless equipment is herein-after specified to be furnished with factory applied finish coats. Equipment to be field painted shall be supplied with factory applied prime coat.
- B. Touch Up: If factory finish on any equipment furnished under this Division is damaged in shipment or during construction of the building, equipment shall be refinished by Contractor to the satisfaction of the Architect/Engineer.
- C. Concealed Equipment: All uncoated cast iron or steel that will be concealed or will not be accessible when installations are completed shall be given one heavy coat of black asphalt before installation.

3.8 CONCRETE WORK

- A. All concrete required for communications work shall be provided under Division 33.

3.9 FIRESTOPPING

- A. Comply with requirements in Division 07 – “Firestopping.”

The Designer shall work with the Architect to coordinate the content in this paragraph with the content in Section 07 27 00 – Firestopping.

- B. Only employees trained/certified by the firestopping manufacturer shall apply firestopping materials.
- C. Maintain fire rating of penetrated fire barriers. Fire stop and seal penetrations made during construction.
 1. Provide firestopping material for through and membrane penetrations of fire-rated barriers.
 2. Install firestops in strict accordance with manufacturer’s detailed installation procedures.
 3. Install firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer’s recommendations, local fire and building authorities, and applicable codes and standards referenced in PART 1 – REFERENCES. Apply of sealing material in a manner acceptable to the local fire and building authorities.

4. For demolition work, apply firestopping to open penetrations in fire rated barriers where cable is removed. Apply firestopping regardless of whether or not the penetrations are used for new cable or left empty after construction is complete.
 5. Firestopping material used to seal open penetrations through which cable passes shall be re-usable/re-enterable.
- D. Fire and smoke stopping cable pathway devices shall be provided for all sleeve penetrations through fire-rated walls and wherever cables (not in conduit) pass through fire-rated walls. Devices shall be arranged singly or in gangs, and installed in strict accordance with the manufacturer's recommendations. Apply the factory supplied gasketing material prior to the installation of the wall plates. Secure wall plates to devices per the equipment manufacturer's recommendations.
1. Putty-type firestopping products are not acceptable.
- E. Fire and smoke stopping cable pathway devices shall be provided for all floor-to-floor firestopping applications.
- F. Firestopping putty and firestopping pillow products shall not be used for vertically oriented applications.

3.10 GROUNDING AND BONDING

- A. Grounding and bonding work shall comply with the Uniform Building Code, Uniform Fire Code, WAC, National Electrical Code, and UL 467, ANSI/TIA/EIA standards and the references listed in PART 1 – STANDARDS AND CODES above, as well as local codes which may specify additional grounding and/or bonding requirements.
- B. Provide grounding and bonding as required under Section 27 05 26 – “Grounding and Bonding for Communications Systems” and as required under other Division 27 sections.

3.11 PROTECTION, CARE AND CLEANING

- A. Protection: Provide adequate protection for all finished parts of the materials and equipment against physical damage from any cause during the progress of work and until final completion. Sensitive electrical equipment shall not be installed until major construction is completed.
- B. Care: During construction, properly cap all lines and equipment to prevent the entrance of sand and dirt. Protect equipment against moisture, plaster, cement, paint or work of other trades by covering with polyethylene sheets.
- C. Cleaning: After installation has been completed, clean all systems as follows:
1. Field Painted Items: Clean exterior of conduits, raceways, piping and equipment exposed in completed structure; removing rust, plaster, cement and dirt by wire brushing. Remove grease oil and similar materials by wiping with clean rags and suitable solvents.
 2. Factory Finished Items: Remove grease, oil and dust on factory finished items such as cabinets and racks, and rack-mounted equipment, and leave surfaces clean and polished. Vacuum inside of all electrical equipment and remove dust and debris.
- D. Connections: Prior to energizing, check all electrical connection hardware.

3.12 DAMAGE AND REPAIRS

- A. Emergency Repairs: Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding the Contractor's warranty or relieving the Contractor of his responsibility during the warranty period.

- B. Responsibility for Damage: Contractor shall be responsible for damage to the grounds, buildings, or equipment due to work furnished or installed under this Division.

3.13 SERVICE OUTAGES

- A. Any telephone, data or television service outage required to perform work under this Contract shall be performed at a time that is coordinated with and convenient to the Owner. Submit to the Owner (in writing) for his approval, a schedule showing the dates and times the Contractor desires to perform his work. This schedule shall be submitted no less than five days prior to commencing work. It may be necessary to perform this work at night, on holidays or maintenance shutdowns. The Contractor shall include in his bid all premium time labor costs for this work.

3.14 IDENTIFICATION AND LABELING

- A. General: Labeling and administration shall comply with ANSI/TIA/EIA 606 and standard industry practices.
- B. Identifiers shall be defined for all communications features, equipment, racks, terminations, conduits, cable trays, faceplates, cabling and grounding/bonding systems as required in Division 27. Identifiers shall be consistent with the Owner's standard labeling scheme.
- C. Labels shall be prepared using machine-printed equipment, producing indelible text on durable label materials. Handwritten labels are not acceptable.
- D. Labels shall be affixed to each item, showing the identifier of that item, and arranged such that they are readable after cabling has been dressed and secured.
- E. Identifiers shall be shown on As-built Drawings.

3.15 TESTING

- A. Test every cable in the project, in accordance with Contract requirements, manufacturer requirements, industry standards, and warranty requirements and as required in Division 27.
- B. Notify the Owner's representative (ITPM) two weeks prior to the start of testing, and invite the Owner's representative to witness the testing.
- C. Prior to the start of testing, submit for Owner review and approval the proposed test procedures, test report forms and timetable for performing the required testing.
- D. Provide test records on a form approved by the Owner and Engineer. Submit the test results for each cable. The records shall include the unique cable identifier, outcome of test, indication of errors found, cable length, retest results, and name and signature of technician completing the tests. Provide test results to the Owner and Engineer for review and acceptance within three weeks of Substantial Completion.
 - 1. Prepare and submit the test results in Adobe Acrobat PDF electronic form (on a flash drive or CDROM) to the Owner and Designer for review. Handwritten test results will not be accepted.
 - 2. The CDROM shall be labeled with the words "Test Results", the project name, and the date of completion (month and year).
 - 3. Test data on the CDROM shall be organized into three folder categories as follows:
 - a. Inter-building Feeders
 - b. Intra-building Risers
 - c. Intra-building Horizontal

4. Each major heading shall be sub-sectioned by test type. For example, within the Inter-building and Intra-building sections, the following subsections or sub-files shall be created:
 - a. Scanner Test Results (Category 3 or Category 6)
 - b. Fiber Optic Attenuation Test Results
 - c. OTDR Traces
 - d. Power Meter Readings
 - e. Green Light Test Results
 5. Test data within each section shall be presented in the sequence listed in the administration records. Information about the test equipment shall also be provided, including:
 - a. the name of the test equipment
 - b. manufacturer
 - c. model number
 - d. the date of the most recent calibration.
 6. Test equipment shall be calibrated as often as the manufacturer specifies, or annually, whichever is more frequent.
 7. The CDROM shall also include a PDF-printed description of each test method used and the specific settings of the equipment used to perform each type of testing.
 8. A copy of all applicable test results shall be submitted (within three weeks of Substantial Completion) to each manufacturer that requires test results pursuant to warranty registration, including TE and Corning.
 9. Any test-report anomalies discovered during review by the Owner or Engineer shall be resolved promptly by the Contractor at no additional cost to the Owner. Installation deficiencies shall be corrected, the testing redone and an updated CDROM containing a comprehensive set of all test reports (not just the portion requiring correction) shall be prepared and submitted to the Owner and Engineer.
 - a. The original test reports (showing the unacceptable results) shall also be included on the CDROM in a subfolder under the corresponding category.
- E. Costs of test shall be borne by Contractor. Contractor shall provide all instruments, equipment, labor and materials to complete test. Should tests detect any defective materials, poor workmanship or variance with requirements of Specifications, Contractor shall make any changes necessary and remedy any defects at his expense.

3.16 AS-BUILT DRAWINGS

- A. Upon completion and at other times during the progress of the work, when required, remove all surplus materials, rubbish and debris resulting from the work.

3.17 PRELIMINARY OPERATION

- A. The Owner reserves the right to operate portions of the communications system on a preliminary basis without voiding the warranty or relieving the Contractor of his responsibilities.

3.18 CLEAN-UP

- A. Upon completion and at other times during the progress of the work, when required, remove all surplus materials, rubbish and debris resulting from the work, and dispose of legally.

3.19 DEMONSTRATION

- A. Demonstrate equipment in accordance with Division 01.

- B. Provide assistance to the Engineer during the demonstration or observation of equipment by operating devices and equipment, opening enclosures for inspection, checking as-built drawing information, and similar tasks, as necessary in the Engineer's judgment, to verify all work performed.
- C. Acceptance Is Contingent On:
 - 1. Completion of final review and correction of all deficiencies.
 - 2. Satisfactory completion of acceptance tests which demonstrate compliance with all performance and technical requirements of Contract Documents.
 - 3. Satisfactory completion of training program and submission of all manuals and drawings required by Contract Documents.

3.20 OWNER-PROVIDED SERVICES

- A. The Owner will provide the following services:
 - 1. Install station patch cords and/or cross-connect "jumpers" for voice and data.
 - 2. Connections to the Local Exchange Carrier, and Inter-exchange Carrier.
 - 3. Connections to the campus voice, video and data network.

END OF SECTION