

## SECTION 27 17 20

### COMMISSIONING OF COMMUNICATIONS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. This Section includes requirements for testing of the Communications Cabling System.

##### 1.02 SUBMITTALS

- A. Provide the following per the criteria set forth in Submittals in Division 27 Specification Section *Basic Communications Requirements*:
1. Other:
    - a. Testing (see Part 2 – Testing herein):
      - 1) Provide a list of proposed test equipment for use in verifying the installation of the communications cabling system.
        - a) Provide for each testing device:
          - i. Manufacturer and product number.
          - ii. Manufacturer documentation showing date and outcome of last re-calibration. Testing device shall have been re-calibrated within the manufacturer's recommended recalibration period.
          - iii. Manufacturer documentation showing software revision. Software revision shall be most current revision available for the device and shall be based upon the most current TIA/EIA testing guidelines.
          - iv. Patch cords and other specialized components.
      - 2) Provide proposed test result forms.
    - b. Provide the calculated optical fiber cable loss budget for each optical fiber cable in the system (see Part 3 – Execution: Testing herein)

#### PART 2 - MATERIALS

##### 2.01 TESTING

- A. General
1. Testing of the systems shall be in accordance with the manufacturer's recommendations and with the Governing Requirements.
  2. Test reports shall be complete and in accordance with the appropriate Governing Requirements.
  3. Where testing discloses deficiencies in the work, the Contractor shall rework, repair, or replace equipment and systems found deficient. The Contractor shall continue remedial measures and retesting until satisfactory results are obtained. Remedial measures and retesting shall be at no additional cost to the Owner.
  4. Testing of product or equipment prior to installation shall include performance testing to establish the applicability of equipment for its intended purpose. The Contractor shall:
    - a. Establish the required test procedures from required Governing Requirements and manufacturer's recommendations.
    - b. Provide necessary test equipment, power, and consumables to perform the test.
    - c. Notify the Engineer of test schedule(s) at least one week in advance.
    - d. Perform test.

- e. Provide test result documentation to the Engineer.
- 5. Final testing and start-up of product, equipment, and systems shall include establishing proper capacity, operation, maintenance, and compliance with Governing Requirements. The Contractor shall:
  - a. Provide the services of manufacturer's representatives for systems to be tested and started up.
  - b. Establish the required test procedures from required Governing Requirements and manufacturer's recommendations.
  - c. Provide necessary test equipment, power, and consumables to perform the test.
  - d. Notify the Engineer of test schedule(s) at least one week in advance.
  - e. Perform tests and start-up functions.
  - f. Provide documentation of test results and fully operational systems to the Engineer.
- 6. Test records shall be provided on a form approved by the Engineer.
- B. Systems Specific: Test shall be performed for each of the following systems as follows:
  - 1. Communications Cabling System
    - a. Test records:
      - 1) Each cable in the system shall be tested. Test result forms shall include the cable identifier, tests performed, outcome of tests and indication of errors found, cable length, retest results, and name and signature of technician completing the tests. Test result forms shall be provided to the Owner and Engineer for review and acceptance.
      - 2) Test records for each cable within the system shall be printed directly from the tester and shall be submitted in paper form (in a binder) and on compact disk to the Owner and Engineer for review. Handwritten test results will not be accepted.
    - b. Testing Devices: Testing devices shall be capable of storing and printing test records for each cable within the system.
      - 1) For copper cables: Fluke DTX 1800 Series or newer.
        - a) Testing device shall be a TIA/EIA TSB-95 Level 3 testing instrument re-calibrated within the calibration period recommended by the manufacturer, with the most current software revision based upon the most current TIA/EIA testing guidelines.
      - 2) For fiber cables: Fluke DTX 1800 Series or newer.
        - a) Testing devices shall consist of a light source/power meter with a stabilized light source for end-to-end attenuation testing and an Optical Time Domain Reflectometer (OTDR) for testing on the reel, for continuity and quality testing, for accurately determining cable length, and for locating and correcting problems noted during attenuation testing. Testing equipment shall be calibrated and traceable to the National Institute for Standards and Technologies (NIST), with an operating range of 850 +/- 30 nm or 1300 +/- 20 nm for multimode testing in accordance with TIA/EIA-526-14 for multimode testing, and an operating range of 1310 +/- 10nm or 1550 +/- 20 nm in accordance with TIA/EIA-526-7 for singlemode testing.
        - b) To ensure quality connectorization, a microscope of not less the 200x magnification shall be used to visually inspect connectors and splices after installation.

## **PART 3 - EXECUTION**

### **3.01 GENERAL**

- A. Work shall comply with the Governing Requirements as defined in Division 27 Specification Section *Basic Communications Requirements*. Governing Requirements of particular relevance to this Section include, but are not limited to:
  - 1. Testing:
    - a. TIA/EIA - 455: Fiber Optic Test Standards
    - b. TIA/EIA - 526: Optical Fiber Systems Test Procedures
    - c. TIA/EIA - 568 Commercial Building Telecommunications Cabling Standard
    - d. IEEE 802.3 (series): Local Area Network Ethernet Standard, including the IEEE 802.3z Gigabit Ethernet Standard

### 3.02 TESTING

- A. General
  - 1. All cables shall be tested in accordance with this document, the ANSI/TIA standards, the PANDUIT® Certification Plus System Warranty guidelines and best industry practice.
  - 2. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the DPS project team for clarification and resolution.
    - a. All twisted-pair copper cable links shall be tested for Category 6 compliance per the requirements in ANSI/TIA 1152 and ANSI/TIA 568-C.2 using a test unit meeting a minimum IEC IIIe level of accuracy.
    - b. All Category 6 cables shall have a minimum of +3db of headroom.
    - c. All testers used must have been factory calibrated by the manufacturer within one year of use or according to factory calibration recommendations, whichever is the more stringent.
    - d. Contractor shall set references according to manufacturer's recommendation prior to each day's testing and reset references anytime tester is left unused for more than two hours.
    - e. All installed fiber shall be tested for link-loss in accordance with ANSI/TIA-C.0 and shall be within limits specified within ANSI/TIA-C.3. DPS may further define acceptable link loss thresholds for specific fiber links.
    - f. For horizontal cabling systems using multimode optical fiber, attenuation shall be measured in one direction at either 850 nanometer (nm) or 1300 nm using an LED light source and power meter.
    - g. Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for single mode) in both directions.
    - h. Test set-up and performance shall be conducted in accordance with the ANSI/568-C.0 Standard, Method B. All test leads must be reference cords built specifically for fiber testing. Fiber testing performed using standard fiber jumpers will be considered invalid and must be repeated by the Contractor at no cost to DPS.
    - i. Where multiple links are combined to complete a circuit between devices, the Contractor shall test each individual terminated fiber link - so only basic link loss is required. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA 568-C.3 Standard unless specified otherwise in by DPS.
    - j. Attenuation testing shall be performed with stable launch conditions, using as test leads true fiber reference cords built to that purpose. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements. While an OTDR may be useful to determine exact locations of light loss, only a loss meter is required for simple link performance verification.
    - k. Test Results and Documentation:

- l. Upon completion of the installation and testing, the telecommunications contractor shall provide three (3) full documentation sets to the DPS/DoTS for approval within three weeks of completion of installation.
- m. Test results must be in the tester native format, spreadsheets will not be accepted.
- n. The media shall be clearly marked on the outside front cover with the words “Project Test Documentation”, the project name, and the date of completion (month and year).
- o. The results shall include a complete record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction (where applicable), reference setup, and test crew member name(s).
- p. The test equipment name, manufacturer, model number, serial number, software (OS) version, model number of test heads and leads (where applicable), and last calibration date will also be provided at the end of the document.
- q. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation.
- r. The test document shall detail the test method used and the specific settings of the equipment.
- s. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented in the documentation.
- t. DPS reserves the right to confirm contractor test results with random testing by a 3rd party including the right to require contractor to perform 100% retesting based upon the results of these random tests.
- u. Mandated retests based on discovery of faulty methods/results shall be performed at Contractor's expense.
- v. Record Drawings are to include cable routes and outlet locations. Their sequential number as defined elsewhere in this document shall identify outlet locations.
- w. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided.
- x. DPS will provide floor plans in paper and electronic (DWG, AutoCAD - latest version) formats on which as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the DPS in hard copy and electronic form (AutoCAD).

#### **PART 4 - EQUIPMENT SCHEDULE**

##### **4.01 – NOT USED**

**END OF SECTION 27 17 20**