

**SECTION 16715  
TELECOMMUNICATIONS ACCEPTANCE TESTING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Testing Publications and Standards
- B. Inspection and testing procedures for copper and fiber optic cable systems
- C. Documentation and As-Built Requirements

**1.2 PUBLICATIONS AND STANDARDS**

- A. Electronics Industry Alliance/Telecommunications Industry Association (EIA/TIA)
  - 1. EIA/TIA 568A - Commercial Building Telecommunications Wiring Standard
  - 2. EIA/TIA 569 - Commercial Building Standard for Telecommunications Pathways and Spaces
  - 3. EIA/TIA TSB 36 - Technical Systems Bulletin Additional Cable Specifications for Unshielded Twisted Pair Cables
  - 4. EIA/TIA TSB 40A - Additional Transmission Specifications for Unshielded Twisted-Pair Connecting Hardware
  - 5. EIA/TIA TSB 67 - Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems.
  - 6. EIA/TIA TSB 72 - Centralized Optical Fiber Cabling Guidelines
  - 7. EIA/TIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
  - 8. EIA/TIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
  - 9. EIA - 310-D - Cabinets, Racks, Panels, and Associated Equipment
  - 10. EIA/TIA-455-57A - Optical Fiber End Preparation and Examination
  - 11. EIA/TIA 455-59 - Measurement of Fiber Point Defects Using An OTDR
  - 12. EIA/TIA 455-60 - Measurement of Fiber or Cable Length Using An OTDR
  - 13. EIA/TIA 455-61 - Measurement of Fiber or Cable Attenuation Using An OTDR
  - 14. EIA/TIA 455-95 - Absolute Optical Power Test for Optical Fibers and Cables
  - 15. EIA/TIA 526-14 - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
  - 16. ANSI/ICEA S-83-596-1994 - Fiber Optic Premises Distribution Cable Technical Requirements

- B. Federal Communications Commission (FCC) part 15 and part 68
- C. Rural Utilities Services (RUS), Bulletin 345-63, RUS Standards for Acceptance Tests and Measurements of Telephone Plant

### **1.3 RELATED SECTIONS**

- A. Contract Terms and Conditions
  - 1. Section 16710 - Telecommunications General Requirements
  - 2. Section 16720 - Telecommunications Basic Materials and Methods
  - 3. Section 16725 - Telecommunications Cable
  - 4. Section 16730 - Underground Structures – Telecommunications.
  - 5. Section 16760 - Telecommunications Grounding and Bonding

### **PART 2 - PRODUCTS**

Not Used

### **PART 3 - EXECUTION**

#### **3.1 GENERAL PROCEDURES**

- A. The Contractor will provide all tools, equipment, and fully trained staff necessary to conduct fully witnessed acceptance testing of all installed telecommunications-related products and systems.
- B. The Contractor shall prepare a complete test plan for all installed telecommunications systems for review and approval by the Engineer of Record. The plan shall show, at a minimum, test configurations, calibration procedures, impedances, and measurement equipment. The scope of this work includes, but is not limited to, the following:
  - 1. All system(s) shall be checked for compliance with these specifications.
  - 2. The Contractor shall maintain a check-off list for University reference during tests.
  - 3. The result of the measurements outlined shall be recorded and submitted along with current as-built drawings to the Engineer of Record as final proof of system performance.
  - 4. The Contractor shall expeditiously replace any system not meeting specifications at no cost to the University. Failure to act in an expeditious manner to properly remedy any abnormality resulting from installation/construction defects or workmanship; faulty material; and/or the failure of the systems, components, or the cable medium to perform in accordance with the University and/or Manufacturer's technical specifications may cause the University to "file a stop work notice" on any other telecommunications development or construction associated with this project. The Engineer of Record will notify the Contractor in writing of such action and is absolved and shall be held harmless from any delays, costs over-runs, scheduling difficulties, etc. assessed by others due to the Contractor's failure to meet the final proof of system performance specifications. Final as-builts will be provided, as specified, at the end of the project.
  - 5. All systems shall meet the bid specifications and be accepted by the Engineer of Record before the work will be considered complete.

- C. After the Contractor has provided complete documentation of all testing and the documentation has been reviewed by the Engineer of Record, the Contractor shall conduct “proof of performance” testing on selected components at the direction and discretion of the Engineer of Record. Such testing will utilize the same equipment and procedures used to conduct and document the initial tests but will be applied on a random basis to verify the testing documentation. If in the judgment of the Engineer of Record, the proof-of-performance test results vary significantly from the acceptance test results, the Contractor shall continue with testing until cleared by the Engineer of Record.
- D. All test equipment shall be calibrated by a certified laboratory or the manufacturer within the last six months, and such certification shall be submitted to the Engineer of Record prior to testing.
- E. All testing shall be coordinated with the Engineer of Record (providing a minimum of one week’s notice) to ensure all acceptance and proof-of-performance testing can be witnessed by qualified personnel.

### **3.2 INSPECTION AND TESTING PROCEDURES FOR COPPER CABLE**

- A. The Engineer of Record/Inspector of Record will conduct routine inspections of the work in progress, and any deficiencies will be discussed at the regular progress meeting. In the event the Engineer of Record/Inspector of Record determines work is progressing in an incorrect manner and waiting for the regular meeting could cause further problems, the Contractor’s on-site project manager will be notified.
- B. Copper Station Cables: The Contractor shall conduct witnessed acceptance testing on all station cables installed as part of this project as defined below:
  - 1. Each station cable and all riser cable pairs will be tested for crosses, opens, grounds, reversed and/or transposed pairs, shorts, foreign battery, continuity, and resistance (in ohms). All riser cable pairs shall be tested for loss in dB. All problems will be resolved and the cable re-tested to ensure compliance.
  - 2. Using a Category 6 rated pair scanner or similar device, all copper station cables will be tested to verify the installation meets the EIA/TIA Category 6 performance specifications as defined in TSB-40A and TSB 67. All test documentation shall be provided as individual prints of forms from data stored in the test instrument, or replicas of that data as transferred to a PC compatible computer. The identification of each circuit shall be entered during the test and shall be part of the printed form. The form shall provide measured values for all parameters required per TSB-40A and TSB 67-A-5 with pass/fail indication for Category 6 requirements. The circuit identification on the test form shall be the same as that on the jack. All test results, including jack numbers, shall be printed on a hardcopy report. All copper station wires shall meet or exceed this performance standard.
  - 3. All pair scanners used on the project shall be calibrated to a single common test cable at the start of each shift and after changing batteries. The hardcopy of the calibration results shall be included as a reference with each batch of station test results submitted.
  - 4. Station wire test results shall also be provided in electronic format (floppy disk) in the latest version (campus standard) of Microsoft Excel.

- C. Copper Interbuilding and Entrance Cables: The Contractor's witnessed acceptance testing on all interbuilding and entrance cables installed as part of this project is defined below:
1. The correct and continuous bonding of cable shields through all outside plant cable splices shall be verified. This test shall be conducted from the MDF and BDF prior to strapping shield grounds at splice or termination points.
  2. Each cable pair shall be tested for crosses, opens, grounds, reversed and/or transposed pairs, shorts, foreign battery, continuity, resistance (in ohms) and loss in dB.
  3. All irregularities will be resolved and the cable re-tested to ensure compliance.
  4. Copper Inter-building and Entrance Cable test results shall be provided in electronic format (floppy disk) in the latest version (campus standard) of Microsoft Excel.

### 3.3 INSPECTION AND TESTING PROCEDURES FIBER CABLE

A. Fiber Optic Station Cable

1. The appropriate high resolution OTDR device shall be used to test the fiber station cable. Tracing printouts (noting the appropriate optical fiber and buffer tube color designation) shall be mounted on separate pages and bound into a three-ring notebook. An incremental scale that reflects the short lengths of cable involved in these tests shall be utilized.
2. All fiber station cable shall be tested from the building's BDF to each fiber station outlet. The results of OTDR testing to define the length of each station cable shall be documented. The Contractor shall conduct a power meter (loss) test of each fiber optic station cable at both wavelengths A to B, B to A, and OSPL (OSPL is defined as  $L_a + L_b$ ). No individual station link segment (including connectors) shall measure more than 2.0 dB loss. Tests shall be conducted using ANSI/EIA/TIA-526-14A, Method B. The Contractor shall provide a typed list reflecting cable ID and actual measured loss.
3. Fiber optic station cable test results shall be provided in electronic format (floppy disk) in the latest version (campus standard) of Microsoft Excel.

B. Fiber Optic Inter-building and Entrance Cable

1. The appropriate high resolution OTDR device to test the fiber interbuilding and entrance cables shall be used. Tracing printouts (noting the appropriate optical fiber and buffer tube color designation) shall be mounted on separate pages and bound into a three-ring notebook. An incremental scale that reflects the short lengths of cable involved in these tests shall be utilized.
2. All inter-building fiber optic cables shall be tested from the MDF to each building's BDF terminal. The results of OTDR testing to define the length of each inter-building cables shall be documented.
3. The Contractor shall conduct a power meter (loss) test of each fiber optic station and riser cable at both wavelengths A to B, B to A, and OSPL (OSPL is defined as  $L_a + L_b$ ). No individual fiber link segment (including connectors) shall measure more than 2.0 dB. The tests shall be conducted using ANSI/EIA/TIA-526-14A, Method B. A typed list reflecting cable ID and actual measured loss shall be submitted to the Engineer of Record.
4. Fiber optic inter-building and entrance cable test results shall be provided in electronic format (floppy disk) in the latest version (campus standard) of Microsoft Excel.

### **3.4 DOCUMENTATION**

#### **A. Fiber Cable Systems**

1. All documentation shall be neatly and legibly done and shall provide a clear understanding of the installed system.
2. The Contractor shall prepare "as-built" plans of all work including interbuilding, entrance, and riser cable locations with footage. All approved changes and actual in-place footage shall be marked, in red, on a full size drawing. The as-builts shall include all fiber optic cable placed with cable lengths, fiber assignments, and cable numbers and counts.
3. The Contractor shall provide signed originals of all acceptance testing documents, which are:
  - a. Fiber optic insertion loss results (using forms provided by the University)
  - b. OTDR graphs and printouts and test results (in a 3-ring binder)
  - c. Current test equipment certifications

#### **B. Copper Cable Systems**

1. The Contractor shall use forms provided by the University or by the Structured Cabling System manufacturer, if approved by the Engineer of Record, to document the successful testing of all copper cables.
2. Category 6 station cable test results noting unique station number and group test results by floor shall be provided.
3. The Contractor shall neatly note floor plans with "as-built" station number and any changes, additions, or deletions to outlet placement. Interbuilding, entrance, and riser plans shall be updated to include actual routes, cable numbers and counts, and lengths of cables.

**END OF SECTION**