

## **SECTION 27 17 00 - TESTING, IDENTIFICATION AND ADMINISTRATION**

### **PART 1 - GENERAL**

#### **1.1 WORK INCLUDED**

- A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents.

#### **1.2 SCOPE**

- A. This section includes the minimum requirements for the testing, certification administration and identification of backbone and horizontal cabling.
- B. This section includes minimum requirements for the following:
  - 1. UTP testing and testers
  - 2. Optical fiber testing and testers
  - 3. Labels and labeling
  - 4. Documentation

#### **1.3 QUALITY ASSURANCE**

- A. All testing procedures and testers shall comply with applicable requirements of:
  - 1. TIA/EIA TSB-67 Field Testing of UTP
  - 2. TIA/EIA 568-A Annex H
- B. Identification and administration work specified herein shall comply with the applicable requirements of:
  - 1. ANSI/TIA/EIA - 606
  - 2. ANSI/TIA/EIA - 569
  - 3. ANSI/TIA/EIA - 568A
  - 4. BICSI Telecommunications Distribution Methods Manual

#### **1.4 SUBMITTALS**

- A. Manufacturers catalog sheets and specifications for cable testers.
- B. Sample documentation from previous job for administration, test results and as-built drawings.
- C. Test reports (submit prior to substantial completion punch list is performed)
- D. 3 copies of a Binder and electronic files containing all spreadsheets end to end reports and as built drawings called for at the completion of job.

## PART 2 - PRODUCTS

### 2.1 OPTICAL FIBER CABLE

- A. Multimode optical fiber light source
1. Provide 850nm and 1300nm +/- 20 nm wavelength LED light sources
  2. Spectral width of sources shall be <math>\leq 50\text{nm}</math> for 850nm wavelengths and <math>\leq 140\text{nm}</math> for 1300nm wavelengths.
  3. The output of the light source shall be 8 MW for 62.5um core optical fiber
  4. Output Stability +/- 0.40 dB from 0 to 50 degrees C
  5. Long Term output stability +/- 0.10dB at 25 degrees C
  6. Power shall be from rechargeable Ni-Cad batteries
  7. Connector types shall include: SMA, FC, ST and LC
  8. Design make: Siecor Light source
  9. Acceptable Manufacturers:
    - a) Fluke
    - b) Wavetek
    - c) Lantek
    - d) Amp
- B. Single mode optical fiber light source
1. Provide 1300nm and 1500nm +/- 20 nm wavelength Laser light sources
  2. Output Stability +/- 0.40 dB from 0 to 50 degrees C
  3. Long Term output stability +/- 0.10dB at 25 degrees C
  4. Power shall be from rechargeable Ni-Cad batteries
  5. Connector types shall include: SMA, FC, ST and LC
  6. Design make: Siecor OS-200D
  7. Acceptable Manufacturers:
    - a) Fluke
    - b) Meson
    - c) Amp
- C. Power Meter
1. Provide 850nm, 1300nm and 1500nm +/- 20 nm wavelength test capability
  2. Measurement range shall be from 10 to -60 dBm
  3. Accuracy shall be +/- 5% at 0 to -50dBm and +/- 10% 10 to 0dBm and -50 to -60 dBm.
  4. Resolution shall be 0.1 dB
  5. Connector types shall include: SMA, FC, ST and LC
  6. Design make: Siecor OM-100F
  7. Acceptable Manufacturers:
    - a) Fluke
    - b) Meson
    - c) Amp

## 2.2 100 OHM UTP TESTER

- A. User Interface
  - 1. 128 x 64 backlit LCD display
  - 2. Date stamp of all tests
  - 3. Tone generation audio warning.
- B. Physical interface shall be modular RJ-45 connector and a serial port with DB-9 connector.
- C. Shall test cable for compliance with the following standards:
  - 1. TIA Cat 3 and 5 per TIA TSB-67: Basic Link or Channel
  - 2. TIA Cat 5 (new) and 5E: Basic Link or Channel
  - 3. ISO/IEC 11801 and EN 50173 Class C and D: Link
  - 4. ISO/IEC 11801 and EN 50173 Class C and D (new): Permanent Link or Channel
  - 5. Aus/NZ Class C and D: Basic Link or Channel
  - 6. STP cabling, (IBM Type 1, 150  $\Omega$ )
  - 7. ANSI TP-PMD IEEE 802.3 10BASE5, 10BASE2: Ethernet with coaxial cabling
  - 8. IEEE 802.3 10BASE-T, 100BASE-TX, 1000BASE-T: Ethernet with twisted pair cabling IEEE 802.5: Token Ring, 4 Mbps or 16 Mbps
- D. Shall perform the following tests as a minimum:
  - 1. NEXT, NEXT @ Remote
  - 2. Wire Map
  - 3. Characteristic Impedance
  - 4. Length
  - 5. DC Loop Resistance
  - 6. Propagation Delay Return Loss (RL), RL @ Remote
  - 7. Delay Skew
  - 8. Attenuation
  - 9. Attenuation-to-Crosstalk Ratio (ACR), ACR @ Remote
  - 10. Power Sum ACR, PSACR @ Remote
  - 11. ELFEXT, ELFEXT @ Remote
  - 12. Power Sum ELFEXT, PSELFEXT @ Remote
  - 13. Power Sum NEXT, PSNEXT @ Remote
- E. Shall use injector for complete wire mapping and TDR for determining cable length.
- F. Shall measure NEXT for all six pair combinations and Attenuation on all four pairs from 1.0 to 350 MHz.
- G. Design Make: Fluke "DSP 4000"
- H. Acceptable Manufacturers:
  - 1. Fluke
  - 2. WaveTek

3. Lantek

## **2.3 LABELS**

- A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
- B. Shall be preprinted or laser printed type.
- C. Where used for cable marking provide vinyl substrate with a white printing area and a clear "tail" that self laminates the printed area when wrapped around the cable.
- D. Where insert type labels are used provide clear plastic cover over label.
- E. Provide plastic tape 6 inches wide continuously printed and bright colored 18" above all direct buried services.
- F. Provide engraved plastic laminated labels, signs and instruction plates. Labels shall be made of engraving stock melamine plastic laminate. Use 1/16" minimum for signs up to 20 square inches or 8 inches in length. Use 1/8" thick for larger sizes. All labels shall be punched for mechanical fastening.
- G. Acceptable Manufacturers:
  1. W.H. Brady
  2. Panduit
  3. Ideal

## **PART 3 - EXECUTION**

### **3.1 OPTICAL FIBER CABLE TESTING**

- A. Backbone Cable
  1. Test the cable on the reel for continuity before installing it, to insure no damage was done in shipment from the manufacturer to the job site.
  2. After installation and termination, test each segment of the cable plant individually as it is installed, to insure each connector and cable is good.
  3. Link attenuation is the only required field test except for the patched runs in the campus backbone system where an OTDR test will be required. Use launch cables at each end and provide print outs showing all connectors. OTDR will also be required to determine bad connections or damage when the link attenuation test fails.
  4. Maximum localized attenuation allowed is 2dB.
  5. Backbone multimode fiber shall be tested in one direction at both 850nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A method B.

6. Backbone single mode fiber shall be tested in one direction at both 1310nm and 1550 nm in accordance with ANSI/EIA/TIA-526-14A method A.1.

7. Multimode fiber shall conform to the following:

850 nm:

<u>Length (meters)</u>	<u>Attenuation (dB)</u>
500	3.5
1000	5.5
1500	7.5
2000	9.0

1300 nm:

<u>Length (meters)</u>	<u>Attenuation (dB)</u>
500	2.2
1000	3.0
1500	3.8
2000	4.5

8. Single Mode Fiber shall conform to the following (note: taken at 1550nm)

Inside:

<u>Length (meters)</u>	<u>Attenuation (dB)</u>
500	2.0
1000	2.5
1500	3.0
2000	3.5
2500	4.0
3000	4.5

Outside:

<u>Length (meters)</u>	<u>Attenuation (dB)</u>
500	1.8
1000	2.0
1500	2.2
2000	2.5
2500	2.8
3000	3.0

B. Documentation

1. Provide attenuation and cable length test results for all installed cable pairs.

### 3.2 100 OHM UTP CABLE TESTING

A. The testing parameters called for in this section shall apply for up to 90 meters of horizontal cable, a work area equipment cord, an RJ45 outlet and 2 cross connect connections in the closet.

B. The test parameters shall include Wire Map, Length, Attenuation and NEXT

C. Wire Map

1. The wire map test shall verify pair to pin termination at each end and check for connectivity errors. The wire map shall indicate the following for each of the eight conductors:
  - a) Continuity to the remote end
  - b) Shorts between any two or more conductors
  - c) Crossed pairs
  - d) Reversed Pairs
  - e) Split Pairs
  - f) Any other miswiring

D. Cable Length

1. The maximum length of the test link including the test equipment cords shall be 94 meters.
2. The link attenuation and NEXT of all cables shall be tested. The link is the sum of the attenuation of all connecting hardware, 10 meters of patch and equipment cords, and 90 meters of cable. The following tables indicate the acceptable values:

E. Data reporting and accuracy

1. General: a Pass or Fail result for each parameter shall be determined by the allowable limits for each parameter. If the test result of a parameter is closer to the test limit than the accuracy of the tester it shall be marked with an asterisk. Data at all measured points shall be uploaded to a P.C. and printed on a laser printer.
2. Wire Map: Wire map tests shall be marked "Pass" if wiring is determined correct.
3. Length: Test results shall be provided in meters and marked "Pass or Fail" based on the length vs. allowable length.
4. Attenuation: Report the attenuation value and the frequency at point of failure or the highest frequency passed. Measured attenuation values lower than 3dB used for a pass/fail determination. Report the attenuation per unit length for links longer than 15 meters. Attenuation shall be measured from 1 MHz to 16 Mhz (Category 3) or 100 Mhz (Category 5) in 1 MHz steps.
5. NEXT: Report the NEXT value and "pass or fail" for samples based on the following:
6. Submit the test results to the engineer in a spiral binder and on CD prior to substantial completion punch list.

### 3.3 IDENTIFICATION & RECORDS

#### A. Pathways

1. Pathways shall be marked at each endpoint and at all intermediate pull or junction boxes. In the case of partitioned pathways (i.e. innerduct) each partition shall have a unique identifier. Pathways shall be labeled in using the following abbreviations:
  - a) CT# - Cable trays
  - b) C# - Conduit
  - c) CH# - Cable hanger runs
2. Mark all conduit pathways at junction boxes and end points with laser printed adhesive tape. (This includes conduits provided by the division 16 contractor)
3. Mark cable hanger runs with laser printed adhesive tape every 3<sup>rd</sup> hanger in main hanger runs. (this includes the required spare cable hanger runs)
4. Provide records in computer generated, table format for all pathways with the as-built drawings. The table shall include the following information:
  - a) Pathway Identifier
  - b) Pathway type
  - c) Percent fill
  - d) Cable identifiers in the pathway
  - e) Length of pathway
  - f) Number and identifier of pullpoints in the pathway

#### B. Rooms and Spaces (Includes entrance facilities, communication equipment rooms, communication equipment spaces and work areas)

1. Provide lamicoid type label, with 1" high white lettering on the door to room or on the plywood backboard in the case where the CER is located inside a lab or other room. Mechanically fasten the label to the door or plywood. Verify the background color with the architect.
2. Label shall indicate CER and the letter i.e. CER-A
3. Provide written records in computer generated, table format for all rooms and spaces with the as-built drawings. The table shall include the following information:
  - a) Space Identifier
  - b) Space type
  - c) Pathways terminating in space
  - d) Cables that terminate in space
  - e) Room numbers served by the CER
  - f) Power panel and circuits serving the space

C. Cables

1. Cables shall be marked at each endpoint and at all intermediate pull or junction boxes. Provide label on the cable and on the faceplate. Label cables using the following convention:
  - a) Cat 6A Cables for data:  
AA01 – A=CER, A= Cat A rack mounted Patch panel, 01 = Port number on patch panel
  - b) Cat 6A for wall telephones:  
AA01 - A=CER, A =Wall mounted 110 block, 01 = the first of 4 port that the 4 pair cable is terminated on
  - c) Coaxial cable:  
AL1T1A – A=CER, L1=trunk from CER, T1=Tap in trunk, A=port on tap
2. Provide written records in computer generated, table format for all cables, with the as-built drawings. The table shall include the following information:
  - a) Cable Identifier
  - b) Cable type
  - c) No. of strands (optical fiber) or pairs (UTP)
  - d) Length
  - e) Pathway identifiers that cable is routed through
  - f) Room number of Station outlet

D. Optical Fiber

1. Provide laser printed label for each fiber pair.
2. The labels shall read as follows AB1 (A= from closet A, B = to closet B, Pair 1 in the A closet)
3. The label shall be identical at both ends.

E. Station Outlets

1. Provide 606 insert with clear plastic label cover on faceplates.
2. Provide a laser printed label in the insert.
3. Provide laser printed adhesive labels on station outlets in surface metal raceway.
4. Labels shall match the cable identifier called for in item C. above.

F. Patch Panels

1. Label patch panels with laser printed adhesive markers
2. Each panel shall be labeled using a Letter designation (A,B,C etc.)

### **3.4 END -TO - END REPORTS**

- A. Provide computer generated spread sheet (Lotus, Excel or Quattro Pro) that details each communication outlet from work area connection to patch panel. The spread sheet shall have columns identifying the station outlet and cable ID room number, pathway ID(s), cable type, and length.

### **3.5 CROSS CONNECT REPORT**

- A. Provide computer generated spread sheet (Lotus, Excel or Quattro Pro) that identifies the patch panel port, type of patch (FO or UTP) and the hub or switch port.
- B. Label Hubs and switches ports using the following convention:
  - 1. 10BT-Letter-port no. (10BT-A-12) - Ethernet Hubs
  - 2. ES-Letter-port no. (ES-B-10) - Ethernet Switch (provide F prefix on Fast Ethernet ports)

### **3.6 AS - BUILT DRAWINGS**

- A. Provide as-built drawings showing all pathways, Station outlets, equipment rooms and entrance facilities on 1/8 scale floor plans.
- B. Provide rack elevations for all equipment cabinets and racks indicating rack, patch panels and hardware identifiers.
- C. The as-builts shall indicate all identifiers on pathways, closets and station outlets and be provided in a dwg, dxf or visio format.

**END OF SECTION**

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