

## SECTION 27-08-13 TESTING OF COPPER CABLES

### PART 1 – GENERAL

#### 1.01 DESCRIPTION

- A. The work covered by this section of the Specifications includes all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction. The work of this section shall include, but is not limited to, the following:
  - 1. Cable testing for copper cables.
  - 2. Providing testing results in accordance with the strictest manufacturers' written recommendations.

#### 1.02 QUALITY ASSURANCE

- A. Refer to Section 27-00-00 for general details.

#### 1.03 CODES, STANDARDS AND GUIDELINES

- A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations in Section 27-00-00.
- B. The Cal Poly ITS Telecomm group, Telecommunications Standards Document and the Labeling, Design and Syntax Standards in Appendix B.

#### 1.04 SUBMITTALS

- A. Refer to Section 27-00-00 for general details.
- B. Shop Drawings:
  - 1. None Required
- C. Submit Manufacturer's Cut Sheets for the following:
  - 1. Any products not specifically listed in the PRODUCTS section shall require a submittal of the manufacturer's cut sheets and approval by the Cal Poly ITS Telecomm group.
- D. List of test equipment to be used.
- E. Sample of test data to be provided to the Cal Poly ITS Telecomm group representative prior to the start of testing for review, comment and acceptance.
- F. Identity and qualifications of Contractor's personnel who will perform the testing.
- G. Submit the proposed schedule for performing testing at least 2 weeks prior to the start of testing.

#### 1.05 IDENTIFICATION

- A. For details, refer to Section 27-05-53 and the Cal Poly ITS Telecomm group Labeling, Design and Syntax Standards in Appendix B.

## 1.06 DEFINITIONS

- A. N/A

## 1.07 WARRANTY

- A. Refer to Section 27-00-00 for general details.

## PART 2 – PRODUCTS

### 2.01 CATEGORY 3 UTP CABLE TESTER

- A. Testing for all cables 25 pair or larger are to use a tester that tests 25 pair at a time.
- B. The field tester must meet the requirements of ANSI/TIA/EIA-568.
- C. Make and model to be submitted for approval by the Cal Poly ITS Telecomm group prior to start of testing.

### 2.02 CATEGORY 6 UTP CABLE TESTER

- A. The field tester must meet the requirements of ANSI/TIA/EIA-568-B.2, Addendum 1
- B. Tester must output test results with Fluke's LinkWare reporting software. PDF format is unacceptable. Alternate reporting software may be used if the associated software (with license if required) is given to the Cal Poly ITS Telecomm group. (Software not to be returned)
- C. Make and model to be submitted for approval by the Cal Poly ITS Telecomm group prior to start of testing.

### 2.03 MULTIMETER

- A. Make and model at Contractor's discretion with Cal Poly ITS Telecomm group approval.

### 2.04 CATV COAX TESTER

- A. Test equipment for the CATV coax wiring must provide TDR and sweep test information.

## PART 3 – EXECUTION

### 3.01 GENERAL

- A. The Contractor shall test, as described below, all metallic cables installed under these specifications.
- B. Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
- C. Where post-manufacturer test data has been provided by the manufacturer on the reel or shipping carton: Submit 2 copies to the Cal Poly ITS Telecomm group representative prior to installing cables.
- D. **Test fully completed systems only. Piecemeal testing is not acceptable.**
- E. **Testing shall not be performed until after all termination hardware is installed and attached, and all labeling and identification has been completed. If all work is not completed prior to testing, test data will be considered not acceptable and shall be redone and resubmitted.**
- F. **Any cable that does not pass all required testing shall be removed, replaced, and retested.**
- G. Remove and replace any defective cables from pathways system. Do not abandon cables in place.

- H. For 100 pair or smaller replace entire cable if a pair or conductor fails a required test. For larger pair count cables, replace if more than 2% of pairs fail a required test.
- I. The Cal Poly ITS Telecomm group reserves the right to observe all portions of the testing process.
- J. The Cal Poly ITS Telecomm group representative further reserves the right to conduct "Proof of performance testing," using Contractor equipment and labor. This shall be a random re-test of up to ten percent (10%) of the cable plant to confirm documented test results. If multiple errors are found, test percentages shall rise.
- K. Perform all tests as required by the manufacturer in support of the structured cabling system warranty.

### 3.02 QUANTITIES

- A. N/A

### 3.03 INSTALLATION

- A. N/A

### 3.04 GROUNDING & BONDING

- A. *All grounding and bonding is to be complete before any system testing is to be attempted.*

### 3.05 TESTING

- A. All test results are to be defined as acceptable / unacceptable using the requirements of ANSI/TIA/EIA-568 B.
- B. Copper Cables – General Requirements
  - 1. After terminating and splicing all cables, test all cable pairs for:
    - a. Continuity to the remote end.
    - b. Shorts between any 2 or more conductors or ground
    - c. Transposed pairs
    - d. Reversed Pairs
    - e. Split Pairs
    - f. Crossed Pairs
    - g. Wire map.
    - h. Length.
    - i. Shield Continuity (If Shielded)
    - j. Continuity to Grounding (If Shielded)
  - 2. Using a (low ohm) multimeter, test continuity to ground (TGB or TMGB) for a maximum resistance of 1 $\Omega$ , see section 27-05-26 for additional detail.
- C. Indoor Riser or OSP Copper Cable
  - 1. After terminating and splicing the cables. Test all cable pairs for:

- a. DC Loop Resistance for any 2 conductors in the cable
- D. Category 6 Copper Station Cables:
1. After terminating both ends of all 4-pair cables, but before any equipment is installed, test these cables for the following:
    - a. Return Loss
    - b. Insertion Loss
    - c. Attenuation
    - d. NEXT (near-end crosstalk)
    - e. PSNEXT (power sum near-end crosstalk)
    - f. FEXT (far end crosstalk)
    - g. ACR-F (attenuation to crosstalk ratio)
    - h. PSACR-F (power sum attenuation to crosstalk ratio)
    - i. Propagation delay
    - j. Delay skew
    - k. Cable length

### 3.06 ACCEPTANCE

- A. All test results for CAT 3 cable are to be documented and submitted in the Manufacturer's native format to the Cal Poly ITS Telecomm group representative (both in a binder and electronically) within five (5) working days of test completion. Alternate reporting software may be used if the associated software (with license if required) is given to the Cal Poly ITS Telecomm group. (Software not to be returned)
- B. All test results for CAT 6 cable to be documented and submitted in Fluke LinkWare format to the Cal Poly ITS Telecomm group representative electronically within five (5) working days of test completion. Alternate reporting software may be used if the associated software (with license if required) is given to the Cal Poly ITS Telecomm group. (Software not to be returned)
- C. ***Test result shall be recorded per cable and three identical copies placed on removable media (CD) for delivery to the Cal Poly ITS Telecomm group representative for review and acceptance.*** If test results are found acceptable, the Cal Poly ITS Telecomm group shall inform the Cal Poly Project Manager in writing or by email.
- D. Each test report shall contain the following general information:
  1. Date of Preparation.
  2. Date of Test.
  3. Project Name (Cal Poly building number).
  4. Contractor's Name
  5. Media Type.
  6. Make, Model and Serial Number of test equipment used.
  7. Date of Last Calibration.
  8. Names of Test Crew.

- E. In addition to the results of the specific tests specified, reports shall also include:
  - 1. Cable ID Number (See the Cal Poly Labeling, Design and Syntax Standards in Appendix B).
  - 2. Cable Type.
  - 3. Pair or Conductor Count.
  - 4. Individual Pair or Conductor Numbers.
  - 5. Results of Each Test for Each Pair or Conductor.
  - 6. Total Number of Serviceable Pairs or Conductors in Cable.
  - 7. Ground Resistance Measurements.
- F. Once the testing has been completed and the Cal Poly ITS Telecomm group representative is satisfied that all work is in accordance with the Contract Documents, the ITS Telecomm group representative will notify the Contractor and/or Cal Poly Project Manager in writing or via email.

**3.07 RECORD (AS-BUILT) DRAWINGS**

- A. None Required

END OF SECTION

DOCUMENT VERSION CONTROL

<b>REVISION</b>	<b>DATE</b>	<b>AUTHOR</b>	<b>REASON</b>
1	02/20/2014	R. VOLK	INITIAL DOCUMENT DEVELOPMENT
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