

## SECTION 27 15 13 - COMMUNICATIONS COPPER HORIZONTAL CABLING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Category 6 twisted pair cable.
  - 2. Twisted pair cable hardware, including connecting blocks, patch panels, plugs and jacks.
- B. Related Requirements:
  - 1. Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for data cabling associated with system panels and devices.

#### 1.3 DEFINITIONS

- A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- B. EMI: Electromagnetic interference.
- C. FTP: Shielded twisted pair.
- D. F/FTP: Overall foil screened cable with foil screened twisted pair.
- E. F/UTP: Overall foil screened cable with unscreened twisted pair.
- F. IDC: Insulation displacement connector.
- G. LAN: Local area network.
- H. Jack: Also commonly called an "outlet," it is the fixed, female telecommunications connector.
- I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.
- J. RCDD: Registered Communications Distribution Designer.
- K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

- M. S/FTP: Overall braid screened cable with foil screened twisted pair.
- N. S/UTP: Overall braid screened cable with unscreened twisted pairs.
- O. UTP: Unscreened (unshielded) twisted pair.

#### 1.4 COPPER HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
  - 1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
  - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
  - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. A work area is approximately 100 sq. ft., and includes the components that extend from the equipment outlets to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Reviewed and stamped by RCDD.
  - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
  - 2. Cabling administration Drawings and printouts.
  - 3. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:
    - a. Telecommunications rooms plans and elevations.
    - b. Telecommunications pathways.
    - c. Telecommunications system access points.
    - d. Telecommunications grounding system.
    - e. Telecommunications conductor drop locations.
    - f. Typical telecommunications details.
- C. Twisted pair cable testing plan.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer, installation supervisor, and field inspector.

- B. Product Certificates: For each type of product.
- C. Source quality-control reports.
- D. Field quality-control reports.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For splices and connectors to include in maintenance manuals.

#### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Contractor shall be recognized by the manufacturer providing the cable system performance warranty as an approved/certified installer of their product. Furnish a certificate from the manufacturer with the shop drawings.
  - 2. Contractor shall submit with shop drawings a list of the project team which shall include, as a minimum, the project manager and foreman. Note on the list the personnel that have been trained and certified by the data system manufacturer along with a brief description of their experience and training. Changes to project staffing after contract award must be requested, in writing, and approved by Owner prior to any changes.
  - 3. Where applicable, contractor shall have personnel trained and certified in category rated UTP and fiber optic cable installation, termination and testing techniques. Personnel shall have experience using a category rated cable tester, fiber optic light meter and power source and OTDR.
- B. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
- C. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
  - 1. Test each pair of twisted pair cable for open and short circuits.

#### 1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

#### 1.11 COORDINATION

- A. Furnish, install, connect, and test all items specified in this section.

- B. Provide all pathways, raceways, and boxes for horizontal cabling systems.
- C. Owner, through Architect, reserves the right to move any outlet or stubbed-up conduit, a distance of twenty-five feet before roughing-in, without additional cost to Owner.
- D. All electronics, active networking hardware, and end-user devices (telephones, computers, monitors, etc) to be furnished and installed by Owner.
- E. Contact the Owner's telecommunications network representative for specific instructions prior to beginning work.
  - 1. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.
- F. All materials shall be provided and installation shall be completed in accordance with Owner's latest telecommunication standards.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.
- B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- C. Grounding: Comply with TIA-607-D-1.

### 2.2 GENERAL CABLE CHARACTERISTICS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
  - 1. Communications, Non-plenum: Type CMR complying with UL 1666.
- B. All cable shall be riser rated, unless noted otherwise.
- C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
- D. RoHS compliant.
- E. Unless otherwise noted, all cabling shall utilize solid conductors.

### 2.3 ACCEPTABLE MANUFACTURER

- A. All horizontal distribution cabling used on project shall be of the same manufacturer.

- B. Manufacturers: Subject to compliance with requirements, provide cabling by one of the following:

1. Belden CDT Networking Division/NORDX.
2. Berk-Tek Leviton; a Nexans/Leviton alliance.
3. General Cable; General Cable Corporation.
4. Hitachi Cable America Inc.
5. Hubbell Premise Wiring.
6. Mohawk; a division of Belden Networking, Inc.
7. Superior Essex Inc.

## 2.4 CATEGORY 6 TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250MHz.
- B. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.
- C. Cable performance shall exceed TIA and ISO Category 6 standard levels by 3 dB in NEXT, PSNEXT, ACR, PSACR, ELFEXT, and PSELFEXT.
- D. Conductors: 100-ohm, 23 AWG solid copper.
- E. Shielding/Screening: Unshielded twisted pairs (UTP).

## 2.5 TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M.
  2. Belden CDT Networking Division/NORDX.
  3. Berk-Tek Leviton; a Nexans/Leviton alliance.
  4. CommScope, Inc.
  5. General Cable; General Cable Corporation.
  6. Hubbell Premise Wiring.
  7. Leviton Manufacturing Co., Inc.
  8. Mohawk; a division of Belden Networking, Inc.
  9. Panduit Corp.
  10. Siemon Co. (The).
  11. Superior Essex Inc.
- C. General Requirements for Twisted Pair Cable Hardware:
1. Comply with the performance requirements of Category 6.
  2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
  3. Cables shall be terminated with connecting hardware of same category or higher.

D. Connecting Blocks:

1. Type:
  - a. 110-style IDC for Category 6.
2. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.
3. Mounting: Rack-mounted.
4. Furnish all connecting blocks with labels and label holders.
5. Furnish protective covers, color coded to match cabling.

E. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

F. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables. Jacks are mounted in an angled panel to increase capacity of the rack.

1. Basis of Design: Leviton 69587 series.
2. Features:
  - a. Universal T568A and T568B wiring cards for 110-style terminations.
  - b. Color-coded front labeling for easy port identification (ANSI/TIA-606-B compliant).
  - c. Capable of multiple re-terminations.
  - d. 48 ports mounted in a plate with a 128-degree angled design.
3. Construction: 16-gauge steel and mountable on 19-inch equipment racks.
4. Number of Jacks per Field: One for each four-pair cable indicated.
5. Bandwidth: Shall exceed usable bandwidth for associated cabling.
6. Shall exceed IEEE 802.3bt standard up to 0.5 amps per conductor (100 watts) continuously for Type 4 POE applications.

G. Patch Cords: Factory-made, four-pair cables in 72-inch (1800-mm) lengths; terminated with an eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
2. Provide patch cords to connect patch panels to network equipment in each telecommunications space. Furnish one patch cord for 100 percent of voice and data outlets installed in project, plus 2 percent (minimum 10) spare.
3. Color: To match associated system cable color.

H. Equipment Cords: Factory-made, four-pair cables in 36-inch lengths; terminated with an eight-position modular plug at each end.

1. Equipment cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
2. Provide equipment cords to connect outlets to equipment and devices (wireless access points, building automation system, fire alarm system, security system, etc.). Furnish one equipment cord for each equipment outlet installed in project.
3. Color: To match associated system cable color.

I. Jacks and Jack Assemblies:

1. Basis of Design: Hubbell NextSpeed Series.
2. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
3. Designed to snap-in to a patch panel or faceplate.
4. Standard: Comply with TIA-568-C.2.
5. Accommodates T568A and T568B wiring.

J. Faceplates:

1. Rear-Loading, Flush-Mounted Faceplate:
  - a. Basis of Design: Hubbell IFP Series.
  - b. Type: Rear-loading, flush-mount for modular jacks and inserts.
  - c. Configuration: Four port, vertical single gang faceplates designed to mount to single gang wall boxes.
  - d. Quantity and configuration of jacks as indicated on drawings.
  - e. Plastic Faceplate: High-impact plastic. Coordinate color with Section 26 27 26 "Wiring Devices."
  - f. Metal Faceplate: Stainless steel, complying with requirements in Section 26 27 26 "Wiring Devices."
  - g. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.
  - h. Label insets with label covers, provide labels on all faceplates.

K. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.6 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.7 GROUNDING

- A. Comply with requirements in Section 27 05 26 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with TIA-607-D-1.

2.8 SOURCE QUALITY CONTROL

- A. Factory test cables on reels according to TIA-568-C.1.
- B. Factory test twisted pair cables according to TIA-568-C.2.
- C. Cable will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### PART 3 - EXECUTION

#### 3.1 WIRING METHODS

- A. Wiring Method: Install cables in raceways, except above accessible ceilings and within cabinets, furniture partitions, and desks where unenclosed wiring method may be used.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Provide minimum 1 inch conduit up from each outlet box, concealed in wall, and turn out above accessible ceiling.
  - 3. Install cables in raceway above all non-accessible ceiling areas.
  - 4. Comply with requirements for raceways and boxes specified in Section 27 05 28 "Pathways for Communications Systems."
  - 5. Provide conduit sleeves as required for all cables in accordance with Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling".
- B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

#### 3.2 INSTALLATION OF PATHWAYS

- A. Comply with Section 27 11 00 "Communications Equipment Room Fittings."
- B. Comply with Section 27 05 28 "Pathways for Communications Systems."
- C. Drawings indicate general arrangement of pathways and fittings.
- D. Comply with NFPA 70 for pull-box sizing and length of conduit and number of bends between pull points.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

#### 3.3 INSTALLATION OF HARDWARE

- A. Comply with requirements for demarcation point, cabinets, and racks specified in Section 27 11 00 "Communications Equipment Room Fittings."
- B. All termination hardware shall be installed in accordance with manufacturer's recommended procedures and methods.
- C. All hardware shall be placed so as to make efficient use of available space in coordination with other uses. All wiring and associated hardware shall be placed so as to not impair the use or capacity of other building systems, equipment, or hardware placed by others (or existing).
- D. Color of all patch panel ports and jacks shall match color of associated system cabling.
- E. Faceplates:



1. Provide blank inserts in all unused ports.
2. Install all faceplates level and plumb.

### 3.4 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

#### A. Comply with NECA 1 and NECA/BICSI 568.

#### B. General Requirements for Cabling:

1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual , Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
9. Cables shall be bundled with removable hook-and-loop fasteners, nylon tie-wraps are not acceptable.
10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
12. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.
13. Slack:
  - a. In each outlet box, provide 12 inches of coiled slack cable.
  - b. At outlet locations, provide 6 feet of slack stored at the last cable support.
  - c. At wireless access point outlets installed above accessible ceiling, provide 20 feet of slack stored at the outlet.

#### C. System Color for Building Cables:

1. Voice: Blue.
2. Data: Blue.
3. Wireless Access Points: Purple.
4. Lighting Control: Green.
5. Security/Access Control: White.
6. CCTV: White.
7. Other systems as applicable

- D. System Color for Jacks:
  - 1. Jacks: Gray.
- E. System Color for Patch Cables:
  - 1. Patch Cables: Same as System Color for Building Cables.
- F. Open-Cable Installation:
  - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  - 2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 48 inches apart.
  - 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- G. Group connecting hardware for cables into separate logical fields.
- H. Separation from EMI Sources:
  - 1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
  - 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
  - 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
  - 4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
  - 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
  - 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

### 3.5 FIRESTOPPING

- A. Comply with requirements in Section 26 84 13 "Penetration Firestopping".
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with "Firestopping Systems" Article in BICSI's "Telecommunications Distribution Methods Manual."

### 3.6 GROUNDING

- A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."
- B. Comply with TIA-607-D-1 and NECA/BICSI-607.
- C. Bond metallic equipment to the Primary or Secondary Bonding Busbar (PBB or SBB), using not smaller than a No. 6 AWG equipment grounding conductor.

### 3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 27 05 53 "Identification for Communications Systems."
  - 1. Administration Class: Class 3.
  - 2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 3 level of administration.
- C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- E. Cable and Wire Identification:
  - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  - 2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
  - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.

4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
    - b. Label each unit and field within distribution racks and frames.
  5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- F. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:
1. Cables use flexible vinyl or polyester that flexes as cables are bent.

### 3.8 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Cables and termination hardware shall be 100 percent tested for defects in installation and to verify cable performance under installed conditions. All conductors of each installed cable shall be verified usable by the contractor prior to system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed through coupler, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100 percent usable conductors in all cables installed.
- C. Tests and Inspections:
1. Every cabling link in the installation shall be tested in accordance with the field test specifications defined in the most recent standard of the Telecommunications Industry Associations (TIA)/Electronics Industry Association (EIA).
  2. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
  3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  4. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
  5. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

- E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- F. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

END OF SECTION