

DIVISION 26 - ELECTRICAL
SECTION 26 05 20 – CABLES FOR INSTRUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Instrumentation Cables

1.02 SUBMITTALS

- A. Submit in accordance with requirements of Section 01 33 00.
- B. Product Data: Submit for each type of product to be used.
- C. Field quality control test reports.
- D. Submit fiber optic cable installation plan
 - 1. Cable pulling plan that specifies the sequence of work tasks, materials, and equipment.
 - 2. Provide an optical link analysis for each fiber optic link.
 - a. Calculate point-to-point (transmit/receive) optical power loss of each fiber link using proposed installed cable lengths.
 - b. Include all losses through connectors.
 - c. Submit calculated values including sketches graphically showing the proposed cable route.

PART 2 - PRODUCTS

2.01 INSTRUMENTATION CABLES

- A. These cables shall be used for all analog signal wiring.
- B. Single Pair or Triad - Overall Shield
 - 1. Conductors shall be single twisted pair or triad tinned copper with an overall shield. The insulation shall be rated at 300V. Conductors shall be bare soft annealed copper, Class B, 19 strand concentric. Insulation shall be 15 mil nominal thickness, 90 C temperature rating and flame retardant.
 - 2. Cable shield shall be 1.35 mil blue aluminum-polyester tape overlapped to provide 100% coverage, and a 7 strand tinned copper drain wire, two sizes smaller than the conductor.

3. Overall jacket shall be flame retardant, 90 C temperature rated and UL listed.
4. The minimum size conductor shall be 18 AWG for shielded instrumentation cable unless otherwise noted.

C. Multi Pairs or Triads - Overall Shield

1. Conductor shall be tinned copper, 19-strand concentric. Insulation shall be flame retardant PVC insulation, 15 mils nominal thickness and a nylon jacket, 4 mil nominal thickness rated 300 volts. Insulation shall have 90 C temperature rating per UL 1277.
2. Cable shield shall be 2.35 mil blue aluminum polyester tape overlapped to provide 100% coverage and a 7-strand tinned cover drain wire same as conductors.
3. Overall jacket shall be flame retardant, 90 C temperature rated and UL listed.
4. The minimum size conductor for shielded pairs or triad shall be 18 AWG unless otherwise noted.

D. Acceptable Manufacturer

1. All instrumentation cable and conductors shall be as manufactured by Okonite Company, Belden Electronic Wire and Cable Company or equal. All instrumentation cable and conductors to be installed in cable trays shall be NEC approved for this use.

2.02 ETHERNET CABLE

A. Unshielded Twisted-Pair Cabling

1. No. 24 AWG, 100 ohm, four pair.
2. Cable Jacket Color: Gray.
3. Comply with TIA/EIA-568-B.2, Category 5e
4. Comply with UL 444.
5. Belden Inc.; General Cable Technologies Corp, or Approved Equal

B. Terminal Connectors: Modular, color-coded, RJ-45 plug.

1. AMP Company, Cooper Wiring Devices; or approved equal

PART 3 - EXECUTION

3.01 SIGNAL AND CONTROL CABLE

A. General

1. Size cable and its conduit to keep pulling tension within manufacturer's recommended limits.
2. Use cable of sufficient length to make a continuous run. Splicing of shielded signal cable will not be permitted.
3. Furnish a separate raceway system for shielded signal cable. Do not run in the same conduit with power cable.
4. Where telemetry cables are run in the same duct bank with power cables, use galvanized steel conduit. Use junction boxes and "LB" fittings in manholes to maintain a continuous steel raceway system for signal cables.
5. Ground cable shield at termination of instrumentation cabinet only using a soldered pigtail with spade lug for ground connection. Solder joint and ground connection should be visible.

B. Telemetry and Instrumentation Signal Systems

1. Separate conduit and wireway runs are required for this category. All wiring is to be isolated from all power systems.

C. Control Wiring

1. Control wiring may be pulled in the power conduits and wireways providing the highest voltage of the adjacent wires is not more than 120 volts.

D. Power Control Systems

1. The wiring of this category (single conductor, or multiple conductor) is to be installed in accordance with the NEC.

3.02 ETHERNET CABLE

A. Installation

1. Comply with NECA 1.

B. Cable Installation:

1. Install exposed cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.
2. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect and patch panels.
3. Pulling Cable: Do not exceed manufacturer's written recommended pulling tensions. 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.

4. 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.
5. Install UTP cables using techniques, practices, and methods that are consistent with Category 5e rating of components and that ensure Category 5e performance of completed and linked signal paths, end to end.
 - a. Do not untwist more than 1/2 inch of Categories 5e and 6 cables at connector terminations.
6. Separation from EMI Sources: Comply with BICSI TDM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment. Comply with the following minimum separation distances from possible sources of EMI:
 - a. Separation between unshielded power lines or electrical equipment in proximity to open cables or cables in nonmetallic raceways is as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: 5 inches.
 - 2) Electrical Equipment Rating between 2 and 5 kVA: 12 inches.
 - 3) Electrical Equipment Rating More Than 5 kVA: 24 inches.
 - b. Separation between unshielded power lines or electrical equipment in proximity to cables in grounded metallic raceways is as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: 2-1/2 inches.
 - 2) Electrical Equipment Rating between 2 and 5 kVA: 6 inches.
 - 3) Electrical Equipment Rating More Than 5 kVA: 12 inches.
 - c. Separation between power lines and electrical equipment located in grounded metallic conduits or enclosures in proximity to cables in grounded metallic raceways is as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - 2) Electrical Equipment Rating between 2 and 5 kVA: 3 inches.
 - 3) Electrical Equipment Rating More Than 5 kVA: 6 inches.
 - d. Electrical Motors and Transformers, 5 kVA or HP and Larger: 48 inches.
 - e. Fluorescent Fixtures: 5 inches.

C. Conduit

1. Comply with TIA/EIA-569-A for maximum length of conduit and bends between pull points, and for pull-box sizing.
2. Use manufactured conduit sweeps and long-radius ells whenever possible.

D. Testing

1. Perform the following field tests and inspections and prepare test reports:
2. Category 5e UTP Cabling Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in Annex I, complying with measurement accuracy specified in Annex H. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - c. Wire-map test that reports open circuits, short circuits, crossed pairs, reversed pairs, split pairs, and improper terminations.
 - d. Channel and permanent link tests for cable length, insertion loss, near-end crosstalk loss, power sum near-end crosstalk loss, equal-level far-end crosstalk loss, power sum equal-level far-end crosstalk, return loss, propagation delay, and delay skew. Performance shall comply with minimum criteria in TIA/EIA-568-B.2.
3. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
4. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
5. Retest and inspect cabling to determine compliance of replaced or additional work with specified requirements.

END OF SECTION