

INSTRUMENTATION CABLE

1. GENERAL

1.1 Product Data

- .1 Submit product data in accordance with Division 1 and Division 16.

1.2 Related Work

- .1 Refer to Division 16.

1.3 Inspection

- .1 Provide adequate notice to the Contract Administrator so that all cable installations can be inspected prior to energizing equipment.

1.4 Standards

- .1 All wire and cable shall be CSA approved.

2. PRODUCTS

2.1 TPSH

- .1 TPSH shall be constructed as follows:
 - .1 Two (2) copper conductors, stranded, minimum #18 AWG, PVC insulated, twisted in nominal intervals of 50 mm.
 - .2 Insulated for 600 V, 90°C.
 - .3 100% coverage aluminum foil or tape shield.
 - .4 Separate bare stranded copper drain wire, minimum #18 AWG.
 - .5 Overall flame retardant PVC jacket to CSA-C22.2.
 - .6 The entire cable assembly to be suitable for pulling in conduit or laying in cable tray.
 - .7 Shaw Type 1751-CSA or Belden equivalent.
- .2 Where multi-conductor TPSH cables are called for, each pair shall be individually shielded, continuous number coded, and the cable assembly shall have an overall shield and overall flame retardant PVC jacket.

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2.2 RTDs and Multi Conductor Shielded Cable

- .1 RTD cables shall be CSA approved and shall be constructed as follows:
 - .1 Three (3) or more copper conductors, stranded, minimum #18 AWG
 - .2 PVC insulated for 600 V
 - .3 100% coverage aluminum foil or tape shield
 - .4 Separate bare stranded copper drain wire
 - .5 Overall flame retardant PVC jacket to CAS-C22.2

2.3 Teck Cables

- .1 As per Division 16

2.4 Wire

- .1 As per Division 16

2.5 100 Base TX Category 5E Communication Cable

- .1 Category 5E cable shall be CSA approved and constructed as follows:
 - .1 4 bonded pairs, solid stranded, #24 AWG
 - .2 Interlocked aluminum armour
 - .3 Rip cord
 - .4 PVC inner and outer jackets
 - .5 UL verified to Category 5E
 - .6 Insulated for 300 V
 - .7 Belden 121700A or approved equal

2.6 Fibre Optic Cables

- .1 Provide break out style fibre optic cable assemblies where indicated in the Specification and Drawings.
- .2 Fibre optic cables shall be indoor/outdoor direct burial rated loose tube, rodent protected and constructed with specified quantity of 50/125/250 µm multi-mode glass fibres, spiral

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interlocked armour, and outer polyethylene jacket. Maximum attenuation shall be 3.5/1.0 dB/km. Minimum modal bandwidth shall be 220 MHz*km

- .3 Provide terminations for fibre optic cables including; buffer tube fan out kits, connectors, termination/distribution panels, and wall mount enclosures, as specified in Division 17
- .4 Provide 50/125/250 µm multi-mode duplex fibre patch cords for inter-cabinet connections.
- .5 Number of fibres are indicated on Drawings, in general fibre optic loop shall be 24 fibre, fibre optic cables to power meters and protection relays shall be 2 fibre.

2.7 Modbus Plus Cables

- .1 Modbus Plus cable, aluminum armour suitable for direct burial, Belden YC39000.
- .2 Provide modbus plus terminators, drop cables, connectors as required.

3. EXECUTION

3.1 Analog Signals

- .1 Use TPSH cable for all low level analog signals such as 4 to 20 mA, pulse type circuits 24 VDC and under, and other signals of a similar nature.
- .2 Use RTD cable for connections between RTDs and transmitters or PLC RTD inputs.

3.2 Digital Signals

- .1 Use TPSH cable for all low level (24 V and below) input and output signals.

3.3 Instrument Power

- .1 Use Teck cable or wire and conduit for power to instruments, for 120 V signals other than those mentioned above and as otherwise indicated on the Drawings. Use stranded wire and cable to supply power to instruments.

3.4 Installation

- .1 Install instrumentation cables in conduit systems or in cable trays. Use a minimum of 300 mm and a maximum of 1000 mm length of liquid tight flexible conduit to connect the field sensors to the conduit.
- .2 Where non-armoured instrumentation cables are installed in cable trays, provide barriers in the tray to separate instrumentation cables from power cables.
- .3 At each end of the run leave sufficient cable length for termination.

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- .4 Do not make splices in any of the instrumentation cable runs.
- .5 Cable shields shall be terminated on insulated terminals and carried through to the extent of the cable.
- .6 Ground cable shields at one end only. Unless otherwise specified, ground the shields at the marshalling panel.
- .7 Protect all conductors against moisture during and after installation.

3.5 Fibre Installation:

- .1 Always follow the Manufacturer's guidelines for minimum bend radius and tension. Minimum bend radius shall be a minimum of 20 times the cable diameter.
- .2 When installing loose-tube cables, use a silicone injection or sealer to prevent gel migration.
- .3 All fibre installations and terminations shall be performed by personnel experienced in fibre optic cable installation.
- .4 Fibre Terminations:
 - .1 Ensure that the fibres are not damaged when the buffer tubes and fibre coatings are removed.
 - .2 After the coating is removed, clean the fibre with isopropyl alcohol to assure the fibre is clean.
 - .3 Use only high performance connectors as classified and required by TIA-568-A.
- .5 Perform cable testing with optical time domain reflectometer instrument and provide complete detailed test report. Test all runs upon completion of permanent terminations, using instrumentation acceptable to Contract Administrator. Before commencing testing, submit sample test data sheets and information with respect to test instrumentation to be used.
 - .1 Ensure that test instrument is temperature-stabilized or is temperature-independent or temperature-compensated before commencing test.
 - .2 Test for following:
 - .1 Run attenuation at [850] and [1300] wavelengths.
 - .2 Run length.
 - .3 Before recording results, compare readings to predicted values based on cable specification and run length, using connector and patch cord losses as part of predicted value. Retest runs with:

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- .1 Attenuation values greater than 6.0 dB / km @ 850 nm and 4.0 dB / km @ 1300 nm
- .6 All fibres must pass the cable testing.

3.6 Cat 5E Installation:

- .1 Always follow the Manufacturer's guidelines for minimum bend radius and tension.
- .2 All installations and terminations shall be performed by personnel experienced in Cat 5E cable installation.
- .3 Perform cable testing with time domain reflectometer instrument and provide complete detailed test report. Test all runs upon completion of permanent terminations, using instrumentation acceptable to Contract Administrator. Before commencing testing, submit sample test data sheets and information with respect to test instrumentation to be used.
 - .1 Test for the following:
 - .1 Continuity.
 - .2 Pair placement and polarity.
 - .3 DC resistance.
 - .4 Characteristics at highest contemplated frequency:
 - .1 Attenuation - data cable.
 - .2 Mutual Capacitance - data cable.
 - .3 Near-end crosstalk (NEXT) - data cable.
 - .5 Run length.
 - .2 Tests to be conducted to Cat 5E standards
 - .3 Reconnect or re-install and retest as necessary to correct excessive variations.

3.7 Conductor Terminations

- .1 All equipment supplied shall be equipped with terminal blocks to accept conductor connections.
- .2 Instrumentation conductors, where terminated at equipment terminals other than clamping type terminal blocks, shall be equipped with Burndy-YAE-2 or STA-KON, self-insulated, locking type terminators, sized as required to fit conductors and screw terminals.

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3.8 Testing

- .1 Test all conductors for opens, shorts, or grounds. Resistance values shall not be less than those recommended by the cable Manufacturer.

3.9 Identification

- .1 Identify all instrumentation cables.
- .2 Identify each conductor with wire numbers using a machine printed Raychem TMS heat shrink wire marker or approved equal.

END OF SECTION