

SECTION 16125

WIRE CONNECTION ACCESSORIES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This section specifies providing wire-connection accessories, such as connectors, terminal lugs and fittings, bundling straps, insulating tape and resin.

1.02 QUALITY ASSURANCE:

- A. Qualifications: Select a manufacturer who is engaged in production of similar wire connection accessories.
- B. Codes, Regulations, Reference Standards and Specifications:
1. Comply with codes and regulations of the jurisdictional authorities.
 2. National Electrical Code (NEC).
 3. UL: 486A, Wire Connectors and Soldering Lugs for Use With Copper Conductors.
 4. American Standards of Testing and Materials (ASTM): D149-97a, Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies; D257-99, Standard Test Methods for DC Resistance or Conductance of Insulating Materials; D412-98a, Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension; D570-98, Standard Test Method for Water Absorption of Plastics; D638-00, Standard Test Method for Tensile Properties of Plastic; D696-98, Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C with a Vitreous Silica Dilatometer; D792-00, Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement; D1000-99, Standard Test Method for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications; D1518-85(1998)e1, Standard Test Method for Thermal Transmittance of Textile Materials; D5034-95, Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test); D5035-95, Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method); D2240-00, Standard Test Method for Rubber Property-Durometer Hardness; and G21-96, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
 5. American National Standards Institute (ANSI): C119.1, Sealed Insulated Underground Connector System 600V
 6. ITS: Directory of ITS Listed Products.
- C. Source Quality Control:
1. Connectors, terminal lugs and fittings listed, per referenced UL or ITS directory.
 2. Factory testing: Submit certified copies of test report for cable splice and tap-insulation/sealing kits as specified.

1.03 SUBMITTALS:

- A. Submit the following for approval in accordance with the General Requirements and with the additional requirements as specified for each:
1. Shop Drawings.
 2. Certification.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Mark each item in accordance with applicable reference standard.
- B. Ship each unit securely packaged and labeled for safe handling in shipment and to avoid damage.
- C. Store products in secure and dry storage facility.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MATERIALS:

- A. Connectors, Terminal Lugs and Fittings:
 - 1. In accordance with UL 486A.
 - 2. For 10AWG and smaller conductor cable: Tin-plated copper pressure connectors with nonflammable, self-extinguishing insulation grip with temperature rating equal to that of conductor insulation.
 - 3. For 8AWG to 4/0 AWG conductor cable: Tin-plated copper compression connectors and terminal lugs with nylon insulating sleeve for insulation grip.
 - 4. For 250 Kcmil and larger conductor cable: Long-barrel, double-compression tin-plated copper connectors and terminal lugs with two-hole pad.
 - 5. For multiple-conductor cable: Watertight aluminum fittings with stainless-steel pressure ring and set screws or compression cone for grounding of aluminum sheath of MC cable.
- B. Bundling Straps:
 - 1. Self-locking steel barb on one end, with tapered strap of self-extinguishing nylon, temperature rating minus 40F to plus 185F.
 - 2. For outdoor use: Ultraviolet-resistant.
- C. Insulating Tape:
 - 1. Plastic tape: Vinyl plastic tape with rubber-based pressure-sensitive adhesive, pliable at zero degree F with the following minimum properties when tested in accordance with ASTM D1000-99:
 - a. Thickness: 8.5 mils.
 - b. Breaking strength: 20 pounds per inch width.
 - c. Elongation: 200 percent.
 - d. Dielectric breakdown: 10,000 volts.
 - e. Insulation resistance, indirect method of electrolytic corrosion: 1,000,000 megohms.
 - 2. Rubber tape: Silicone-rubber tape with silicone pressure-sensitive adhesive, with the following minimum properties when tested in accordance with ASTM D1000-99:
 - a. Thickness: 12 mils.
 - b. Breaking strength: 13 pounds per inch width.
 - c. Elongation: 525 percent.
 - d. Dielectric breakdown: 13,000 volts.
 - e. Insulation resistance, indirect method of electrolytic corrosion: 1,000,000 megohms.
 - 3. Arcproof tape: Flexible, coated one side with flame-retardant flexible elastomer, self-extinguishing, non-combustible, with the following minimum properties:
 - a. Thickness, ASTM D1000: 30 mils.
 - b. Breaking strength, ASTM D5034-95 and D5035-95: 50 pounds per inch width.

- c. Thermal conductivity, ASTM D1518-85: 0.0478 BTU per hour per square foot per degree F.
 - d. Electrical arc resistance: Withstand 200 amperes arc for 30 seconds.
 - 4. Glass tape: Woven-glass fabric tape with pressure-sensitive thermosetting adhesive, with the following minimum properties when tested in accordance with ASTM D1000-99:
 - a. Nominal width: 3/4 inch.
 - b. Thickness: Seven mils.
 - c. Breaking strength: 170 pounds per inch width.
 - d. Elongation: Five percent.
 - e. Dielectric breakdown: 2,500 volts.
 - f. Insulation resistance, indirect method of electrolytic corrosion: 5,000 megohms.
- D. Epoxy Resin: Suitable for insulating and moisture sealing cable splices, with the following minimum properties:
 - 1. Dielectric strength, ASTM D149-97a: 400 volts per mil.
 - 2. Volume resistance, ASTM D257-99: 2.8×10^{15} ohm per centimeter cube at 30C.
 - 3. Water absorption, ASTM D570-98:
 - a. 0.193 percent in 24 hours at 23C.
 - b. 0.62 percent in 24 hours at 53C.
 - 4. Tensile strength, ASTM D638-00: 8,000 psi.
 - 5. Elongation, ASTM D638-00: 2.4 percent.
 - 6. Coefficient of expansion, ASTM D696-98: 6.8×10^{-5} inch per inch per degree C.
- E. Cable splice and tap-insulation/sealing kit: Suitable for use on 600-volt, 90C cables, material compatible with cable insulation and jacket, meeting the seal test requirements of ANSI C119.1.
 - 1. Heat-shrinkable tubing or wraparound heat-shrinkable sleeve: approved per referenced UL or ITS directory, flame-retardant, corrosion-resistant thick-wall tubing with factory-applied sealant for field insulation on in-line splices and taps or wraparound-type sleeve for retrofit installation on existing splices and taps to provide a watertight seal and insulating encapsulation, with the following additional requirements:
 - a. Material: Cross-linked polyolefin.
 - b. Shrink ratio: 3 to 1 minimum.
 - c. Physical properties:
 - 1) Ultimate tensile strength: 2,350 psi, ASTM D412-98a.
 - 2) Ultimate elongation: 350 percent, ASTM D412-98a.
 - 3) Hardness, Shore D: 42, ASTM D2240-00.
 - 4) Water absorption: 0.050 percent, ASTM D570-98, Method 6.1.
 - 5) Specific gravity: 1.28, ASTM D792-00.
 - d. Electrical properties:
 - 1) Dielectric strength: 450 volts per mil, ASTM D412-98a.
 - 2) Volume resistivity: 1×10^{14} ohm cm, ASTM D257-99.
 - e. Thermal properties:
 - 1) Continuous operating temp.: -55C to +135C.
 - 2) Air oven aging (14 days at 175C):
 - a) Tensile strength: 2,680 psi.
 - b) Elongation: 375 percent.
 - 3) Low temp. flexibility (4 hours at -55C): No cracking when flexed.
 - 4) Heat shock (4 hours at 250C): No cracking, flowing or dripping.
 - f. Chemical properties:
 - 1) Corrosivity: Non-corrosive.
 - 2) Fungus resistance: Non-nutrient, ASTM G21-96.
 - 3) Flammability: Self-extinguishing.

PART 3 - EXECUTION

3.01 SPLICES AND TERMINATIONS:

- A. Make wire and cable splices in outlet, junction or pull boxes, in cable troughs or in equipment cabinets. Splices in conduit are prohibited.
- B. Secure connectors or terminal lugs to conductor so as to engage all strands equally.
- C. Do not rupture insulation nor expose bare conductors.
- D. Install compression connectors and terminal lugs using tools and pressure recommended by manufacturer. Indent mark connectors and terminal lugs with number of die used for installation.
- E. Apply anti-corrosion joint compound to connectors, terminal lugs and bolting pads before installation.
- F. Wrap ½-lapped layer of arcproof tape, glass tape overall on cable splices installed in air tunnels, ducts and shafts.
- G. Install terminal fittings on multiple-conductor cable in accordance with manufacturer's recommendation. Completely seal cable from moisture.
- H. On cable splices, taps and terminations in manhole handhole and outdoor junction and pull boxes, cover connectors with electrical putty, wrapped with three layers of plastic tape or final layer of rubber tape and then install watertight encapsulation as follows and under the supervision of kit manufacturer's representative or using a factory-certified installation technician, proficient in field installation of heat-shrinkable sealing kits.
 - 1. Use heat-shrinkable tubing for encapsulation of new splices, taps and terminations.
 - 2. Use wraparound-type heat-shrinkable sleeve for encapsulation of existing splices, taps and terminations.

3.02 CATHODIC PROTECTION SPLICES AND TERMINATIONS:

- A. For splices made in aboveground cable, use compression connectors covered with electrical putty, wrapped with three layers of plastic tape and final layer of rubber tape.
- B. Install compression terminal lugs using tools and pressure recommended by manufacturer. Indent mark terminal lugs with number of die used for installation.
- C. For splices made in direct-burial cable, use thermit weld sealed with cast epoxy-resin encapsulation.

3.03 INSPECTION:

- A. Have splices in direct-burial cable for stray current and cathodic protection inspected by the Engineer before backfilling.
- B. Have splices and taps in manholes, handholes and outdoor junction and pull boxes inspected by the Engineer or the manufacturer's representative, when available.

END OF SECTION