

TECHNICAL SPECIFICATIONS

ITEM 00679 INSULATED JACKETED TRAFFIC SIGNAL CABLE

679.1 Description. This specification covers polyvinyl chloride compound jacketed polyethylene insulated cables, rated 600 volts, for use in signal systems in underground conduit, as aerial cable supported by a messenger, or for installation in buildings.

679.2 General Construction. Cable under this specification shall be composed of uncoated copper conductors individually insulated with heat stabilized polyethylene. The insulated conductors shall be laid up in a compact cable form and bound with suitable tape. The cable core shall be enclosed in a polyvinyl chloride compound jacket.

679.3 Conductors. The copper conductors shall, before insulating, conform to the requirements of ASTM Designation B-3, latest revision.

The conductors shall be solid unless otherwise specified by the purchaser.

The number and size of the conductors shall be as specified by the purchaser, or sized according to the load per the National Electrical Code.

679.4 Insulation. The insulating compound before application to the conductors shall be heat stabilized polyethylene conforming to the requirements of ASTM Designation D1248, 63T, Type 1, Class B, Grade 4. The insulation shall be applied concentrically about the conductor. Insulation after the application to the conductors shall meet the following requirements when tested in accordance with the procedures given in ASTM Designation D1351, latest revision, and ASTM Designation D470, latest revision.

Physical Properties of Polyethylene Insulation

A. Initial Properties		
Tensile Strength lbs. per sq. in., minimum		1400
Elongation at rupture, percent, minimum		350
B. After 48 hours in air oven at 100° C.		
Tensile Strength percent of original, minimum		75
Elongation at rupture, percent of original, minimum		75
C. Cold Bend Test, 1 hour at -55° C.; plus or minus 1 degree no cracks (Mandrel diameter 2.5 time insulation diameter)		

The nominal thickness of the insulation shall not be less than that specified in Table I. The minimum thickness of the insulation shall be not less than 90 percent of the nominal value.

Moisture Absorption.

- A. After a twenty-four hour immersion in tap water at 50° C. plus or minus 1° C., the specific inductive capacity of the insulation shall be not more than 2.5. After a continued fourteen day immersion, the specific inductive capacity shall be not more than 1.5 percent higher than the value determined at the end of the first day, nor more than 1.0 percent higher than at the end of the seventh day.
- B. The moisture absorption tests shall be conducted in accordance with methods specified in IPCEA-S-61-402, NEMA WC5, latest revision.

Electrical Properties.

- A. Dielectric Strength. Each processed length of insulated conductor before cabling shall withstand the test voltage specified in Table I for a period of 5 minutes after immersion in water for not less than 6 hours and while still immersed.
- B. Insulation Resistance. Each processed length of insulated conductor, after withstanding the Dielectric Strength Test, and while still immersed, shall comply with the insulation resistance requirements of Table I.
- C. The Dielectric Strength and Insulation Resistance Tests shall be conducted in accordance with the requirements of ASTM Designation D470, latest revision.

**TABLE I
INSULATION THICKNESS, TEST VOLTAGE
AND INSULATION RESISTANCE**

Conductor Size AWG	Insulation Thickness Inch	Test Voltage	Insulation Resistance at 60° F. Meghoms-1000 Ft.
20	0.025	2500	15,000
19	0.025	2500	15,000
18	0.025	2500	15,000
17	0.025	2500	15,000
16	0.025	2500	14,800
15	0.025	2500	13,700
14	0.025	2500	12,600
13	0.030	3000	13,200
12	0.030	3000	12,100
11	0.030	3000	11,000
10	0.030	3000	10,100
9	0.030	3000	9,200
8	0.030	3000	8,300

Conductor Color Coding. Standard color coding for cable shall be in accordance with Table II. When permitted by the purchaser, the conductor coding may be numerals and words printed on the conductor insulation. Base colors shall be obtained by the use of colored insulation. Tracers shall be colored stripes or bands which are part of, or firmly adhered to, the surface of the insulation in such a manner as to afford distinctive circuit coding throughout the length of each wire. Tracers may be in continuous or broken lines, such as a series of dots or dashes, and shall be applied longitudinally, annularly, spirally, or in other distinctive patterns.

**TABLE II
CONDUCTORS COLORS AND SEQUENCE**

Conductor Number	Base Color	First Tracer
1	Black	
2	White	
3	Red	
4	Green	
5	Orange	
6	Blue	
7	White	Black
8	Red	Black
9	Green	Black
10	Orange	Black
11	Blue	Black
12	Black	White
13	Red	White
14	Green	White
15	Blue	White
16	Black	Red
17	White	Red
18	Orange	Red
19	Blue	Red
20	Red	Green
21	Orange	Green

The color sequence may be repeated as necessary. Color code sequence applies when cable is composed of mixed sizes.

Special color coding, when specified in unpaired conductor cables, shall consist of black for all conductors except that one conductor shall be identifiable conductor in each layer.

For combination cables consisting of pairs with single conductors, color code sequence given in Table II, Specification No. 19 - 2 shall be used for pairs, repeated as necessary.

679.5 Conductor Assembly.

- A. Two Conductor Cable. Two conductor cables shall have a maximum length of lay not more than 30 times the insulated conductor diameters.

Two conductor cables shall be of the round, twisted type.

Fillers shall be used where necessary to form a two conductor round twisted cable.

- B. Multi-Conductor Cables Having More Than Two Conductors. In multi-conductor cables having more than two conductors, the single conductors shall be laid up symmetrically in layers with lay not exceeding the following:

Number of Conductors In Cable	Maximum Length of Lay
3	35 times insulated conductor diameter
4	40 times insulated conductor diameter
5 OR MORE	15 times assembled core diameter

Each layer of conductors in the cable shall be laid in a direction opposite to that of adjacent layers. When permitted by the purchaser, uni-directional lay may be used. The outer layer shall be left hand lay.

Fillers shall be used, where necessary, to secure a uniform assembly of conductors of a firm, compact cylindrical core.

679.6 Fillers. Fillers, when used, shall be of a non-metallic moisture-resistant material which shall have no injurious effect upon the component parts of the cable.

679.7 Identification. Each shipping length of cable shall have a tape showing the name of the manufacturer and the year in which the cable is manufactured, placed over or under the tape covering the conductor assembly before the application of outer coverings. As an alternative method of identification, the above information may be applied to the outer surface of the jacket.

679.8 Cable Tape. The conductor assembly shall be covered with a spiral wrapping of a moisture resistant tape applied so as to lap at least 10 percent of its width.

679.9 Jacket. Over the taped conductor assembly there shall be applied a tightly fitting polyvinyl chloride compound jacket which shall meet the following requirements when tested in accordance with ASTM Designation D1047, latest revision.

Physical Properties of Polyvinyl Chloride Jacket

A. Initial Properties, Tensile Strength, lbs. per sq. in., minimum	1800
Elongation at rupture, percent minimum	250
B. After 5 days in air oven at 100° C., Tensile Strength, percent of original, minimum	85
Elongation at rupture, percent of original, minimum	60
C. Head Shock Test, Air Oven, 1 Hour at 121° C.,	no cracks
D. Heat Distortion Test, Air Oven, 1 Hour at 121° C., decrease in thickness, percent, minimum	50
E. Cold Bend Test, 1 Hour at -40° C.,	no cracks
F. Flame Test, minutes burning, maximum	1
G. After 4 hours at ASTM No. 2 oil at 70° C. Tensile Strength, percent of original, minimum	80
Elongation at rupture, percent of original, minimum	60

The nominal thickness of the jacket shall be as specified in Table III. The average thickness shall be not less than 90% of the specified thickness. The minimum thickness shall be not less than 70% of the nominal thickness.

TABLE III

Calculated Diameter of Cable Under Jacket, Inches	Jacket Thickness Mils
0.425 and less	45
0.426 - 0.700	60
0.701 - 1.500	80
1.501 - 2.500	110
2.501 and larger	140

679.10 Sampling, Inspecting, and Acceptance. Inspection and tests shall be made prior to shipment and at the place of manufacture.

The manufacturer shall, when requested by the purchaser at time of placing the order, furnish the purchaser in suitable form, a certified report of the tests made on the cable to show compliance with this specification.

Tests on Entire Cable. The individual conductors of each length of completed cable shall meet the voltage and insulation resistance requirements of Section 4, except that the final electrical test on multiple conductor cables may be made without immersion in water. Each conductor of a multiple conductor cable shall be tested against all other conductors and shield if present.

Sample Tests. One sample for establishing conformity to this specification shall be taken from each 10,000 feet or fraction thereof, of each type and size of cable except that for the physical dimensions and the visual inspection a sample shall be taken from each reel. In case that these samples fail to meet the requirements of this specification, two additional samples shall be selected from new cable lengths and the lot shall be accepted if retests are both satisfactory. However, in case of any failure on the retest, the lot shall be rejected.

The manufacturer may re-examine rejected material and submit it for reinspection at his option.

679.11 Packing and Marking for Shipment. Reels shall be substantially constructed and in good condition. The cables shall be suitably protected. Each end of the cable shall be available for testing, properly sealed, and protected against injury. Each reel shall be plainly and permanently marked with manufacturer's full description of the cable, giving the length of the cable on the reel, the number of conductors in the cable and the date of shipment from the factory.

679.12 Guarantee. If it is the normal trade practice for the manufacturer to furnish a guarantee for the work provided herein, the Contractor shall turn this guarantee over to the Engineer for potential dealing with the guarantor. The extent of such guarantee will not be a factor in selecting the successful bidder.