

## TECHNICAL SPECIFICATIONS

### MEDIUM VOLTAGE ETHYLENE PROPYLENE RUBBER (EPR) POWER CABLE

#### 1. SCOPE

To furnish complete, factory pre-assembled cable, designed for installation on a grounded wye system having distribution primary voltages of 2400/4160, 7620/13,200, and 15,240/26,400 volts. This cable shall be suitable for underground, or interior power circuits in either wet or dry applications, and is used for primary leads, primary distribution in power plants and URD and network feeder applications, transformer and generator leads, apparatus connections and vertical risers where high reliability and long life are desired, and where higher temperatures may be encountered.

Multi-conductor cables shall consist of three individual strand filled conductors, each with extruded semiconducting strand shield, insulation and semiconducting insulation shield. The three single cables shall be parallel wound into one three conductor cable. Single-conductor cables shall consist of an individual strand filled conductor, with extruded semiconducting strand shield, insulation and semiconducting insulation shield.

#### 2. APPLICABLE STANDARDS

All cable shall meet or exceed the latest edition of the following industry standards except where specifically noted:

AEIC CS8-07	Specification for Extruded Dielectric Shielded Power Cables Rated 5 through 46 kV
ANSI/ICEA S-94-649	Standard for Concentric Neutral Cables Rated 5,000 – 46,000 Volts
ANSI/ICEA S-97-682	Standard for Utility Shielded Power Cables Rated 5,000 – 46,000 Volts
ICEA T-25-425	Guide for establishing stability of resistivity for conducting polymeric components of power cables.
ASTM B-3	Copper wire, soft or annealed.
ASTM B-8	Copper conductors, concentric lay stranded, hard, medium hard, or soft.
ICEA T-32-645	Guide for Establishing Compatibility of Sealed Conductor Filler Compound with Conducting Stress Control Material.
ASTM B-230	Aluminum Wire, EC-H19 for Electrical Purposes.
ASTM B-231	Aluminum conductors Concentric Lay Stranded.
ASTM B-609	Aluminum Wire, Annealed and Intermediate tempers for Electrical Purposes.
ASTM D2275-89	Standard Test Method for Voltage Endurance of Solid Electrical Insulating Materials Subjected to Partial Discharges (Corona) on the Surface
NEMA WC 26	Wire and Cable Packaging

Where a particular product requirement or characteristic is specified in more than one document, the most stringent shall apply.

#### 3. DESIGNATIONS

- 3.1. The maximum continuous operating temperature of conductor, at rated load, shall be limited to 105°C, the emergency operating temperature shall not exceed 140°C, and the short circuit operating temperature shall not exceed 250°C as per the latest revision of AEIC .

## 4. CONSTRUCTION

### 4.1. CONDUCTOR

- 4.1.1. Aluminum conductor shall be  $\frac{3}{4}$  hard drawn or full hard drawn, class B, stranded 1350 conductor. If compressed conductor is used, it shall not be compressed more than 3% of its original diameter as per ICEA . Compressed conductors shall be used for all cables except Item ID CAI CL 013 (750 cu), which shall be compact.
- 4.1.2. Concentric - a conventional concentric stranded conductor, in accordance with ASTM specifications, is to be furnished all conductor. Solid copper concentric neutral wires shall be spirally applied and the entire assembly covered with a LLDPE jacket.
- 4.1.3. Strand filling - in order to alleviate water (electrochemical) treeing in the insulation, strand filling compound will completely fill the conductor's inner strand layer(s). This compound shall be flexible and stable under the conditions imposed by the cable's operation within limits stipulated herein, and compatible with the conductor, strand shield and insulation materials per ICEA Publication T-32-645. The outer strand surface of the conductor shall be clean from the filling compound so that splices and terminations can be applied using standard compression type connectors employing the same techniques as for unfilled conductors.
- 4.1.4. Copper conductors are to be composed of untinned soft or annealed concentric copper wires and conforming to reduced diameter compressed formation meeting, before stranding, physical requirements of ASTM specifications.

### 4.2. CONDUCTOR SHIELDING

This cable shall be an extruded, black-colored, non-conducting thermoset material in accordance with Part 3 of ANSI / ICEA S-94-649-2004. The minimum point thickness shall be 12mils for # 2 - 4/0awg, 16mils for 250 - 500kcmil, 20mils for 750-1000kcmil and 24mils above 1000 kcmil.

### 4.3. INSULATION

The Insulation shall be a discharge resistant, EPR based compound in accordance with Part 4 of ANSI / ICEA S-94-649-2004. The minimum point thickness of the insulation shall be in accordance with Table I. The discharge resistance of the insulation shall be demonstrated by withstanding 21kVac (@ 25°C & 20% RH) for 250 hours without failure when tested in accordance with the method described in ASTM D2275-89 "Standard Test Method for Voltage Endurance of Solid Electrical Insulating Materials Subjected to Partial Discharges (Corona) on the Surface".

**TABLE I**

Voltage (kV)	Insulation Thickness (mils)		AC Test Voltage (kV)	
	100%	133%	100%	133%
5	85	110	18	23
15	165	210	35	44
25	245	305	52	64
35	330	400	69	84

### 4.4. INSULATION SHIELDING

Cable Insulation Shielding shall consist of a nonmetallic semiconducting material extruded directly over the insulation and helically applied solid bare copper wires. The nonmetallic layer shall be black-colored with properties and thickness conforming to the requirements of Part 5 of ANSI / ICEA S-94-649-2004. The layer shall be free stripping from the EPR insulation. The concentric neutral shield shall consist of solid bare copper wires applied helically per Part 6 of ANSI / ICEA S-94-649-2004. Number and size wires are given in Table II.

TABLE II

Phase Conductor (awg/kcmil)	Aluminum Conductor		Copper Conductor	
	One-Third Concentric Number- Size	Full concentric Number-Size	One-Third Concentric Number- Size	Full concentric Number-Size
1/o	6-#14	16-#14	9-#14	16-#12
4/o	11-#14	20-#12	18-#14	20-#10
350	18-#14	20-#10	18-#12	-
500	16-#12	-	17-#10	-
750	24-#12	-	20-#9	-
1000	20-#10	-	21-#8	-

#### 4.5. JACKET

- 4.5.1. For corrosion protection in duct installations as well as in other types of installation, the cable shall be jacketed with a Linear Low Density Polyethylene Compound. The jacket shall be extruded to encapsulate the concentric neutral wires filling the interstice area leaving no voids and shall be free stripping. The JEA item ID CAICL011 (1000 MCM) requires a modified overlaying jacket.
- 4.5.2. This jacket is to be applied without contamination or oil between the jacket and cable, and shall be suitable for exposure to direct sunlight.
- 4.5.3. A water swellable powder or tape shall be applied between the insulation shield and the jacket to block the ingress of moisture into and along the interface and around the concentric wires of the cable.
- 4.5.4. The jacket thickness shall be in accordance with the applicable section of ICEA .

### 5. CABLE ASSEMBLY

Insulation and semiconducting compounds shall be maintained in an extra clean, closed system from their manufacture to the cable extruder. The cable shall be true triple extruded and dry cured. The cable shall be assembled in lengths specified in section 10.

### 6. DIMENSIONS AND DATA

Approved manufacturers for each bid item shall be notified and required to submit approval drawings and documentation that includes the cross sectional drawing of the cable and dimensions including: Outside diameter, diameter over conductor shield, diameter over insulation, and diameter over insulation shield. The dimensions provided must be given with plus and minus tolerances and conform to ICEA and AEIC geometry and dimensional tolerances. Ampacities, impedance values, and cable weight per thousand feet (lbs/1000ft) shall also be included. In addition, the manufacturer and designation of the insulation and semi-conductive compounds used in the production of the cable shall be provided on each drawing. At the time of notification, all required drawings/documentation must be received within the specified time period and approved by JEA Standards for specification conformance.

## 7. IDENTIFICATION

- 7.1. The cable shall have permanent contrasting marking (indented or hot foil tape) on the jacket at interval not to exceed five feet. The marking on each cable jacket shall contain the manufacturer's name, plant designation, conductor size and type, insulation and wall thickness, voltage rating and year of manufacture. Sequential footage markings shall be applied at a maximum of every three feet on all single conductor cables and on phase A or phase 1 of all three conductor cables.
- 7.2. Markings shall meet the requirements of AEIC.
- 7.3. Multi-conductor or parallel cables shall have permanent contrasting phase identification (indented preferred) applied to the outer jacket of each conductor at a maximum of twenty four inch intervals. Phase marking may be either 1, 2, 3, or A, B, C.

## 8. SHIPPING

- 8.1. Each reel shall be shipped complete with protective cover and identification marking for storage. Non-returnable wood reels shall meet the requirements of NEMA WC-26, Class II (Note: Arbor holes minimum diameter allowed 3-1/4"). The reels must be able to withstand shipping, handling, and storage for at least one year without decomposition. JEA approved water proof insulated End Caps shall be installed on each cable end. (See the JEA Master Material Catalog Items THEHS002, THEHS003 & THEHS004). Reel sizes indicated are maximum (outside to outside dimensions).
- 8.2. Any material shipped to JEA and deemed unacceptable shall be returned to the manufacturer at his expense.
- 8.3. A metal tag permanently attached to the side of the reel shall depict beginning and ending footage markings. This information shall be stamp punched or permanently marked, with indelible ink, on the tag. A metal tag is not required if the beginning and ending footage markings are "legibly and permanently written with black indelible ink on the wood flange (within 12 inches of the outside edge) and included on the manufacturer's standard reel tag".
- 8.4. Cable shall be supplied on the following maximum reel sizes and reel lengths: Reel length tolerance is -0% +10%.

<u>Item ID</u>	<u>Conductor Size</u>	<u>Conductor Type</u>	<u>KV</u>	<u>Min. Reel Length</u>	<u>Max Size</u>
CAI CL001	1/0	AL	28	5000'	NR 72x48
CAI CL002	1/0	AL	28	1500'	NR 72x48
CAI CL011	1000	AL	28	1000'	NR 72x36
CAI CL123	500	CU	15	1000'	NR 72x36

## 9. TESTING

- 9.1. JEA reserves the right to subject cable to test by a recognized laboratory.
- 9.2. Each length of completed cable shall be tested, electrically and physically, in accordance with ICEA.
- 9.3. Certified test reports shall be furnished on all cables shipped. The report shall include the master reel numbers, JEA item ID, purchase order number, shipping reel number(s) and the actual test results compared to the required values. The conductor shield, insulation and insulation shield compound designation shall also be included in the certified test report.
- 9.4. The results of all tests shall be mailed to the address below within 30 days of shipment:

JEA UG Distribution Standards  
21 West Church St., Tower 5th Floor  
Jacksonville, Florida 32202

- 9.5. Each length of cable shall be tested in accordance with AEIC specifications. ICEA T-34-664 "Guide For Conducting Longitudinal Water Penetration Resistance Tests On Longitudinal Water Blocked Cables" shall be used to test the entire cable cross section at 10 PSIG for embedded jacket cables and 5 PSIG for modified overlaying jacket cables. Water block test is not required on tape shielded cable designs.

## 10. JEA SPECIFIC REQUIREMENTS

<u>JEA Item ID</u>	<u>Conductor Size</u>	<u>Conductor Type</u>	<u>KV</u>	<u>Concentric</u>	<u>Jacket</u>	<u># of Cond.</u>	<u># of Strands</u>	<u>Max O.D.</u>	<u>Amp</u>	<u>Type Neutral</u>	<u>Reel Length</u>
CAI CL001	1/o	AL	28	16-14 AWG	LLDPE	1	19	1.300"	180	Full	5000'
CAI CL002	1/o	AL	28	6-14 AWG	LLDPE	3	19	1.300"	180	1/3 ea	1500'
CAI CL011	1000	AL	28	6-14 AWG	LLDPE	3	19	1.300"	180	1/3 ea	1000'
CAI CL123	500	CU	15	16-12 AWG	LLDPE	3					1000'

**Note:** Reel lengths shown are minimum allowed lengths. (See section 8.4 for details).

## 11. APPROVED MANUFACTURERS

List of approved manufactures can be seen in the latest copy of the Master Material Catalog. However, the approved manufacturers still must have their drawings pre-approved before providing a quotation as stated in section 12.

## 12. SUBMITTAL REQUIREMENTS

THE FOLLOWING INFORMATION MUST BE PROVIDED BY THE RESPONDENT WHO RANKS FIRST AFTER THE BAFO SUBMITTAL, AND BE APPROVED BY THE STANDARDS ENGINEER BEFORE A MANUFACTURER CAN BE DEEMED THE AWARDEE OF THE CONTRACT (DOES NOT APPLY TO SPOT BUYS):

- 12.1. Manufacturer must submit one copy of the dimensions and data drawings, showing all required information as stated in this specification for each item, specifically listing the item ID.
- 12.2. Approved manufacturer drawings shall be marked approved and signed by the standards engineers and then a copy returned to the manufacturer.

THE FOLLOWING INFORMATION MUST BE FINALIZED PRIOR TO SHIPMENT OF MATERIAL:

- 12.3. Drawings sent prior to quotation must be re-submitted prior to shipment of any items to insure there have been no material or design changes. If changes are required they must be noted by the manufacturer and approved by the appropriate JEA standards engineer.

## Adjustments

<u>Date</u>	<u>Change</u>	<u>Author of Change</u>
11/9/18	Adjusted "Medium Voltage TRXLP Jacketed Power Cable" Spec to "Medium Voltage Ethylene Propylene Rubber (EPR) Power Cable" Spec	PARKTA
11/13/18	Added on pg.1 under Applicable Standards, ASTM D2275-89	PARKTA
11/13/18	Changed Table on pg.5 under JEA Specific Requirements, from Nom. O.D. to Max O.D.	PARKTA
11/13/18	Updated Conductor Shielding on pg.2, with EPR terminology.	PARKTA
11/14/18	Updated Cable Assembly on pg.3	PARKTA
11/14/18	Updated Insulation on pg.2, with EPR terminology	PARKTA