

TECHNICAL SPECIFICATIONS**MEDIUM VOLTAGE TRXLP JACKETED POWER CABLE****1. SCOPE**

- 1.1. To provide requirements for cables designed for installation on a grounded wye system having distribution primary voltages of 2400/4160 (5kV Nominal Voltage), 7620/13,200 (15kV Nominal Voltage), 15,240/26,400 (28kV Nominal Voltage) and 35,000/20200 (35kV Nominal Voltage). These cables shall be suitable for underground, or interior power circuits in either wet or dry applications, and are 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.
- 1.2. Single-conductor cables shall consist of an individual strand filled conductor, with extruded semiconducting strand shield, insulation, semiconducting insulation shield, metallic shield and jacket.
- 1.3. Paralleled cable assemblies shall consist of three single-conductor cables wound in parallel onto a single reel.

2. APPLICABLE STANDARDS

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

AEIC CS8	Specification for Extruded Dielectric Shielded Power Cables Rated 5 through 46 kV
ANSI/ICEA S-94-649	Standard for Concentric Neutral Cables Rated 5 Through 46KV
ANSI/ICEA S-97-682	Standard for Utility Shielded Power Cables Rated 5 – 46KV
ICEA T-25-425	Test Method for Establishing Volume Resistivity Compatibility of Water Blocking Components with Extruded Semiconducting Shield Materials.
ICEA T-31-610	Test Method for Conducting Longitudinal Water Penetration Resistance Tests on Blocked Conductors
ICEA T-34-664	Test Method for Conducting Longitudinal Water Penetration Resistance Tests on Longitudinal Water Blocked Cables
ICEA T-32-645	Test Method for Establishing Volume Resistivity Compatibility of Water Blocking Components with Extruded Semiconducting Shield Materials.
ASTM B3	Standard Specification for Soft or Annealed Copper Wire
ASTM B8	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B230/B230M	Standard Specification for Aluminum 1350-H19 Wire for Electrical Purposes
ASTM B231B231M	Standard Specification for Concentric-Lay-Stranded Aluminum 1350 Conductors
ASTM B496	Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors
ASTM B609/B609M	Standard Specification for Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical Purposes
NEMA WC 26	Binational Wire and Cable Packaging Standard

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

3. CONDUCTOR MAXIMUM RATED TEMPERATURES

- 3.1. The maximum continuous operating temperature of conductor, at rated load, shall be limited to 90°C, the emergency operating temperature shall not exceed 130°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 conductors shall be 1350, either $\frac{3}{4}$ hard drawn or full hard drawn, and Class B, Compressed per applicable ASTM standards.
- 4.1.2. Copper conductors are to be untinned (bare), soft or annealed, Class B, Compressed per applicable ASTM standards. Compressed conductors shall be used for all cables except Item ID CAI CL 013 (750 cu), which shall be compact.
- 4.1.3. Strandfilled Conductors – to mitigate water (electrochemical) treeing in the insulation, a strandfilling 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 and strand shield per ICEA T-32-645. The outer strand surface of the conductor shall be free from the strandfilling compound. Item ID CAI CL 008 shall NOT have a Strandfilled conductor.

4.2. CONDUCTOR SHIELDING

- 4.2.1. This cable shall have an extruded, black colored, thermoset, conventional or super-smooth semiconducting shield applied directly over the conductor for stress relief and better adhesion of the insulation, and be compatible with the insulation material. Allowable conductor shield materials are listed in TABLE I.

TABLE I

<u>Manufacturer</u>	<u>Compound Designation</u>	<u>Type</u>
Borealis	LE-0594	Conventional
Borealis	LE-0595	Conventional
Borealis	LE-0500	Super-Smooth
Borealis	LE-0504	Super-Smooth
DOW	HFDA-0580	Conventional
DOW	HFDA-0581	Conventional
DOW	HFDA-0585	Conventional
DOW	HFDA-0800	Super-Smooth
DOW	HFDA-0802	Super-Smooth
Prysmian	LS572A	Conventional
Prysmian	LS572B	Conventional
Prysmian	XFB5502A	Super-Smooth
Prysmian	XFB5502B	Super-Smooth

4.3. INSULATION

- 4.3.1. The cable shall consist of extruded unfilled tree retardant cross linked thermosetting polyethylene insulation (DOW HFDC-4202 or Borealis LE-4212) directly over the conductor shield at the 100% level and comply with the requirements of ANSI/ICEA S-94-649.
- 4.3.3 The insulation diameter shall be in accordance with ICEA for CAI CL001 and CAI CL002. The insulation diameter shall be in accordance with AEIC CS8 on all other cables cover by this specification.

4.4. INSULATION SHIELDING

4.4.1. Extruded semiconducting shield (DOW HFDA-0693, Borealis LE-0520 or Prysmian LS-567A) shall be used between the insulation and the outer jacket to relieve stress.

4.4.2. The insulation shield diameter shall be in accordance with ICEA for CAI CL001 and CAI CL002. The insulation shield diameter shall be in accordance with AEIC CS8 on all other cables cover by this specification.

5. CABLE INSULATION EXTRUSION

5.1. Polyethylene Insulation, and semiconducting shield compounds shall be maintained, and extruded and cured in an extra clean, closed system. The cable shall be true triple extruded and dry cured.

6. METALLIC SHIELDING

6.1. The metallic shield shall consist of one of the following, with details as outlined in TABLE II.

6.1.1. A concentric neutral of solid bare copper wires helically applied per ANSI/ICEA S-94-649. Number and size of wires are given in Table II, concentric neutral alternate constructions per ICEA are allowed, alternate constructions not defined by ICEA must be approved by JEA.

6.1.2. A flat strap neutral of bare or tin-coated straps per ANSI/ICEA S-97-682. Number and size of flat straps are given in TABLE II.

6.1.3. A wire shield of solid bare copper wires helically applied per ANSI/ICEA S-97-682. Number and size of wires are given in Table II.

6.1.4. Uncoated, helically applied copper tape shielding with a nominal 25% overlap; shield may consist of either a single tape or two tapes intercalated.

TABLE II

<u>JEA Item ID</u>	<u>Description</u>	<u>Metallic Shield Type</u>	<u>Metallic Shield Details</u>
CAI CL 001	28 kV · 1/C · 1/0 AWG AL	Concentric Neutral	16 - #14 AWG
CAI CL 002	28 kV · 3-1/C Parallel · 1/0 AWG AL	Concentric Neutral	6 - #14 AWG
CAI CL 004	5 kV · 1/C · #8 AWG CU	Wire Shield	6 - #22 AWG
CAI CL 005	28 kV · 1/C · 350 kcmil AL	Concentric Neutral	18 - #14 AWG
CAI CL 008	28 kV · 1/C · 400 kcmil CU	Copper Tape Shield	One or Two Tapes (6.1.4)
CAI CL 009	15 kV · 1/C · 400 kcmil CU	Copper Tape Shield	One or Two Tapes (6.1.4)
CAI CL 010	35 kV · 1/C · 750 kcmil AL	Concentric Neutral	15 - #10 AWG
CAI CL 011	28 kV · 1/C · 1000 kcmil AL	Concentric Neutral	18 - #14 AWG
CAI CL 012	5 kV · 1/C · 750 kcmil AL	Concentric Neutral	24 - #12 AWG
CAI CL 013	15 kV · 1/C · 750 kcmil CU	Flat Strap Neutral	18 – 0.041" X 0.199"*
CAI CL 015	28 kV · 1/C · 350 kcmil CU	Concentric Neutral	18 - #14 AWG
CAI CL 020	28 kV · 3-1/C Parallel · 1/0 AWG CU	Concentric Neutral	9 - #14 AWG

*18 - 0.199" X 0.041" strips (based upon 25 KA fault current for .223 seconds, ICEA P-45-482,85°C/200°C, 18 - #10 AWG)

7. JACKET

- 7.1.1. For protection against corrosion of the metallic shield and mechanical protection of the cable, the cable shall be jacketed with a Linear Low-Density Polyethylene Compound. The jacket is to be applied without contamination or oil between the jacket and underlying insulation shield and metallic shield, and shall be suitable for exposure to direct sunlight. The jacket shall be free stripping and either be an encapsulating or overlaying (sleeved) jacket with water-blocking elements (water-swellaable powder or water-swellaable tape) per TABLE III and with thicknesses per ICEA S-94-649.
- 7.1.2. Item ID CAI CL 011 shall have a water-swellaable tape applied over the concentric neutral wires with two non-hygroscopic ripcords longitudinally applied at approximately 180° apart, above the water-swellaable tape. The ripcords shall be capable of ripping through the overlaying jacket.

TABLE III

<u>JEA Item ID</u>	<u>Description</u>	<u>Water-Blocking Elements</u>	<u>Jacket Type</u>	<u>Nominal Cable O.D. (inches)</u>
CAI CL 001	28 kV · 1/C · 1/0 AWG AL	Powder	Encapsulating	1.30
CAI CL 002	28 kV · 3-1/C Parallel · 1/0 AWG AL	Powder	Encapsulating	1.30
CAI CL 004	5 kV · 1/C · #8 AWG CU	Powder	Encapsulating	0.64
CAI CL 005	28 kV · 1/C · 350 kcmil AL	Powder	Encapsulating	1.71
CAI CL 008	28 kV · 1/C · 400 kcmil CU	Powder	Encapsulating	1.64
CAI CL 009	15 kV · 1/C · 400 kcmil CU	Powder	Encapsulating	1.42
CAI CL 010	35 kV · 1/C · 750 kcmil AL	Powder	Encapsulating	2.27
CAI CL 011	28 kV · 1/C · 1000 kcmil AL	Tape	Overlaying	2.28
CAI CL 012	5 kV · 1/C · 750 kcmil AL	Powder	Encapsulating	1.51
CAI CL 013	15 kV · 1/C · 750 kcmil CU	Powder	Encapsulating	1.66 MAX
CAI CL 015	28 kV · 1/C · 350 kcmil CU	Powder	Encapsulating	1.71
CAI CL 020	28 kV · 3-1/C Parallel · 1/0 AWG CU	Powder	Encapsulating	1.30

8. IDENTIFICATION

- 8.1. The cable shall have permanent contrasting markings (indented or hot foil tape) on the jacket at an interval not to exceed five feet. Cable identification shall meet the requirements of AEIC and contain plant designation. 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 paralleled cable assemblies.
- 8.2. Parallel cable assemblies shall have permanent contrasting phase identification (indented preferred) applied to the outer jacket of each cable at a maximum of twenty-four inch intervals; phase markings may be either 1, 2, or 3, or A, B, or C.

9. DIMENSIONS AND DATA

- 9.1. Approved manufacturers for each bid item shall be required to submit approval drawings and documentation that includes the cross-sectional drawing of the cable and dimensions including: insulation and insulation shield diameters and tolerances, and the overall nominal and maximum cable diameter (diameter over jacket). Diameters and tolerances must conform to AEIC and ICEA requirements. Cable weight per thousand feet (lbs./1000-ft.) shall also be included.
- 9.2. Ampacities and impedance values with applicable parameters shall be provided.
- 9.3. Additionally, the manufacturer and compound designation for the conductor shield, insulation and insulation shield shall be provided on each drawing.
- 9.4. At the time of notification, all required drawings/documentation must be received within the allotted time and approved by JEA Standards for specification conformance.
- 9.5. List of approved manufactures can be seen in the latest copy of the Master Material Catalog <https://www.jea.com/MaterialsCatalog/emmc.pdf>.

10. PACKAGING AND SHIPPING

- 10.1. Each reel shall be shipped complete with protective cover and identification marking for storage. Non-returnable wood reels per NEMA WC-26, Class II with a minimum arbor hole diameter of 3.125-inches. The reels must be able to withstand shipping, handling, and storage for at least one year without decomposition.
- 10.2. Heat shrinkable, water proof, insulated end caps shall be installed on each cable end. Examples of these are listed as THEHS002, THEHS003 & THEHS004 and can be found in the JEA Master Material Catalog at <https://www.jea.com/MaterialsCatalog/emmc.pdf>.
- 10.3. 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".
- 10.4. Cable shall be supplied with the maximum reel sizes and reel lengths and tolerances as listed in TABLE IV:

TABLE IV

JEA Item ID	Description	Reel Length and Tolerance (feet)	Maximum Reel Size (FL X OW) (inches)
CAI CL 001	28 kV · 1/C · 1/0 AWG AL	5000, -0%, +10%	72 X 45
CAI CL 002	28 kV · 3-1/C Parallel · 1/0 AWG AL	1500, -0%, +10%	72 X 45
CAI CL 004	5 kV · 1/C · #8 AWG CU	1000, -0%, +10%	72 X 36
CAI CL 005	28 kV · 1/C · 350 kcmil AL	1000, -0%, +10%	72 X 36
CAI CL 008	28 kV · 1/C · 400 kcmil CU	1000, -0%, +10%	72 X 36
CAI CL 009	15 kV · 1/C · 400 kcmil CU	1000, -0%, +10%	72 X 36
CAI CL 010	35 kV · 1/C · 750 kcmil AL	1000, -0%, +10%	72 X 45
CAI CL 011	28 kV · 1/C · 1000 kcmil AL	1000, -0%, +10%	72 X 36
CAI CL 012	5 kV · 1/C · 750 kcmil AL	2000, -0%, +10%	72 X 36
CAI CL 013	15 kV · 1/C · 750 kcmil CU	1000, -0%, +10%	72 X 36
CAI CL 015	28 kV · 1/C · 350 kcmil CU	1000, -0%, +10%	72 X 36
CAI CL 020	28 kV · 3-1/C Parallel · 1/0 AWG CU	1500, -0%, +10%	72 X 45

*Ideally JEA would like to keep the reel lengths at 5000'/1500' for cables 001, 002, and 020, however with our change of reel size from 47" OAW to 45" OAW we understand that this may not fit on the reel, JEA will accept 4500'/1400' for cables 001, 002, and 020.

10.5. Any material shipped to JEA and deemed unacceptable shall be returned to the manufacturer at his expense.

11. TESTING

11.1. JEA reserves the right to subject cable to test by a recognized laboratory.

11.2. Each shipping length of cable shall be tested, electrically and physically, in accordance with ICEA.

11.3. Certified test reports shall be available upon request on all cables shipped for a period up to five years. 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.

11.4. Each length of cable shall be tested in accordance with the AEIC CS8 specification. ICEA T-34-664 "Test Method 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 cables with encapsulating jackets and 5 PSIG for cables with overlaying jackets.

12. SUBMITTAL REQUIREMENTS

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 JEA 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.

REVISION HISTORY

<u>Date</u>	<u>Description</u>	<u>Author of Change</u>
4/14/20	Slight re-wording of text for Section 9.1	PARKTA
4/14/20	Slight re-wording of text for Section 9.5	PARKTA
4/14/20	Slight re-wording of text for Section 12	PARKTA
3/7/23	Reel size OW max decreased to 45" for all cable	PARKTA
8/1/23	Removed any reference to CAICL040	PARKTA
8/1/23	Arbor hole decrease from 3.25" to 3.125" Min, 10.1	PARKTA
6/27/24	Added to Table I on pg3, HFDA-0585	PARKTA
7/16/24	Updated wording in 7.1.2, Ripcord is to now be placed above the Water swellable tape	PARKTA
7/16/24	Added " * " to Table IV on footage exceptions	PARKTA