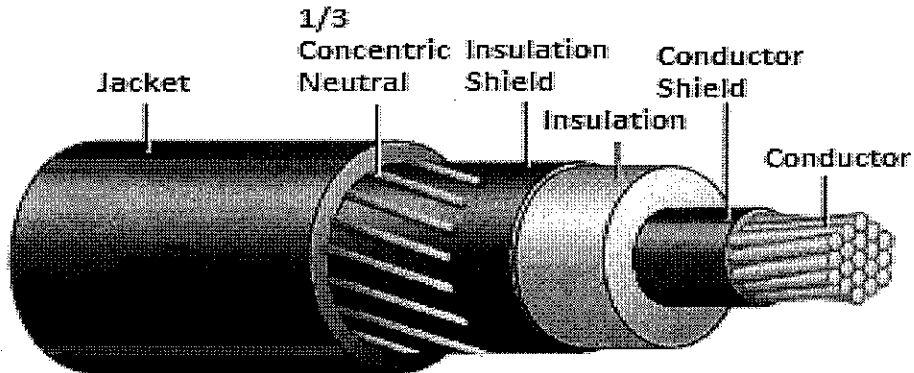


TECHNICAL SPECIFICATION

25kV CLASS UNDERGROUND CABLE

JPSCo Tech Spec No: 25KVUGCABLE-201407
 Supersedes: 0910-S-97 & 25KVUGCABLE-201403



Revision Number	Date of Revision	Revision Made	Prepared By
1	September 3, 2012	<ol style="list-style-type: none"> 1. Replaced the withdrawn-standard ICEA S-66-524 with current standards governing concentric neutral cables rated 5kV – 46 kV 2. Updated Table 1.2 to reflect current standards as it relates to wire number for concentric neutral. 	L. Fisher
2	March 10, 2014	<ol style="list-style-type: none"> 1. Standardized cable voltage classes to 25kV 2. Updated Sections 4-8 and Tables 1-4 3. Added manufacturer data sheet 	D. Tomlinson
3	July 15, 2014	<ol style="list-style-type: none"> 1. Standardized phase conductor stranding to compressed and compact round. 2. Replaced ICEA Standard S-94-649 and ANSI/ASTM D2656 with IEC Standard 60502-2:2014 3. Replaced ASTM B230 and B400 with IEC 60228:2004-11 4. Updated Tables 1 and 2 	D. Tomlinson

Prepared By:	Reviewed By:	Approved By:
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**TECHNICAL SPECIFICATION
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PART INDEX

1.	Scope	3
2.	General Requirements	5
3.	Standards and Service Conditions	3
4.	Detailed Requirements	5
4.1	Type	5
4.2	Ratings	6
4.3	Data to be furnished	8
4.4	Construction	8
5.	Tests	10
6.	Packaging and Marking	10
7.	Shipping/Labeling	11
8.	Information to be Provided by Supplier	12
9.	Appendix A – Schedule of Technical Data	13

The "Technical Specifications, General Requirements" forms part of this specifications

1. SCOPE

- 1.1 This specification cover single conductor aluminum cross-linked polyethylene insulated, shielded, concentric neutral underground cables for use on 50 Hertz 24 GRDY/13.8 kV, 13.8 Delta, 12 GRDY/6.9 kV system.

The construction and testing of the cable shall be accordance with the IEC Standards Publication 60502-2 and 60228 unless otherwise stated.

The 25 kV underground cable shall consist of six (6) components:

- a. Phase Conductor
- b. Conductor Shield
- c. Primary Insulation
- d. Insulation Shield
- e. 1/3 Concentric Neutral Conductor
- f. Jacket/Outer Sheath

2. GENERAL REQUIREMENTS

2.1 INFORMATION

Refer to "Submittal of Information" Section 2, paragraph 2.1 of "Technical Specifications, General Requirements".

2.2 DRAWINGS ETC. BY SELLER

Refer to "Codes and Standards" Section 2, paragraph 2.2 of "Technical Specifications, General Requirements".

3. STANDARDS AND SERVICE CONDITIONS

3.1 STANDARDS

- 3.1.1 Refer to "Codes and Standards" Section 3 of "Technical Specifications, General Requirements".

- 3.1.2 Applicable sections of the following standards shall be observed in the Design, Manufacture, Performance and Tests of the cables.
- 3.1.2.1 IEC Standard 60502-2 Ed 3.0 2014-02: Power Cables with Extruded Insulation and Their Accessories for Rated Voltages from 1 kV up to 30 kV.
 - 3.1.2.2 IEC Standard 60228 Ed 3.0 2004-11 – Conductors of Insulated Cables
 - 3.1.2.3 NEMA WC-21 Non-returnable reels for wire and cable.
- 3.1.3 In the event of a conflict between this specification and any of the above, the more stringent specification shall have precedence and shall govern. However the Bidder shall point out these conflicts in his bid at the time of tendering.

3.2 SERVICE CONDITIONS

- 3.2.1 Refer to "Geographic Conditions" Section 4 of "Technical Specifications, General Requirements".
- 3.2.2 Installation will be indoor or outdoor, single or bunched in any of the following condition or combination of conditions: Dry or wet locations, strapped to poles or laid under-ground in ducts, conduit or directly buried in earth to approximate depth of 0.75 m (2 1/2 feet). Cables will be installed in or within close proximity to chemical plants, refineries, industrial plants or residential areas.

4. DETAILED REQUIREMENTS

4.1 TYPE

- 4.1.1 Single core cross-linked polyethylene insulated 25 kV class, 50 mm² (#1/0 AWG). Aluminum phase conductor, compressed or compact round, concentric-lay-stranded, shielded, jacketed, 1/3 copper concentric neutral. Underground Cable to be used on nominal 24 GNDY/13.8 kV, 13.8 Delta and 12 GNDY/6.9 kV system. Cable is to be grounded at both ends.

- 4.1.2 Single core cross-linked polyethylene insulated 25 kV class, 120 mm² (#4/0 AWG). Aluminum phase conductor, compressed or compact round, concentric-lay- stranded, shielded, jacketed, 1/3 copper concentric neutral. Underground cable to be used on nominal 24 GNDY/13.8 kV, 13.8 Delta and 12 GNDY/6.9 kV system. Cable is to be grounded at both ends.

- 4.1.3 Single core cross-linked Polyethylene Insulated, 25 kV Class, 400 mm² (750 MCM). Copper phase conductor, compressed or compact round, concentric-lay-stranded, shielded, jacketed, 1/3 copper concentric neutral. Underground cable to be used on nominal 24 GNDY/13.8 kV, 13.8 Delta and 12 GNDY/6.9 kV system. Cable is to be grounded at both ends.

4.2 RATINGS

4.2.1. Cable Ratings

The cable shall conform to the ratings and dimensions listed in Tables 1 and 2 below:

Table 1: Cable Ratings [IEC 60502-2:2014 Tables B.2 & B.3/IEC 60228:2004 Table 2]

Cable Class (kV)	System Voltage (kV)	BIL (kV)	Cable Size mm ² (AWG/MCM)	Minimum Ampacity* (A)			Maximum DC Resistance of Phase Conductor at 20°C (Ω/km)	Maximum Conductor Continuous Temperature Rating (°C)
				Direct Buried	In Ducts	In Air		
25	24 GNDY/13.8	150	50 (#1/0)	157	146	189	0.641	90
	13.8 Delta		120 (#4/0)	260	242	332	0.253	
	12 GNDY/6.9		400 (750)	572	571	837	0.047	

*Assumes unarmoured cables, 50 Hz operating frequency, 20°C earth ambient temperature, 90°C operating temperature

Table 2: Cable Dimensions

PHASE CONDUCTOR										NEUTRAL CONDUCTOR	
Cable Class (kV)	Cable Size mm ² (AWG/MCM)	Material/Type	Nominal Diameter Range mm (mils)	Nominal Insulation Thickness mm (mils)	Nominal Insulation Outer Diameter mm (mils)	Nominal Insulation Shield Outer Diameter mm (mils)	Nominal Complete Cable Outer Diameter mm (mils)	Minimum Number of Wires	Material /Type	No. of Wires x AWG Size	
25	50 (#1/0)	Aluminum/Concentric-Lay-Stranded	7.7-8.6 (303-339)	6.6 (260)	23.37 (920)	25.40 (1000)	31.19 (1228)	19	Concentric	6 x #14	
					12.3-13.5 (484-532)	27.18 (1070)	29.72 (1170)			36.37 (1432)	37
	400 (750)	Copper/Concentric-Lay-Stranded Compressed/C Compact Round	22.3-24.6 (878-969)	100% Insulation	39.32 (1548)	41.86 (1648)	50.93 (2005)	61	Helicly-applied annealed copper	25 x #10	

4.4 CONSTRUCTION

4.4.1 PHASE CONDUCTOR

4.4.1.1 Aluminum Conductor

The phase conductor for the #1/0 and #4/0 AWG cables shall be composed of aluminum, compressed or compact round concentric lay stranding in accordance with Item 4.1 of IEC Standards Publication 60228:2004.

A conductor filling (stand blocking) is required to prevent ingress of water into the conductor. The material shall be designed to withstand 90°C operating temperature.

4.4.1.2 Copper Conductor

The phase conductor for the 750 MCM cable shall be of Class 1 or Class 2 compressed or compact round stranding, plain, annealed copper and in accordance with Item 4.1 of IEC Standards Publication 60228:2004.

4.4.2 CONDUCTOR SHIELD

The conductor shield shall consist of a single extrusion of black, semi-conducting thermosetting cross linked polyethylene (XLPE) rated for 90°C continuous operation and shall be in accordance with Item 7.2 of IEC Standards Publication 60502-2:2014.

4.4.3 INSULATION

The insulation shall be an extruded tree-retardant, cross-linked thermosetting polyethylene (TR-XLPE), 100 percent insulation level rated for 90°C continuous operation. It shall be applied directly over and be in intimate contact with the conductor shield. The insulation shall be in accordance with Item 6 of IEC Standards Publication 60502-2:2014.

4.4.4 INSULATION SHIELD

The insulation shield shall consist of a single extrusion of black semi-conducting polyethylene applied directly over the insulation. It shall be thermally compatible with the completed cable and be in accordance with Item 7.3 of IEC Standards Publication 60502-2:2014.

4.4.5 CONCENTRIC NEUTRAL

The concentric neutral shall consist of helically-applied annealed copper wires wrapped helically over the semi-conducting insulation shield with an opposite lay to the phase conductor.

The concentric neutral shall have a conductance equal to one third (1/3) of the phase conductor.

4.4.6 JACKET

The jacket shall be made from black ultraviolet (UV) resistant polyvinyl chloride (PVC). It shall have three extruded red stripes and the NESC lightning bolt symbol. The jacket shall protect the cable against moisture, corrosion, chemical action and mechanical damage. The jacket shall be in accordance with Item 14.2 of IEC Standards Publication 60502-2:2014.

5. TESTS

- 5.1 The cable manufactured to this specification must conform to the test requirements of the latest version of IEC 60502-2. The manufacturer shall submit two copies of the certified test report covering each production run for the subject cable. Results of production tests required by the reference specification shall be shown.
- 5.2 Manufacturer shall invite two (2) Representatives of the Purchaser at the Manufacturer's expense to witness the tests. This invitation shall be extended at least two (2) weeks before commencement of such tests. This condition may be waived at the Discretion of the Purchaser. The cost to the purchaser for the witnessing of these tests shall be shown as a separate item in the bid.

6. PACKAGING AND MARKING

- 6.1 Cables shall be packaged on non-returnable wooden type export reels designed and manufactured to NEMA WC-21 standards.
- Refer to "Export Packaging" Section 7 of "Technical Specifications, General Requirements" for further information.
- 6.2 Cables to be supplied in lengths of approximately 550 m (1,800 feet).
- 6.3 Each reel must be clearly marked on tagged (supplier's standard) showing legibly all essential information such as product identification, item description (cable type and size) Length and Gross, Tare and Net Weight.
- 6.4 For "Export Markings" refer to Section 8 of "Technical Specifications, General Requirements".
- 6.5 All conductors shall be clearly marked with the minimum following labels every two (2) feet along its length:
- a. Name of manufacturer
 - b. Phase conductor size (AWG/MCM) and material.
 - c. Voltage class
 - d. Insulation material and thickness (mils)
 - e. Jacket material

- f. Month and year of manufacture
- g. "PROPERTY OF JPS"

e.g. XYZ Wire Co 4/0 AWG AL 25 KV TRXLPE 260mils PVC 032014
PROPERTY OF JPS – NESC Lightning Bolt

- 6.6 All cables shall be clearly marked with the decreasing length of cable remaining on the reel every 50 feet along the length of the cable.

7. SHIPPING/LABELLING

Each reel shall have a nameplate clearly indicating the following information minimum information:

- Name of manufacturer
- Cable voltage class
- Phase conductor size (AWG/MCM) and material
- Insulation material and thickness
- Neutral conductor material, number of wires x AWG size
- Cable length
- Cable weight (kg/km)
- Month and Year of Manufacture
- Gross shipping weight
- Reel weight (less lagging)
- First and last sequential length numbers

Cable ends shall be sealed against the ingress of moisture. There shall be no water in the strands prior to sealing.

Unless otherwise specified on the purchase or release order, cable is to be shipped on the largest reels within the JPS handling limits of 1800 mm diameter and 2700 kg (gross) with a minimum reel hole size of 65 mm. The cable on the reel is to be suitably protected for shipping.

8. INFORMATION TO BE PROVIDED BY SUPPLIER

The following information shall be required for tender consideration:

- Completion of Data Sheet in Appendix A
- Any deviations from the requirements of this specification
- Certified cross-sectional drawings detailing the dimensional components of the cable
- Warranty Conditions

The following information shall be required prior to shipment and approved by JPS Engineering Standards Department:

- Certified Test Reports as per Section 5

APPENDIX A - SCHEDULE OF TECHNICAL DATA

DATA SHEET FOR 25 kV UNDERGROUND CABLES

Manufacturer		
Country of Origin		
Voltage Class (kV)		
Ampacity (A) [Please state assumptions]	Direct Buried	
	In Ducts	
	In Air	
Basic Impulse Level BIL (kV)		
DC Resistance of Cable at 20°C (Ω/km)		
Maximum Continuous Operating Temperature (°C)		
Phase Conductor	Size (AWG/MCM)	
	Material (Al/Cu)	
	Type (Compressed/Compact Round)	
	No. of Strands	
Conductor Shield	Material	
	Thickness	
Insulation	Material	
	Thickness	
Insulation Shield	Material	
	Thickness	
Neutral Conductor	Material	
	Type	
	No. of Wires x AWG Size	
Jacket	Material	
	Thickness	
Extruded Red Stripes with NESC Lightning Symbol on Jacket as per JPS Specification (Section 4.4.6)		Yes <input type="checkbox"/>
		No <input type="checkbox"/>
Cable Labelling and Serial Marking as per JPS Specification (Sections 6.5 & 6.6)		Yes <input type="checkbox"/>
		No <input type="checkbox"/>
Deviations from JPS Specification		