

**SPECIFICATIONS FOR LOW VOLTAGE
POWER AND CONTROL CABLES**

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**11-SDMS-01
Rev.03**

**SPECIFICATIONS FOR LOW VOLTAGE POWER AND
CONTROL CABLES**

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Revision History

#	Date	Revision No.	Revised By	Major Revision Description
1	01/2020	03		Add 1x800mm ² AL power cable
2	01/2020	03		Change warranty duration to 5 years
3				
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1. Scope

This SEC Distribution Materials Specification specifies the minimum technical requirement for design, engineering, manufacturing, inspection, testing and performance of XLPE insulated, unarmored, four core Aluminum or single core Copper power cables, PVC insulated multi core control cables rated up to 750V, suitable for direct burial or installation in ducts or in air within cable guard on poles intended to be used in the low voltage system of Saudi Electricity Company (SEC), Saudi Arabia.

2. CROSS REFERENCES

This Specification shall always be read in conjunction with SEC General Specification No. 01-SDMS-01 latest revision titled “General Requirements for all Equipment/Materials”, which shall be considered as an integral part of this SDMS.

This SDMS shall also be read in conjunction with SEC Purchase Order or Contract Schedules and the Scope of Work and Technical Specifications for project, as applicable.

3. APPLICABLE CODES AND STANDARDS

The latest revision of the following Codes and Standards shall be applicable for the equipment/material covered in this SDMS. In case of conflict, the vendor/manufacturer may propose equipment/material conforming to one group of Codes and Standards quoted hereunder without jeopardizing the requirements of this SDMS.

Standard #	Title
IEC 60228	Conductors of Insulated Cables
IEC 60502-1	Cables for Rated Voltages of 1kV ($U_m=1.2KV$) and 3KV ($U_m=3.6KV$)
IEC 60227	Polyvinyl Chloride Insulated Cables Of Rated Voltages Up To And Including 450/750V

Table 1: List of applicable standards

4. DESIGN AND CONSTRUCTION REQUIREMENTS

4.1.GENERAL

- 4.1.1 Cables shall meet or exceed the requirements of this Specification in all respects.
- 4.1.2 Manufacturer's drawings, as required by 01-SDMS-01 latest revision, shall show the outline of the cables, together with all pertinent dimensions. Any variations in these dimensions due to manufacturing tolerances shall be indicated.

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4.2. DESIGN CRITERIA

- 4.2.1 Unless otherwise specified, the cable shall be manufactured and tested in accordance with the referred standards.
- 4.2.2 Cables shall be designed for ambient temperature conditions specified in 01-SDMS-01 latest revision.
- 4.2.3 The cable shall be designed for a maximum permissible continuous temperature of 90°C, emergency loading temperature of 105°C and maximum conductor short circuit withstand temperature of 250°C.
- 4.2.4 The ratings and dimensions shall be as indicated in Data Schedule.

4.3. MATERIALS

4.3.1. CONDUCTOR

- 4.3.1.1 The conductor shall be uncoated annealed copper or aluminum class 2 as per IEC 60228 and shall be compacted and stranded.
- 4.3.1.2 Copper power and control cable shall be soft drawn multi-strands with
- 4.3.1.3 minimum number of strands as specified in the relevant IEC. The conductor size, shape and material shall be as specified in Data Schedule and shall be as shown in Table 2 below:

Conductor size (mm ²)	Material	Design	Insulation	Shape
2.5	Copper	Control 2 core	PVC	Round
2.5	Copper	Control 12 core	PVC	Round
70, 185, 300	Aluminum	Power 4 core	XLPE	Sector
35, 120, 185, 630	Copper	Power 1 core	XLPE	Round
800	Aluminum	Power 1 core	XLPE	Round

Table 2: Cable type overview

4.3.2. INSULATION

- 4.3.2.1 Power cables insulation shall be extruded solid dielectric cross-linked polyethylene (XLPE), Control cables insulation shall be polyvinyl chloride (PVC). Insulation shall comply with the appropriate requirements specified in IEC 60502-1.
- 4.3.2.2 The nominal insulation thickness shall be as per values specified in IEC 60502-1, with respect to voltage rating and cable cross-section.

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4.3.2.3 The nominal minimum insulation thickness of control cables shall be according to relevant standard.

4.3.2.4 The average insulation thickness shall not be less than the specified nominal value.

4.3.2.5 The minimum thickness of the insulation at any point shall not fall below the nominal value by more than 0.1 mm + 10% of the specified nominal value.

4.3.3. INNER COVERING AND FILLERS REQUIREMENTS

4.3.3.1 The inner covering is not required as power cables are unarmored, however, the outer shape of the cable shall remain practically circular and no adhesion occurs between cores and sheath.

4.3.3.2 Multi-core, sector shape cables shall have non hygroscopic film fillers in order to form a compact circular outer shape.

4.3.3.3 Inner covering in control cables shall be according to relevant standard.

4.3.3.4 Filler material shall be compatible with the insulation and suitable for the operating temperature of the cable.

4.3.4. OUTER SHEATH

4.3.4.1 The outer sheath material shall be black PVC, type ST2 as per IEC 60502-1.

4.3.4.2 The nominal thickness of the outer sheath shall be as per IEC 60502-1.

4.3.4.3 Minimum thickness at any point shall not be less than value specified as per IEC 60502-1 of the nominal value.

4.3.4.4 Thickness in control cables shall be according to relevant standard.

4.4. CORE IDENTIFICATION

4.4.1 The XLPE insulation of the Four-core cable shall be colored, Red, Yellow, Blue and Black.

4.4.2 Single core Copper cable shall be with Black XLPE insulation.

4.4.3 Single core (800mm²) Aluminum cable shall be with Dark green XLPE insulation.

4.4.4 The core insulation of control cables shall be black PVC marked with indelible clear white print numerals.

4.5. FABRICATION

All cables shall be free of material and manufacturing defects, which would prevent it from meeting the requirements of this Specification.

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4.6. MARKING

- 4.6.1 The jacket for all cables shall be marked by embossing at intervals not exceeding one meter with the following minimum information:
- The manufacturer's name (in English, Arabic or trademark)
 - Voltage designation (in English)
 - Type of insulation, XLPE (in English)
 - Conductor size and material (in English and Arabic)
 - Year of manufacture (in English and Arabic)
 - Cumulative length at every one meter with the highest length mark on the outer end of the cable.
- 4.6.2 All cables shall be marked with "Property of Saudi Electricity Company" in both Arabic and English.
- 4.6.3 All marking/numbering shall be indelible, marking by matrix print shall not be acceptable.

5. TESTS

5.1. GENERAL

- 5.1.1 All cables shall be tested in accordance with the latest standards and as specified herein. Supplier shall provide all test results for review and acceptance by SEC.
- 5.1.2 The full range of Routine, Sample and Type tests specified in IEC 60502-1, clause 14, 15, 16 and 17 shall be carried out as applicable.
- 5.1.3 Routine and/or special tests shall be carried out in the supplier's factory. Type test report/certificate from SEC approved independent testing laboratory shall be submitted to SEC.

5.2. ROUTINE TESTS

The following routine tests shall be carried out on all finished cables:

5.2.1. ELECTRICAL RESISTANCE OF CONDUCTORS

resistance values shall be in accordance with IEC 60228.

5.2.2. AC VOLTAGE TEST

Cable shall be tested for 5 minutes at the following voltages:

- Phase to ground = 3.5kV for single core cable
- Phase to Phase = 6kV for multi core cable

5.2.3. SAMPLE TESTS

Conductor Examination shall be in accordance with IEC 60228.

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Dimensional Check shall be in accordance with IEC 60502-1, clauses listed below:

- a. For insulation, clause 4.2 and table 3
- b. For outer sheath, clause 12.3

Hot Set Test for XLPE insulation, as per IEC 60502, clause 15.10.

5.3. TYPE TESTS

Complete test (electrical and non-electrical) shall be carried out as per the relevant IEC standards.

6. PACKING AND SHIPPING

In addition to the applicable items per 01-SDMS-01, packing and shipping of the cable shall conform to the following:

- a. The cable ends shall be sealed with a waterproof, heat shrinkable plastic or elastomeric end cap with adhesive type sealing compound. Cable ends shall be properly secured to the reel.
- b. The cable shall be delivered without splices, on standard sized returnable wooden reel of sturdy construction properly packed and lagged externally to prevent possible damage to the cable during transportation. Wood lagging or better material shall also be secured with steel straps to provide physical protection for the cables during transit and during customary storage and handling operations.
- c. The minimum diameter of the drum of the shipping reel shall not be less than the minimum bending diameter of the cable.
- d. Cables shall be supplied in lengths of 500 meters. The allowable tolerance on the specified length shall be $\pm 5\%$.

6.1. REEL MARKINGS

6.1.1. GENERAL REQUIREMENTS

Cable reels/drums shall be marked in legible and indelible letters on aluminum plate 30x20 cm plate, giving the following particulars:

- a. Cable voltage and conductor material and size
- b. Type of cable
- c. Length and weight of cable on reel
- d. Gross weight
- e. Dimensions of reel
- f. Manufacturer's name and country of origin

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- g. SEC address and purchase order number
- h. Serial number of reel
- i. SEC stock number in bold numerals
- j. Direction of rolling of reel
- k. 11-SDMS-01

6.1.2 All markings shall appear on both sides of the reel.

6.1.3 Cable reel identification shall include any additional information as required by SEC shipping instructions.

7. GUARANTEE

The Supplier shall guarantee the cables against all defects arising out of faulty design or workmanship, or of defective material for a period of five (5) years from the date of delivery.

8. SUBMITTALS

Submittals required with the tender:

- a. The supplier shall complete and return one copy of the attached Data Schedule for every type of cable offered
- b. Guaranteed Ex-works delivery date
- c. Type test certificates
- d. Dimensional cross-sectional drawings of each cable and cable drum along with technical data and catalogues shall be submitted by the supplier to facilitate evaluation of the offer

Submittals required following the award of contract:

- a. Details of manufacturing and test programs
- b. Factory test reports

All of the above required shall be in hard and soft copy.

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9. TECHNICAL DATA SCHEDULE

SEC Inquiry No: _____

Item No: _____

No	Description	SEC Specified Values	Vendor proposed values**
1	Reference manufacturing standard	IEC 60502/IEC 60227-7	
2	Max. permissible continuous conductor temperature	90°C	
3	Max. permissible continuous temp. of outer sheath (°C)	*	
4	Rated voltage (control/power)	750/1000 V	
5	No. of cores	As per Table 2	
6	Conductor material	CU or AL	
7	Shape of conductor	Sector/round	
8	Conductor cross-section (mm ²)	*	
9	Approximate diameter of conductor (mm)	*	
10	No. of strands of conductor	As per IEC	
11	Insulation material	PVC/XLPE	
12	Nominal thickness	As per IEC	
13	Diameter over insulation	*	
14	Core identification (red, yellow, blue, black)	YES	
15	Filler material	*	
16	Outer sheath material	PVC type ST2	
17	Thickness of outer sheath	As per IEC	
18	Color of outer sheath	Black/Dark green	
19	Marking embossed as specification	Yes	
20	Overall diameter of the cable	*	
21	Net weight per km (kg/km)	*	
22	Conductor DC resistance at 20°C (ohms/km)	*	
23	Conductor AC resistance at operating temp. (ohms/km)	*	
24	Inductance (Mh/km)	*	
25	Inductive reactance (ohms/km)	*	
26	Conductor impedance at maximum continuous operating temperature (ohms/km)	*	
27	Capacitance	*	
28	Short Circuit Rating of Cable Based on maximum Conductor Operating Temp. 1 sec. (kA)	*	

Table 3: Low voltage power and control cables – Design and Construction Requirements (SEC Ref: 4.0)

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SEC Inquiry No: _____

Item No: _____

No	Description	SEC Specified Values	Vendor proposed values**
1	Drum type	Returnable	
2	Length of cable (m)	500 meters	
3	Dimensions (m)	*	
4	Gros weight (kg)	*	
5	Net weight (kg)	*	
6	Marking as per the Specification	Yes	

Table 4: Low voltage power and control cables – Packing and Shipping (SEC Ref: 6.0)

SEC Inquiry No: _____

Item No: _____

No	Description	SEC Specified Values	Vendor proposed values**
1	All submittals as per the Specification	Yes	

Table 5: Low voltage power and control cables – Submittals (SEC Ref: 8.0)

(*) – Values to be provided/proposed by the Vendor

(**) – Please provide explanation for deviations, if any

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- g. Additional Technical Information or Features Specified by SEC
- h. Additional Supplementary Data or Features Proposed by Bidder/Vendor/Supplier.
- i. Other Particulars to be filled-up by the Bidder/Vendor/Supplier.
- j. List of Deviations and Clauses to which exception is taken by the Bidder/Vendor/Supplier. (Use separate sheet, if necessary).

Description	Manufacturer of Material/Equipment	Vendor/Supplier
Name of Company		
Location and Office Address		
Name and Signature of Authorized Representative with Date		
Official Seal / Stamp		