12-SDMS-01
Rev.03

SPECIFICATIONS
FOR
CABLE JOINTS, TERMINATIONS, AND ACCESSORIES UP TO 36 KV

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1.0 SCOPE

This SEC Distribution Materials Specification (SDMS) specifies the minimum technical requirements for design, engineering, manufacture, testing, inspection and performance of joint kits, indoor and outdoor termination kits, and their accessories up to 36 kV, intended to be used in the distribution system of Saudi Electricity Company (SEC).

2.0 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 scope of work/technical specifications for projects, as applicable.

The latest revisions of the following specifications shall be applicable with reference to cables.

2.1 11-SDMS-01 Specification for low voltage power and control cables
2.2 11-SDMS-03 Specification for insulated power cables for rated voltage from 15 kV up to 36 kV (U_m)
2.3 12-SDMS-02 Lugs and connectors for MV/LV distribution system

Reference for cables, sleeve and lug connectors not covered by above specifications shall be as per tender enquiry.

3.0 APPLICABLE CODES & STANDARDS

The latest revisions of following codes and standards shall be applicable for materials covered in this SDMS. In case of any conflict, the manufacturer/vendor may propose materials conforming to one group of industry codes and standards quoted hereunder without jeopardizing the requirements of this SDMS.

3.1 IEC 60060-1 & 2 High-voltage test techniques
3.2 IEC 60230 Impulse tests on cables and their accessories
3.3 IEC 60502-1, 2 & 4 Power cables with extruded insulation and their accessories for rated voltages from 1 kV (U_m = 1.2 kV) up to 30 kV (U_m= 36 kV).
3.4 IEC 61442 Test methods for accessories for power cables with rated voltage from 6 kV (U_m= 7.2 kV) up to 30 kV (U_m 36 kV)
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</tr>
<tr>
<td>3.7</td>
<td>HD 629.1 S2</td>
<td>Test requirements on accessories for use on power cables rated voltage from 3.6/6(7.2) kV up to 20.8/36(42) kV Part 1</td>
</tr>
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<td>Test requirements on accessories for use on power cables rated voltage from 3.6/6(7.2) kV up to 20.8/36(42) kV Part 1</td>
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<td>EN 50393</td>
<td>Test methods and requirements for accessories for use on distribution cables of rated voltage 0.6/1.0 (1.2) kV</td>
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<td>Plug-in type bushings above 1 kV up to 52 kV and from 250 A to 2.50 kA for liquid filled transformers</td>
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<td>Standard for Separable Insulated Connector System for Power Distribution Systems above 600 Volts</td>
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<td>3.17</td>
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<td>Mechanical and Physical testing for Splices and Termination LV</td>
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4.0 DESIGN AND CONSTRUCTION REQUIREMENTS

4.1 General

4.1.1 Joint/Termination kits and accessories shall meet or exceed the requirements of this specification in all respects.

4.1.2 Manufacturer's drawings shall show outline of joints, terminations, and accessories together with all pertinent dimensions. Any variation in these dimensions due to manufacturing tolerances shall be indicated.

4.1.3 All lug and sleeve connectors included inside the kit shall be supplied from SEC approved manufacturers and in accordance to relevant SEC specification. Moreover, connectors may be supplied by kit manufacturer provided report of type test conducted by SEC-approved laboratory were submitted to and accepted by SEC. Connectors manufactured by other manufacturer are not acceptable.

4.2 Design Criteria

4.2.1 Cable Joints

a) Cable joints shall meet all requirements of applicable standards, and shall be designed such that no insulating or semiconducting tapes shall be required, except void filler tape and sealing mastic.

b) Cable joints shall provide waterproofing, mechanical and electrical protection and be completely sealed from cable jacket to cable jacket.

c) Outer jacket shall be mechanically strong and be coated with hot-melt adhesive.

d) All outer jackets shall accept stamping/identification of installation information. It shall be tagged, embossed or engraved.

e) Name of manufacturer should be permanently super embossed clearly on all outer tubes for easy tracing.

f) Cable joints shall meet all the test requirements mentioned in section 5.0

Heat Shrink

a) The diameter of heat shrinkable materials shall reduce to a predetermined size upon application of heat with high temperature according to respective standards yielding a minimum shrink ratio of 3 to 1 and a maximum longitudinal shrinkage of 5%.

b) The recovered wall thickness of insulation tubing over the connector shall be uniform and equal to or greater than the cable insulation
thickness as given in IEC 60502-1 and IEC 60502-2.

c) The adhesive shall have a softening temperature not less than 90 °C, in accordance with ASTM E28, shall be compatible with other components of joints and cables, and, after curing, shall not flow at temperatures of normal service.

**Cold Shrink**

a) Require no special tools for installation and no components that need any heat for shrinking except for outer jacketing.

b) Stress control and sealing should either be built-in or provided separately.

c) It should be manufactured from high performance silicone or extruded EPDM rubber with very high thermal stability and long term elasticity.

**Pre-Molded**

a) Require no special tools for installation and no components that need any heat for shrinking except for outer jacketing.

b) Manufactured from peroxide cured EPDM rubber or high performance silicone.

**4.2.2 Long Joint**

This joint is intended to repair damaged MV cable requiring extra length where applicable.

a) Length of ferrules shall not be less than 440 mm.

b) All ferrules shall be either crimped or shear bolt type with very smooth surface.

c) It should be either heat shrink, cold shrink, or pre-molded

**4.2.3 Terminations**

**Heat/Cold Shrink**

a) Termination shall meet the criteria stated under section 4.2.1.a to 4.2.1.d, and shall be designed to provide a complete moisture seal, including the crotch area of multi-core cables and complete re-jacketing of individual cores conforming to class-1 terminations as per applicable standards.

b) The anti-tracking tube shall be generally suitable for indoor and
outdoor installation, ultraviolet and chemical resistant and without adhesive coatings and shall be capable of being stored without damage at temperatures up to 55 °C.

c) Creepage distance for outdoor termination shall be according to the latest revision of SEC General Specification No: 01-SDMS-01 applicable for coastal areas. Length of termination for indoor application shall be as per tender/inquiry.

d) The termination system shall meet all test requirements described in section 5.0 of this specification.

**Premolded**

a) Require no special tools for installation and no components that need any heat for shrinking except for breakouts and tails.

b) Use of insulating tape along cable insulation is not acceptable.

**Premolded Elbow Connectors**

a) It shall be suitable for outer cone bushing according to EN 50180 and EN 50181.

b) The premolded screened separable connectors shall be manufactured from sulfur or peroxide cured EPDM rubber, having a thick (3 mm) molded outer shield with resistance of maximum 5000 ohm.

c) Require no special tools for installation and no components that need any heat for shrinking except for breakouts and tails (for 3-core cables).

d) The connectors shall be designed to provide a complete moisture seal (IP 67 as per IEC 60529), including the crotch area of multi-core cables, and complete re-jacketing of individual cores.

e) Use of insulating or semiconducting tapes along cable insulation is not acceptable.

f) Routine test shall be done on each individual premolded screened separable connector housing checking partial discharge extinction and AC voltage withstand.

**Plug-in Connector**

a) It shall be suitable for inner cone bushing according to EN 50180 and EN 50181.

b) Premolded stress cone shall include geometric field control elements.
c) Outer surface of main connector body shall be screened and earthed.

d) Outer jacket of all conductors shall be 5 m long (tail length).

<table>
<thead>
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<th>TYPE</th>
<th>CURRENT RATING</th>
<th>CONDUCTOR/SIZE</th>
<th>VOLTAGE</th>
</tr>
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<tr>
<td>2</td>
<td>800 A</td>
<td>Cu--185 mm², 240 mm²</td>
<td>36 kV</td>
</tr>
<tr>
<td>3</td>
<td>1250 A</td>
<td>Cu--185 mm², 240 mm², 500 mm²</td>
<td>36 kV</td>
</tr>
</tbody>
</table>

4.2.4 Cable End Caps

Cable end caps shall be without hook or valve and be internally coated with adhesive to provide environmental sealing to the cable jacket at the end of cable. Individual cap in proper packing shall be supplied.

4.2.5 Repair Sleeve

a. Wrap around sheath/repair sleeve for MV cables shall be heat shrink type and shall be coated with adhesive that becomes activated on the application of heat and when shrunk will form a bond with cable jacket.

b. Repair sleeves for LV cables shall be supplied in length of 1.5 meters complete with channels and clips in proper packing.

c. The diameter of sleeve (as supplied and retainable/recovered after shrinkage) shall be marked on the sleeve.

4.2.6 Identification Marker

a. For identification of medium voltage joint and termination kits, identification marker shall be supplied with blank, white-colored, adhesive-baked, wrap-around polyolefin, capable of operating temperature minus 55°C to plus 135°C and recovery temperature of plus 100 °C.

b. Details and dimension are given in fig 1.

4.3 Fabrication

4.3.1 Cable Joints

a) Cable joints shall be supplied in complete kit with all materials and components required to complete the installation. Connectors shall be included in the kits. The cable joints shall be suitable for cables specified in the tender/inquiry.
b) Components shall not be adversely affected in any manner by contact with other materials normally used in the construction of cable joints and shall not increase the rate of corrosion of any metal with which they may come into contact.

For heat shrink joints for 36 kV applications:

The dual wall co-extruded tubing has to be supplied to restore both insulation and screening of the core (an additional red insulating tube is allowed).

Tenderers must submit:

i. Proof that dual wall tubings are manufactured by means of co-extrusion.

ii. Confirmation of the maximum thickness of insulation provided over the connector for the maximum size of conductor for which the tubing is supplied. The insulation layer shall provide an insulation thickness of at least 20% more than the cable insulation.

c) All components of a joint shall perform without distress under the normal conditions, cyclic loading, and fault conditions.

d) Components supplied with adhesive coatings shall have means to prevent the coated surfaces from adhering to each other.

e) In case of tape armored and shielded cable, all items needed for tape clamping shall also be provided, including worm type rings for such application. Moreover, inner sleeve shall be provided between the metallic screen and the galvanized steel wraparound cover.

f) Reinstatement of mechanical protection for armored cables shall be in the form of galvanized steel wraparound cover, not steel tubing. Ends of steel strips forming wraparound shall be rounded and not sharp. The cover shall be protected with heat shrinkable tube.

g) Transition joints shall be suitable for different types of cables specified in the tender/inquiry.

4.3.2 Termination

a) Terminations shall be supplied in complete kit form with all materials and components required to complete the installation, including the cable lugs, steel mounting bracket and polymeric insulators (in case of outdoor termination), in one box. Fabrication shall be the same as mentioned under section 4.3.1.a to 4.3.1.e.

b) Outdoor overhead lines pole top termination kits for 15 kV and 36 kV cables shall include galvanized steel mounting bracket with mounting
slot suitable for M20 bolt and include polymer insulators with hot-dipped galvanized or stainless M12 steel stud for all the three cores. Lug connectors shall be suitable for M12 stud and shall be longitudinally sealed type.

c) Low voltage cable terminations shall be suitable for outdoor conditions. All accessories required for complete termination shall be included in the kit along with longitudinally sealed lugs, sealing tube for lugs, and core sleeves in red, yellow, and blue color for phase and neutral identification.

4.4 Marking

4.4.1 All components of joints and terminations shall be clearly marked with the manufacturer’s name and reference numbers. The marking shall be done before coating the adhesive onto the component.

4.4.3 All components shall be capable of being stored without deterioration within the temperature range of -10 ºC to +50 ºC. Components or materials, if subjected to a shelf-life limitation, shall have the final date of use prominently and permanently shown on all packages.

4.4.4 Each hard box shall be printed with the following information:
   a) Joint/termination/accessories catalog number
   b) Purchase order number/tender
   c) Manufacturer’s name
   d) Year of manufacture
   e) Date of expiry
   f) SEC item number

4.4.5 Each wooden box shall be fixed with an aluminum plate bearing the following information:
   a) Purchase order number/tender
   b) Manufacturer’s name
   c) Year of manufacture
   d) Date of expiry
   e) Joint/termination/separable elbow/accessories catalog number
   f) Gross weight in kilograms (pounds)
   g) Position of slinging points and other relevant handling instructions.

5.0 TESTING AND INSPECTION

All joints, terminations, and accessories shall be tested in accordance with the respective latest applicable standards mentioned in clause 3.0. The tests sequence procedure shall be submitted for SEC approval.
5.1 **Routine Tests**

These tests shall be carried out in accordance with the requirements of respective standard to which the joints, terminations, and accessories are offered.

5.2 **Type Tests**

5.2.1 **Electrical Tests**

The vendor shall provide certified test reports from SEC-approved laboratory along with the bid for the materials offered to show that the applicable electrical tests mentioned applicable standards in clause 3 have been qualified.

5.2.2 **Mechanical and Physical Tests**

The vendor shall provide certified, independent test reports with the bid to show that the materials offered meet all the mechanical and physical testing requirements, as applicable.

6.0 **PACKING AND SHIPPING**

6.1 The joint / termination kits and accessories shall be delivered ready for service.

6.2 All components in the kit should be individually packed and labeled in the main packing.

6.3 All void filling mastic and sealant tapes should be packed in aluminum foil to prevent moisture absorption.

6.4 Kits shall include identification marker sized 125 mm x 50 mm (figure 1) made of polyurethane or of cardboard in water-proof plastic cover and installation instruction shall include instruction that the identification marker shall be filled-up using permanent marker pen and attached to the joint/termination.

6.4 Each joint and termination kit along with appropriate installation instructions in English and Arabic languages shall be packed separately in hard board box. The number of boxes per non-returnable pallet shall be limited in such a way that no damage by its own weight will occur during transport.

6.5 Packing shall be designed to protect against ingress of moisture and to prevent mechanical damage. Packing notes shall be included in each hard board box giving a description of the goods packed.

6.6 The kits shall not be packed in perishable material.
6.7 Outdoor overhead lines pole top terminations, which include galvanized steel mounting bracket and insulators (for three-core or for three single-core termination kits), 15 kV and 36 kV cables, shall be packed in one box.”

6.8 All components shall be capable of being stored without deterioration within the temperature range of 0 °C to + 50 °C. Components or materials, if subject to a shelf life limitation, shall have the final date of use prominently and permanently shown on all packages.

7.0 GUARANTEE

The supplier shall guarantee the kits against all defects arising out of faulty design or workmanship or defective material for a period of two years from the date of delivery or one year from installation date, whichever comes first.

8.0 SUBMITTALS

8.1 Submittals required with Tender/Inquiry

a) Two copies or one set of reproducible documents shall be supplied along with the tender.
b) Soft copy of all documents for the tender shall be placed in CD/DVD and submitted during the tender.

8.2 Certified Independent Test Reports from SEC approved test facility

a) To show that the material offered meet the electrical type tests specified in applicable standards.
b) To show that the material offered meet the mechanical and physical type tests as per the applicable standards.

8.4 Required documents for offered material

8.4.1 Duly completed technical data schedule for each offered item.

8.4.2 Installation instruction in English and Arabic languages.

8.4.3 Complete list of items contained in each joint and termination kit.

8.4.4 Catalogue for all components used with highlighted part number.

8.4.5 Detailed engineering drawings showing the design of Joint, Termination and accessories.
8.5 **Submittal of certificate confirming the accuracy/completeness of kit contents.**

The supplier shall submit certificate that termination/joint kit shall be supplied along with all required kit contents/components complete in all respects and ready for installation as well as according to list supplied by him at the time of prequalification. The supplier shall be liable to supply any component found missing at the time of delivery/installation immediately without any delay, SEC reserve the right for suitable action.

8.6 **Submittals required following award of contract**

8.5.1 **Factory Test Reports**

a) Quality Assurance Tests.

b) Routine Tests.

c) Manufacturing/Test Schedules.
9.0 TECHNICAL DATA SCHEDULE

Cable Joints and Terminations
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<tr>
<th>SEC Tender No.</th>
<th>Line Item No.</th>
<th>SEC Item No.</th>
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Applicable Standards and Codes: ____________________________

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<tr>
<th>SEC REF.</th>
<th>DESCRIPTION</th>
<th>SEC SPECIFIED VALUES (*)</th>
<th>VENDOR PROPOSED VALUES</th>
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<tr>
<td>4</td>
<td>DESIGN AND CONSTRUCTION REQUIREMENTS</td>
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<td></td>
</tr>
<tr>
<td>1 Joint/ Termination</td>
<td>*</td>
<td></td>
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</tr>
<tr>
<td>2 Type</td>
<td>Heat Shrinkable Cold Shrinkable PreMolded Elbow/Tee connector Plug In Connector</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>3 Outdoor/Indoor (Termination Kit only)</td>
<td>*</td>
<td></td>
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<td>4 Tail length (Termination Kit only)</td>
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<tr>
<td>5 Type 2/Type 3 (Plug In Connector only)</td>
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<tr>
<td>6 Conductor material, size and number of cable cores</td>
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<td>7 Voltage designation (kV)</td>
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<tr>
<td>8 Manufacturer catalog number</td>
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<td>9 Class of termination as per applicable standard.</td>
<td>Yes</td>
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<tr>
<td>10 Creepage distance (mm) (Outdoor Termination only)</td>
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<tr>
<td>11 List of contents per kit supplied as per SEC approved sample</td>
<td>Yes</td>
<td></td>
<td></td>
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<tr>
<td>12 Submittals required as part of tender/inquiry included</td>
<td>Yes</td>
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<td>13 Weight of each joint/termination (kg)</td>
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<tr>
<td>14 Name of the manufacturer</td>
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<td></td>
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<td>15 Country of origin</td>
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* As per tender/inquiry, as applicable.
## 9.0 TECHNICAL DATA SCHEDULE

**Cable Joints and Terminations**  
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A) Additional technical information or features specified by SEC.

B) Additional supplementary data or features proposed by bidder/vendor/supplier.

C) Other particulars to be filled-up by the bidder/vendor/supplier.

D) List of deviations and clauses to which exception is taken by the bidder/vendor/supplier.  
(Use separate sheet if necessary)

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<th>Description</th>
<th>Manufacturer of Material</th>
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<td>Name &amp; Signature of Authorized Representative with date</td>
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<td>Official Seal / Stamp</td>
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Technician’s Name: ________________________________
Technician’s ID number: __________________________
Employer: ______________________________________
Date of work completion: __________________________
Supervisor’s Name: ________________________________
Supervisor’s ID Number: ____________________________
SEC # ____________________ PO # __________________
Manufacturer: ________________________________

Figure 1 – Identification Marker