الشركة السعودية للكهرباء
Saudi Electricity Company
طاقة مثمرة

12-SDMS-01

REV. 04 (04-04-2018)

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

Saudi Electricity Company

1. SCOPE

This SEC Distribution Materials Specification (SDMS) specifies the minimum technical requirements for design, engineering, manufacture, testing, inspection and performance of all kind of cable accessories for low and medium voltage, intended to be used in the distribution system of Saudi Electricity Company (SEC).

1.1. REQUIREMENTS ON THE ACCEPTABILITY OF THE PRODUCTS

The prerequisite for product approval is the positive assessment and approval of the products in the pre-qualification process by SEC. Compliance with the requirements of this SEC standard is the basis for the manufacturer and product approval by SEC.

The approval of products or/and manufacturers requires inter alia the carrying out of investigations as well as the submission of documents, samples and certificates. The documents, test results, samples and certificates required for the assessment are to be made available to SEC free of charge.

After specifying the kits, SEC reserves the right to make claims, amendments and additions exceeding the provisions of this SEC standard. If the kits or any parts thereof are produced by third parties on behalf of the manufacturer, these must be named with the manufacturer's specification. SEC reserves the right to carry out audits at the manufacturer's production site at all times in order to verify compliance with the requirements described in this SEC standard. For this purpose, it is also possible to take kits out of the running production line. The SEC standard can be modified or supplemented at any time. The approval of SEC is revocable at any time.

1.2. APPROVED SAMPLE FOR MASS PRODUCTION

At the request of SEC, for example before signing a new contract or in the case of coordinated product changes, the supplier is obligated to make available one free retained sample, according to the agreed design.

1.3. REQUIREMENTS FOR PRODUCT CHANGES

After placing the contract, product modifications by the manufacturer are only permitted with the approval of SEC. Product changes of any kind must be coordinated in advance with SEC Standardization department. If SEC identifies non-agreed changes, this leads to the blocking of the manufacturer and the resulting costs are to be assumed by the manufacturer.

If the production location is relocated, or if the company has previously produced at its own premises, SEC must be informed. Deviations from the SEC standard require the explicit written approval of SEC. In the case of complaints or product defects, the technical product management must be informed immediately in writing.

2. CROSS REFERENCES TO OTHER SEC STANDARDS

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.

- 11-SDMS-01 Specification for low voltage power and control cables
- 11-SDMS-03 Specification for insulated power cables for rated voltages from 15 kV up to 36 kV (Um)
- 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. APPLICABLE CODES AND STANDARDS

The latest revision of the following codes and standards shall be applicable for the equipment/materials covered in this SDMS. In case of any deviation, the vendor/manufacturer may propose equipment/materials conforming to alternate codes or standards. However, the provisions of SEC Standards shall supersede the provisions of these alternate standards in case of any difference.

Table 1: List of applicable standards for low voltage

Standard #	Title
HD 623 S1	Specification for joints, stop ends and outdoor terminations for distribution cables of rated voltage 0.6/1.0 kV
IEC 61238-1	Compression and mechanical connectors for power cables for rated voltages up to 30 kV (Um = 36 kV) - Part 1: Test methods and requirements
EN 50393	Test methods and requirements for accessories for use on distribution cables of rated voltage 0,6/1,0 (1,2) kV

Table 2: List of applicable standards for medium voltage

Standard #	Title
IEC 60060-1&2	High-voltage test techniques
IEC 60230	Impulse tests on cables and their accessories
IEC 60502-2	Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV) – Part 2: Cables for rated voltages from 6 kV (Um = 7,2 kV) up to 30 kV (Um = 36 kV)
IEC 60502-4	Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV) – Part 4: Test requirements on accessories for cables with rated voltages from 6 kV (Um = 7,2 kV) up to 30 kV (Um = 36 kV)
IEC 61442	Test methods for accessories for power cables with rated voltage from 6 kV (Um = 7.2 kV) up to 30 kV (Um 36 kV)
IEC 61238-1	Compression and mechanical connectors for power cables for rated voltages up to 30 kV (Um = 36 kV) - Part 1: Test methods and requirements, (Class A)
HD 629.1 S2 + A1	Test requirements on accessories for use on power cables of rated voltage from 3,6/6(7,2) kV up to 20,8/36(42) kV - Part 1: Cables with extruded insulation
IEC 60507	Artificial pollution tests on high-voltage insulators to be used on a.c. systems
IEC 60815-3	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions
EN 50180	Bushings above 1 kV up to 52 kV and from 250 A to 3,15 kA for liquid filled transformers
EN 50181	Plug-in type bushings above 1 kV up to 52 kV and from 250 A to 2,50 kA for equipment other than liquid filled transformers

4. TESTING AND INSPECTION

4.1. GENERAL

All cable accessories shall be tested in accordance with the respective latest applicable standards mentioned in Chapter 3 – Applicable codes and standards.

4.2. TYPE TESTS

The vendor shall provide certified test reports from independent / approved laboratory along with the bid for the materials offered to show that product has been qualified according to the applicable test sequence as mentioned in the respective standards.

A new type test has to be done in full conformance with the requirements of the latest version of IEC standard if changes in the materials, the structure or the production process take place, which could have an effect on the operating characteristics. SEC has to be informed about planned or implemented changes (e.g. use of new materials, use of new manufacturing processes, commissioning of new production plants or production sites) in order to coordinate the further procedure in a particular case.

SEC reserves the right to review and / or verify the compliance with the standards, guidelines and regulations as well as this Technical Specification, including the required type test.

4.3. TYPE TESTS DOCUMENTS

The test documents have to be in electronic format (readable with freely available PC software such as Acrobat Reader), so that they can be provided by the manufacturer. The manufacturer shall provide the test documents in hard-copy if requested.

5. MARKING

All components of the kits shall be clearly marked with the manufacturer's name and reference numbers. The marking shall be done before coating the adhesive onto the component. Electrically conducting components shall be marked 'conducting' clearly and permanently unless they are very small to accommodate respective marking.

All components shall be capable of being stored without deterioration within the temperature range of -10 ºC to +55 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.

The electrical relevant components of cable accessories must be marked with the following data:

- Company name or logo
- Production indicator for traceability
- In the case of joints, cross-section, diameter, or application range should be marked as well

Packaging for each cable accessory has to be printed with the following information:

- Manufacturer's name
- Manufacturer’s Type No. / catalog number
- Purchase order number/tender

- Cable size/diameter
- Nominal Voltage
- Year of manufacture
- Date of expiry
- SEC item number
- Possibly changed materials (look at chapter: Product change)

On the outer packaging which contains the cable accessories, following information should be printed:

- Gross weight in kilograms (pounds)
- Position of slinging points and other relevant handling instructions

It has to be possible to read all information directly.

6. SUBMITTALS, DELIVERY, TRANSPORT, STORAGE, DISPOSAL

6.1. SUBMITTALS REQUIRED WITH TENDER/INQUIRY

Two copies or one set of reproducible of the following shall be supplied along with the tender. Complete tender documents pertaining exactly to the offered items shall be submitted in line with the relevant standard mentioned in Chapter 3 – Applicable codes and standards on an electronic storage media or sent through email. These include:

- Certified Independent Test Reports from SEC approved test facility
  - To show that the material offered meet the electrical type tests specified in mentioned in Chapter 3 – Applicable codes and standards
  - To show that the material offered meets the mechanical and physical type tests as per the applicable standards
  - The type test certificate issued by the laboratory should mention the range of the item tested included in the type tests
- Full details of the proposed quality assurance procedures, sampling, routine tests, and special tests.
- Data schedules of all offered items will be submitted along with the detailed kit content list showing clear and colored image of each components.
- The supplier shall be liable to supply any component found missing at the time of delivery/installation immediately without any delay, SEC reserves the right to take suitable action.

6.2. DELIVERY, PACKING, AND SHIPPING

The joint/termination kits and accessories shall be delivered ready for service. All components in the kit should be individually packed and labeled in the main packaging. Each group of same material can be packed in one bag. Mastics and sealant tapes are to be packed in polybags. Stress control mastics should be packed in aluminum foil to prevent moisture absorption.

Each kit along with appropriate installation instructions in English and Arabic languages shall be packed separately in card board box. The kit should also contain a complete kit content list and a manufacturer certificate guaranteeing the completeness of the kit content agreed with SEC. Maximum 10 boxes shall be packed in properly palletized non-returnable wooden boxes or as per specified requirements.

Packing shall be designed to protect against ingress of dust, moisture, and mechanical damage. The kits shall not be packed in perishable material.

All components shall be capable of being stored without deterioration within the temperature range of 0°C to + 55°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. GENERAL REQUIREMENTS ON INSTALLATION INSTRUCTIONS

The installation instructions must be clearly assigned to the respective cable accessory according to the application of this Technical Specification. All necessary steps for installing the final product are to be described in an easy readable manner including images for each step. The installation instructions have to be approved by SEC prior to tender. The installation instructions must contain the required designations and sheath-opening (cutback) dimensions. The joint/termination components, the kit content list, and the respective installation instructions have to be clearly and unambiguously identifiable.

The installation instructions are to be enclosed in English and Arabic Language (where applicable) and are printed in color. Any modifications to the assembly or the material, even insignificant, which have an effect on the installation instructions, must be clearly noted on each installation instruction and packaging unit for at least half a year (e.g. with a colored sticker with exact reference to which point was changed), as agreed with SEC (see chapter: Product change). The revision level, the date of creation or revision must be recognizable on the installation instructions.

The final pages of each installation instructions is a full-page completely assembled cable joint/termination in a cut-away/sectional view showing all active components of the kits.

The installation instructions for the complete cable accessory is to be also available in electronic format (readable with freely available PC software such as Acrobat Reader), so that the manufacturer can send it by e-mail.

8. DESIGN AND CONSTRUCTION REQUIREMENTS

8.1. GENERAL REQUIREMENTS FOR ALL VOLTAGE LEVELS

Joints/terminations and accessories shall meet or exceed the minimum requirements of this specification and standards in Chapter 3 – Applicable codes and standards in all respects and shall be designed such that no insulating or semiconducting tapes shall be required, except void filler tape and sealing mastic.

The conductors of the cables consist of aluminum or copper, according to IEC, are round or sector-shaped, stranded, compacted.

The cable construction is based on the 11-SDMS-01 and 11-SDMS-03.

The basic statements on design and implementation also apply to specific applications for cable types or cross-sections are not listed above.

The joints must be easy to install (see also Chapter 7 – General requirements on installation instructions) and have a compact design. The installation of the joint must be done under the same temperatures as the cable.

The heat shrink tubes shall be made out of polyolefin or EPDM rubber, or a combination of both and the longitudinal shrinkage of the sleeve must not exceed +5%/-10% of the original length.

The sealing overlapping distance (except the breakout overlap) should not be less than 100 mm so that moisture can't penetrate any side of the cable joint so that it's completely sealed from cable jacket to cable jacket.

All outer sleeves shall be identified by the name of manufacturer and should include an embossed lot number for traceability purposes.

Sleeves or components supplied with mastic coatings shall have means to prevent the coated surfaces from adhering to each other.

Cable joints shall meet all the test requirements mentioned in Chapter 4 – Testing and inspection.

8.2. LOW VOLTAGE CABLE ACCESSORIES REQUIREMENTS

The existing or used cables comply with IEC 60502-1 and the conductor cross-sections will be from 35 mm^2 to 630 mm^2.

Technology of the cable accessories is heat-shrink.

The connection of sector-shaped conductors must be possible without a rounding tool for mechanical connectors. In the case of crimp connectors, pre-rounding is mandatory.

8.3. MEDIUM VOLTAGE CABLE ACCESSORIES REQUIREMENTS UP TO 36 KV

The existing or used cables comply with IEC 60502-2 and the conductor cross-sections will be from 50 mm² to 500 mm².

Technology of the cable accessories are either pre-molded or cold-shrink.

Creepage distance for outdoor termination shall be also according to the latest revision of SEC General Specification 01-SDMS-01 applicable for coastal areas.

The stress control grader or grading joint is to be designed in an easy-to-assemble design. The stress grading via connectors can be integrated in the joint body.

As requested in the inquiry, the outer sealing can be made by either one of the following:

a.) two-single sleeves (parking position on one side mounting position)

b.) wrap around sheath so that the assembly is possible even in tight conditions

c.) injected cast-resin

The wrap around sheath repair sleeve for medium voltage shall be of the heat shrink type and shall be coated with an adhesive which becomes activated on the application of heat and will form a bond with cable jacket when shrunk.

Metal shields, such as copper tape or copper wire, should be connected by a solderless connection system such as roll springs or mechanical connectors in combination with copper mesh.

An inner jacket installed over the joint-body prior to reinstatement of the mechanical protection of armored cables shall be provided in the joint kits.

For tape armored cables, all items required for connection (such as worm drive clamps) are to be provided in the kit content. Moreover, inner sleeve shall be provided between the metallic screen and the galvanized steel wraparound cover.

Reinstatement of mechanical protection for armored cables shall be in the form of galvanized steel wire or sheet wraparound cover, not steel tubing. Ends of steel armor forming wraparound shall not be sharp. The armor shall be protected by outer heat shrinkable sealing sleeves.

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. Details are given in Figure 1.

8.4. GENERAL REQUIREMENTS FOR SPECIFIC ACCESSORIES

8.4.1. CABLE JOINTS

For heat shrink joints (LV cables only):

- For the central joint body, the minimum insulation thickness of the primary cable insulation has to be replaced across the connector.
- The adhesive shall have a softening temperature not less than 90 ºC.

For pre-molded and cold shrink joints:

- Joints should be manufactured from EPDM rubber or high performance silicone.
- Connectors shall be of water-blocking type.

8.4.2. LONG JOINTS

Long joints are intended to repair damaged MV cables requiring extra length where applicable.

Length of connectors shall not be less than 440 mm.

All connectors shall be either compression or shear bolt type with very smooth surface.

It should be either pre-molded or cold-shrink.

8.4.3. TERMINATIONS

For heat shrink terminations (LV cables only), the anti-tracking tube shall be generally suitable for indoor and outdoor installation, ultraviolet and chemical resistant and shall be capable of being stored without damage at temperatures up to 55 ºC.

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.

For pre-molded and cold shrink terminations, use of insulating tape along cable insulation is not acceptable.

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.

Outdoor overhead lines pole top termination kits for 17.5 kV or 36 kV cables shall include hot-dipped galvanized steel mounting bracket with mounting slot suitable for M20 bolt and include polymer insulators with M12 stainless steel stud for all the three cores. Lug connectors shall be suitable for M12 stud and shall be longitudinally sealed (water-blocking) type.

8.4.4. SEPARABLE ELBOW CONNECTORS (T-BODY)

Separable elbow connectors shall be suitable for type C bushings according to EN 50180 and EN 50181.

The screened separable elbow connectors shall be manufactured from EPDM or high performance silicone rubber, having a minimum thickness of 3.0 mm molded outer shield with resistance of maximum 5000 ohm.

It should not require any special tools for installation and no components that need any heat for shrinking except for breakouts and tails (for 3-core cables).

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

8.4.5. INSIDE CONE PLUG-IN TYPE CONNECTORS

Plug-in connectors shall be suitable for inner cone plug-in type bushing according to EN 50180 and EN 50181. Pre-molded stress cone shall include geometric field control elements. Outer surface of main connector body shall be screened and earthed. Outer jacket of all conductors shall be 5.0 m long (tail length).

Table 3: Requirements for plug-in connectors

Interface Type	Current rating	Conductor size	Voltage
2	800 A	Copper: 185 mm^2, 240 mm^2	36 kV
3	1250 A	Copper: 185 mm^2, 240 mm^2, 500 mm^2	36 kV

8.4.6. INJECTED CAST-RESIN JOINTS

The joint-body is either pre-molded or cold shrink. Connectors shall be longitudinally sealed (water-blocking), shear bolt type with very smooth surface. Outer protection is made with electrical grade injected polyurethane resin. The polyurethane resin shall be provided in two chamber cartridges, one chamber for the resin and one chamber for the hardener. Mixing shall be done such that the resin is not exposed or in direct contact with the atmosphere and can be hosed out from the cartridge manually or using automatic pumping gun. Injection of the polyurethane resin to form the outer protection of the cable is through a nozzle/injection value and ensures to prevent forming of bubbles.

8.4.7. 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.

8.4.8. REPAIR SLEEVES

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.

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

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

8.4.9. TRANSITION JOINTS

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

Connectors used for transition joints shall be of tinned copper or tinned aluminum alloy compatible to both copper and aluminum conductors. The minimum thickness of tin coating is 20µm.

9. GUARANTEE

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

10. TECHNICAL DATA SCHEDULE

Table 4: Joints and terminations

SEC Inquiry No: Item No:

No	Description	SEC Specified Values	Vendor proposed values**
1	Joint/Termination	*	
2	Type (Heat Shrink, Cold Shrink, Pre-molded, Separable Connector, Plug-in)		
3	Outdoor/Indoor (termination only)	*	
4	Indoor termination length: Low voltage Medium voltage	* * *	
5	Conductor material, size, and number of cable cores	*	
6	Voltage designation (kV)	*	
7	Manufacturer catalog number	*	
8	Class of termination as per applicable standard	Yes	
9	Creepage distance (mm, for outdoor termination only)	*	
10	List of contents per kit supplied as per SEC approved sample	Yes	
11	Submittals required as part of tender/inquiry included	Yes	
12	Weight of each joint/termination (kg)	-	
13	Name of the manufacturer	Yes	
14	Country of origin	Yes	

Joints and Terminations

SEC Inquiry No: Item No:

- Additional Technical Information or Features Specified by SEC

- Additional Supplementary Data or Features Proposed by Bidder/Vendor/Supplier.

- Other Particulars to be filled-up by the Bidder/Vendor/Supplier.

- 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		

11. APPENDIX

Figure 1: Identification marker

Technician's Name: _____

Technician's ID number: _____

Employer: _____

Date of work completion: _____

Supervisor's Name: _____

Supervisor's ID Number: _____

SEC # _____ PO # _____

Manufacturer: _____