

**SPECIFICATION FOR LOAD-BREAK SWITCHES**

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**REV. 01**

**SPECIFICATION**

**FOR**

**LOAD-BREAK SWITCHES**

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### Revision History

| # | Date          | Revision No. | Major Revision Description   |
|---|---------------|--------------|--|
| 1 | November 2020 | 1            | Insulators type changed for using polymer insulators instead of porcelain insulators.          |
| 2 | November 2020 | 1            | Guarantee period changed to be according to SEC new rules (5 years from the date of delivery). |

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### **1 Scope**

This SEC Distribution Material specification describes the minimum technical requirements for design, engineering, manufacturing, testing, inspection, delivery and performance requirement for air type load break switch (LBS) for 33kV and 13.8kV, intended to be used in the overhead distribution system of the Saudi Electricity Company (SEC).

### **2 Cross References**

- 2.1 This specification shall always be read in conjunction with the 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.
- 2.2 This SDMS shall always be read in conjunction with SEC purchase order requirements or contract schedules.
- 2.3 This specification shall always be read in conjunction with SEC specification for polymeric insulators No. 15-SDMS-02, latest revision.

### **3 Applicable Codes and Standards**

The latest revision of the following codes and standards shall be applicable for the equipment/materials covered in this specification. In case of any deviation, the vendor/manufacture may propose equipment/material conforming to an alternate code or standard. However, the provision of SEC standards shall supersede the provisions of these alternate standards in case of any difference.

| Standard     | Title   |
|--------------|---|
| IEC 60600    | High Voltage Test Techniques.   |
| IEC 60129    | Alternating Current Disconnecter and Earthing Switches.   |
| IEC 62217    | Polymeric HV Insulators for Indoor and Outdoor Use – General Definitions, Test Methods and Acceptance Criteria          |
| IEC 60437    | Radio Interference Test on High Voltage Insulators.   |
| IEC 60507    | Artificial Pollution Test on High Voltage Insulators to be used on A.C System.  |
| ANSI C 37.41 | Design Tests for High Voltages Fuses, Distribution Including Air Switches, Fuse Disconnecting Switches and Accessories. |
| ANSI C 37.42 | Specification for Distribution Cut Outs And Fuse Links.   |
| BS 729       | Specification for Hot dip galvanized coatings on iron and steel articles  |

*Table 1: Applicable Codes and standards.*



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In case of any deviation from the listed standards, it should be indicated in the list of deviations submitted by the supplier.

### **4 SERVICE CONDITIONS:**

- 4.1 The load break switch shall be suitable for operation under the service conditions as per SEC latest revision of general Specification No. 01-SDMS-01.
- 4.2 The load break switch and fittings shall withstand the effect of direct solar radiation at their installed locations. The temperature of exposed surfaces shall be regarded as 75°C plus the effect of internal heating.

### **5 SYSTEM CONDITIONS:**

The load break switch shall be suitable for installation in a system as given in the latest revisions of the SEC general specification No. 01-SDMS-01.

### **6 DESIGN AND CONSTRUCTION REQUIREMENTS:**

#### **6.1 Current Rating:**

This specification covers the different standard ratings for load break switches, which are of 400A and 600A for both 13.8 kV and 33 kV system voltages.

- 6.2 The load break switch shall be capable of switching load current with full recovery voltage across the switch and interrupting transformer magnetizing current and overhead line charging current. This shall permit all switching to be done live such as disconnecting/connecting tie lines/paralleling of feeders. Load break switch shall be equipped with permanently fitted load break devices, capable of interrupting rated current and shall be capable of closing on faults.

#### **6.3 Basic insulation level:**

The basic insulation level for 13.8kV and 33kV system shall be as per SEC latest revision of general Specification No. 01-SDMS-01.

#### **6.4 Rated Short Time Withstand Current:**

The rated r.m.s short time current for one second shall be as follows:

| System Voltage | Rated Short Time Withstand Current for 1 sec. |
|----------------|---|
| 13.8 KV        | 21 kA   |
| 33 KV          | 25 kA   |

*Table 2: Rated Short Time Withstand Current.*

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### 6.5 Radio Influence:

The maximum value shall be as follows:

| SYSTEM VOLTAGE | Radio interference voltage |
|----------------|----------------------------|
| 13.8 KV        | 250 $\mu$ V at 1 MHZ       |
| 33 KV          | 650 $\mu$ V at 1 MHZ       |

Table 3: Radio interference voltage.

### 6.6 Creepage Distances:

Creepage distances are based on nominal line-to-line voltage. Creepage/Leakage distance shall be 25/40mm/kV minimum as per SEC general specification No. 01-SDMS-01.

### 6.7 Main Assembly:

This specification covers three-pole disconnectors, which shall be suitable for vertical or horizontal mounting, mounted on a fabricated galvanized steel base, and operated by a permanently fitted handle and link. The moving contact for each phase, which is normally in the closed position, is opened by the operation of handle.

6.7.1 All three moving contacts mechanically linked to provide simultaneous isolation of all three phases.

6.7.2 Arc extinguishing devices shall be fitted on the fixed contacts to provide protection to the main contacts from erosion.

### 6.8 Insulators:

The insulators shall be polymer with grey color single-piece housing and sheds that are designed to minimize trapping of contamination of dust, sands, etc. Housing shall be made of UV-resistant high-temperature vulcanized silicon rubber with hydrophobic surface and is manufactured using a direct molding method according to SEC specification for polymeric insulators No. 15-SDMS-02, latest revision.

### 6.9 Contacts:

The current carrying contact area shall be of silver plated copper of high conductivity. The fixed contact at which the circuit is broken shall be a split head contact shaped to accept the disconnect blade, parallel to the direction of motion of the blade.

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### **6.10 Bearing and Guide:**

The supplier shall specifically state the material and finishing of both rubbing and rolling surfaces at every point where rotation or other movement occurs and the measures taken to ensure easy movement both initially and throughout the life of the disconnecter.

### **6.11 Operating Gear:**

Operation shall be from the ground by means of a handle. The supplier shall show how variation in height is provided for and state the maximum height over ground at which the disconnecter can be effectively operated. All joints employed in the operating linkage must be capable of with standing vibration due to wind so that no slackening can occur.

6.11.1 A suitable insulated barrier shall be fitted in the operating link to safeguard any person operating the load break switch (L.B.S).

6.11.2 All operating gears shall be designed to minimize accumulation of dust and corrosion.

6.11.3 The position and arrangement of the complete gear including all supports shall be shown in submittal drawing and also the means of locking the handle in both the 'ON' and "OFF" positions by means of SEC's padlock.

### **6.12 Operating Speed and Effort:**

The supplier shall state the minimum speed or time to complete the operation to interrupt the current and also the initial and follow through pull needed to carry out this operation at any time during the life time of the load break switch (L.B.S), assuming that the recommended maintenance is regularly carried out. The supplier shall provide operation and maintenance manual along with the load break switch (L.B.S).

### **6.13 Connections:**

The terminals on the load break switch for connection of line conductors must be such that connections cannot work loose due to vibration. The terminals shall be suitable for copper, ACSR/AW, Aluminum and aluminum alloy conductors without risk of corrosion. The material used shall consist of suitable alloy plated copper. The terminals shall be designed for use with compression lugs, provided with M12 studs, nuts and washers for fixing the lug and shall be suitable for the SEC standard sizes of conductors.



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### **6.14 Earthing Facilities:**

Each load break switch (L.B.S) shall be provided with M12 studs, nuts and washers in an accessible position for earthing the operating gear and frame work. These shall be used to fix a copper compression earthing lug.

### **6.15 Earthing of Operating Handle:**

The operating handle shall have a suitable means of attaching an earth lead.

### **6.16 Galvanizing:**

All iron components shall be coated with zinc or a material having equivalent protection against atmospheric corrosion. If coated by the hot dip galvanizing method, coating shall be made in accordance with BS 729.

The supplier shall state weight/thickness of zinc coating on the attached schedule.

## **7 MARKING:**

Each load break switch (L.B.S) shall be provided with a weather proof and corrosion proof name plate and shall give the following information in English and/or Arabic.

- 7.1 Purchase order /tender No.
- 7.2 Manufacturer name.
- 7.3 Year of manufacturing.
- 7.4 Type of load break switch (L.B.S).
- 7.5 Rated current.
- 7.6 Rated short time withstand current.
- 7.7 Rated voltage.
- 7.8 Short circuit current.



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### **8 TESTING AND INSPECTION:**

#### **8.1 General:**

All load break switches (L.B.S) shall be tested in accordance with the latest standards and as specified herein. The supplier shall provide acceptable type test and routine test certificates for his offered load break switches ( L.B.S). SEC at his discretion may wish to have additional or to repeat type test being carried out. Two certified copies of the test reports shall be submitted to the SEC for approval. No load break switch (L.B.S) shall be shipped until approval of the test reports has been given by SEC. Routine and /or sample tests shall be carried at the supplier/manufacturer factory. Type tests shall be carried out at independent testing laboratory and be witnessed by a representative of an independent testing laboratory or other representative acceptable to SEC.

#### **8.2 Type Test:**

All load break switches shall be type tested in accordance with the latest standards in this specification given below.

- 8.2.1 Dielectric tests to IEC 60129 clause 6.1.
- 8.2.2 Power frequency withstand (1 minute dry & wet).
- 8.2.3 Impulse withstand (1.2 x 50  $\mu$ sec).
- 8.2.4 Temperature rise test to IEC 60129 clause 6.3.
- 8.2.5 Resistance tests to IEC 60129 clause 6.4.
- 8.2.6 Short time withstand current and peak current withstand tests to IEC 60129 clause 6.5.
- 8.2.7 Test to prove satisfactory operation under ice conditions (only on special request by SEC) to IEC 60129 clause 6.103.
- 8.2.8 Operating and mechanical endurance tests to IEC 60129 clause 6.104
- 8.2.9 Test for measuring Radio interference levels to IEC 60437.
- 8.2.10 Pollution tests to IEC 60507.
- 8.2.11 Load break tests to ANSI C 37.41 clause 7.

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### **8.3 Routine Tests:**

All offered load break switches (LBS) shall meet the routine test requirements of the standards given below:

8.3.1 Power frequency voltage withstand test (dry) to IEC60129 clause 7.1.

8.3.2 Voltage tests on control and auxiliary circuits to IEC 60129 clause 7.2

8.3.3 Measurement of the resistance of main circuit to IEC 60129 clause 7.3

8.3.4 Mechanical operating tests to IEC 60129 clause 7.101

### **8.4 Inspection:**

The SEC may wish to witness tests or visit the factory during manufacture of any or all Items covered by this specification. Accordingly, the supplier shall be give the purchaser adequate notice of manufacturing program and test to be witnessed. SEC may require certificates and data from the manufacturer/supplier on all pertinent aspects of the manufacturing process. However, for detailed inspection conditions refer to the latest revision of the SEC general specification No 01-SDMS-01, clause 7.

## **9 PACKING AND SHIPMENT**

9.1 Each load break switch (L.B.S) shall be packed individually in a strong non-returnable wooden crate in such manner to prevent damage components during transportation and handling up to installation site.

9.2 Packing shall be designed to prevent entry of dust, ingress of moisture and other foreign materials.

9.3 Packing shall be marked with the following:

9.3.1 Manufacture's name

9.3.2 Country of origin.

9.3.3 SEC Item number.

9.3.4 SEC purchase order number.

9.3.5 Weight in kilogram.

9.3.6 Handling instruction.

9.3.7 Voltage and current rating.

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- 9.4 Supplier shall contact material department for additional packing, handling and shipment instructions as applicable.
- 9.5 Packing note in Arabic and English shall be included in each case giving description of goods packed.
- 9.6 Load break switches (L.B.S) shall not be packed in any organic material.

## **10 GUARANTEE**

- 10.1 Vendor shall guarantee the load break switches (L.B.S) against all the defects arising out of faulty design, workmanship or defective material for a period of five (5) years from the date of delivery.
- 10.2 If no exception/deviations are taken to this specification and no list of deviations is submitted, it shall be deemed that, in every respect, the offered load break switches (L.B.S) and their accessories conform to this specification. A reference list of the present users of the offered load break switch with the relevant address and fax No. shall be included.

## **11 TECHNICAL DATA SCHEDULE:**

- 11.1 The vendor shall complete and return one copy of the attached technical data schedule with quotation. In addition to data schedule, submittal for clauses from 11.2 to 11.4 shall be provided with quotations.
- 11.2 Detailed dimensional drawing of the Load break switch showing mounting arrangements.

The supplier shall provide literature describing field experience under similar service conditions to those given in SEC Ref No.4. A reference sale list shall be included. This shall detail the quantities sold, name and address of users, the number of years in service in each case. The literature shall show at least 10 years service in each environment.

- 11.3 Type test certificates.
- 11.4 Submittals required following award of contract are given below.
- Manufacturing schedule, progress report and test schedule.
  - Test reports



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**TECHNICAL DATA SCHEDULE**

**LOAD BREAK SWITCH**

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SEC Inquiry No. \_\_\_\_\_ Item No. \_\_\_\_\_

| S/N | DESCRIPTION   | UNIT  | SEC SPECIFIED VALUES |         | VENDOR PROPOSED VALUES |
|-----|---|-------|----------------------|---------|------------------------|
| 1   | System Voltage  | kV    | 13.8                 | 33      |                        |
| 2   | Rated Voltage   | kV    | 15.2                 | 36      |                        |
| 3   | Continuous current capacity                           | A     | 400/600              | 400/600 |                        |
| 4   | Breaking current capacity                             | A     | 400/600              | 400/600 |                        |
| 5   | Short time withstand current (1sec)                   | kA    | 21                   | 25      |                        |
| 6   | Creepage distance                                     | mm/kV | 25/40                | 25/40   |                        |
| 7   | Dry flash over voltage                                | kV    |                      |         |                        |
| 8   | Wet flash over voltage                                | kV    |                      |         |                        |
| 9   | Max radio interference voltage                        | μV    | 250                  | 650     |                        |
| 10  | Ambient temperature during temperature rise tests     | °C    |                      |         |                        |
| 11  | Temperature rise of contacts                          | °C    |                      |         |                        |
| 12  | Temperature rise of terminals                         | °C    |                      |         |                        |
| 13  | Material of support insulators and color.             | -     | Polymer/ Grey        |         |                        |
| 14  | Bird proof insulators                                 |       | Required             |         |                        |
| 15  | Minimum clearance between phase and earth             | mm    |                      |         |                        |
| 16  | Method of attachment of insulator-to-insulator base.  | -     |                      |         |                        |
| 17  | Minimum clearance between phases.                     | mm    |                      |         |                        |
| 18  | State main contacts material                          | -     |                      |         |                        |
| 19  | State main contacts plating material.                 | -     |                      |         |                        |
| 20  | All current carrying parts of copper or copper alloy. | -     | vendor               |         |                        |
| 21  | All ferrous components galvanized.                    | -     | vendor               |         |                        |
| 22  | Operating speeds                                      | -     | vendor               |         |                        |
| 23  | Short circuit levels                                  | kA    | 21                   | 25      |                        |
| 24  | Fitting of permanent load break device                | -     | Required             |         |                        |
| 25  | Fault closing capability                              | -     | Required             |         |                        |

Table 4: Technical Data Schedule 1.



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**TECHNICAL DATA SCHEDULE**

**LOAD BREAK SWITCH**

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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                                     |                                    |                 |

Table 5: Technical Data Schedule 2.