38-SDMS-05

REV.02

SPECIFICATION FOR SMART OVERHEAD LINE (OHL) FAULT INDICATORS FOR OVERHEAD DISTRIBUTION NETWORK

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Revision History

#	Date	Revision No.	Revised By	Major Revision Description
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1 Scope

This specification defines the minimum technical requirements for design, engineering, manufacturing, testing, inspection and performance of smart OHL fault indicators intended to be used in medium-voltage overhead line distribution network of Saudi Electricity Company (SEC) in Saudi Arabia.

OHL fault indicators within the sense of this specification means the fault indicators themselves, including all supporting devices, integrated or separately installed and their power supply.

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 specification. It shall also be read in conjunction with SEC purchase order and/or contract schedules, and scope of work/technical specifications for projects, as applicable.

The latest revision of SEC specification 10-SDMS-01 shall be applicable with reference to 13.8kV and 33kV ACSR/AW overhead line conductors.

3 Applicable codes and standards

The latest revision/amendment of the following codes and standards shall be applicable for the equipment/materials covered in this specification. In case of conflict/difference, the vendor/manufacturer may propose equipment/material conforming to alternative codes or standards; however, the provisions in SEC standards shall supersede the provisions in these standards.

Standard #	Title
IEEE 495	Guide for Testing Faulted Circuit Indicators
IEC 60529	Degrees of Protection Provided by Enclosures (IP Code)
IEC 60068-2-11	Basic Environmental Testing Procedures - Part 2: Test - Test Ka: Salt Mist
IEC 61000-4-2	Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test
IEC 61000-6-2	Electromagnetic Compatibility (EMC) - Part 6-2: Generic Standards - Immunity for Industrial Environments
IEC 62689	Current and Voltage Sensors or Detectors to be Used for Fault Passage
IEC 60870-5	Telecontrol Equipment and Systems - Part 5: Transmission Protocols
IEC 61850	Communication Networks and Systems for Power Utility Automation

Table 1: list of applicable standards

4 Service and system conditions

The smart OHL fault indicators shall be suitable for operation under the service conditions specified in the latest revision of SEC specification 01-SDMS-01.

All fittings and attachments of the smart OHL fault indicators shall be capable of withstanding the effects of direct solar radiation at their installed locations. The temperature of surfaces exposed to direct solar radiation shall be as per the last version of 01-SDMS-01, especially clause 4.6 plus the effect of any internal heating.

5 Material, design and construction requirements

5.1 General

5.1.1 The smart OHL fault indicator shall meet or exceed the requirement of this specification in all respects and it shall be manufactured and tested in conformance with relevant international standards.

5.1.2 Manufacturer's drawings shall show the outline of the smart OHL fault indicators together with all pertinent dimensions and clamping range to applicable overhead line conductors. Any variations in these dimensions due to manufacturing tolerances shall be indicated

5.2 Design criteria

5.2.1 The smart OHL fault indicators shall be designed to operate at ambient temperature from - 10°C up to +75°C and suitable for mounting on overhead line conductors up to 25mm overall diameter with rated operating voltage of up to 36kV.

5.2.2 The housing of the smart OHL fault indicators shall be made of weatherproof, robust, non-metallic, fire-retardant, UV stabilized material. The dimensions shall not exceed 250mm in length and 180mm in width/overall diameter. Each equipment, except the indicators itself, shall be installed in cubicles and boxes suitable for the environmental conditions.

5.2.3 In case of master device in a separate pole mounted cubicle or panel, power supply components, wiring, any necessary equipment and mounting accessories shall be included in the delivery. The equipment shall be supplied by backup power supply with or without external power supply, which are to be included in the delivery.

5.2.4 The smart OHL fault indicators shall be suitable for outdoor installation with IP 65 degree of protection or better. It shall be suitable for installation and removal on live overhead lines with the use of insulated hot-stick and/or by using hot-stick adapters provided by the manufacturer. Hot-stick mounting adapter shall be supplied for every 50 units of the smart OHL fault indicators.

5.2.5 Clamping tightness of the smart OHL fault indicators shall be able to withstand wind pressure without slipping or falling out of the conductor.

5.2.6 The smart OHL fault indicators shall be equipped with ultra-bright blinking LEDs for local indications. Any additional indicating method may be proposed and shall be evaluated by SEC. Local indications shall have a clear 360° visibility from a distance of 100m at daylight and 500m at night-time. Provision for live line testing the indications shall be available.

5.2.7 The smart OHL fault indicators shall be maintenance-free, fully self-contained without external transformer or connections, and do not require additional source of supply.

5.2.8 The backup source for power supply for driving the local indications shall be military-grade, easily replaceable with or without using common hand tools and shall have a minimum operating life of 10 years and total continuous indicating time of 1500 hours or more under the given environmental conditions. Soldered battery terminal connections are not acceptable.

5.2.9 The smart OHL fault indicators shall be bi-directional and able to detect all line-to-line and line-to-ground fault conditions with built -in restraints to prevent false operation due to sudden variations in load- current, proximity to other circuits, inrush currents due to feeder switching or auto-recloser operation.
Smart OHL Fault Indicators shall be capable to segregate between Transient Fault & Permanent Fault Conditions.

5.2.10 The smart OHL fault indicators shall be equipped with the following selectable and adjustable local reset options:

- Local Automatic Reset: 10 to 30 seconds after recovering the line voltage (re-energized line) and return of minimum primary current of 3A.
- Local Timed Reset: 2, 4, and 8 hours.

5.2.11 Local manual reset shall also be provided such as by using magnet mountable on standard insulated hot-sticks, or proximity local remote- control, or any other method accessible from the ground level. Magnet and its adapter to hot-sticks, and/or proximity local remote-control shall be supplied for every 50 units of smart OHL fault indicators.

5.2.12 The smart OHL fault indicators shall be provided with manual pre-adjusted trip current value of the load currents in steps of up to 500 amperes or better, and load dependent self-adjusted value of trip current.
The smart OHL fault indicators shall have a response time not lower than 80ms to prevent false indication due to disturbances with tolerance of ±10ms.

5.2.13 Smart OHL Fault Indicator shall be capable to sense the Earth Fault Currents of 15A or Lower with appropriate adjustable steps.

5.2.14 The smart fault indicator shall be provided with precision clock. The preferred solution is to synchronize this clock from the distribution control center via the applicable communication protocol or by GSM Global Clock.

5.2.15 Unless otherwise specified the following features shall be provided as an option:

- measurement of the conductor temperature to allow for preventive switching operations in case the temperature reaches or exceeds the conductor's specified limits
- detection of broken conductor with high impedance of the ground connection.

5.3 Communication Requirements

5.3.1 The master device / smart OHL fault indicators shall exchange information with adjacent slave smart fault indicators via short-distance radio frequency communication. The master smart fault indicators shall forward the received information to the distribution control center (SCADA/DMS) and / or SMS clients such as mobile devices. The communication to the distribution control center shall be realized through standard communication protocols as specified later on. The delivery shall include all equipment required up to the interface port at the control center servers (ADMS), which are to be considered as redundant. This includes, but not limited to communication devices, remote terminal units, data collectors, etc. Communication solutions with additional interim servers and software for connection of devices to the control center servers shall not be accepted.

5.3.2 The master device should be able to periodically transmit an SMS "heartbeat" or other message at a selectable period to remote servers or SMS client to verify its status.

5.3.3 The master device / smart OHL fault indicators shall be provided with a SIM card slot to accommodate a standard size SIM card for use in Saudi Arabia GSM network for the purpose to forward information to the distribution control center (remote servers) and/or to an SMS client / mobile device. The master device / smart OHL fault indicator shall be capable to operate with the following

telecommunication standards in the mobile phone network GSM (GPRS, 3G, 4G, NB IoT, 5G, etc.)

5.3.4 Alternatively, as optional communication methods, the following communication (methods) could be available for connecting the smart OHL earth fault indicator to the remote servers: VHF or UHF radio and Wi-Fi.

5.3.5 For connection to the distribution control center standardized protocols shall be used. These could be:

- IEC 60870-5-101
- IEC 60870-5-104
- IEC 61850 (future)

5.3.6 The communication protocol shall be selected as per purchase order requirements.

5.3.7 The smart OHL fault indicators shall provide communication abilities from 50 to 100 meters to exchange information to adjacent smart OHL fault indicators.

5.3.8 Unless otherwise specified the smart fault indicator shall be remotely configurable via a hand held device operation on RF interface / radio link.

5.3.9 Unless otherwise specified smart fault indicators shall be remotely configurable from the distribution control center. The option shall include all required hardware and software.

6 Marking

Each smart OHL fault indicator shall have a clear and durable name plate that will remain visible throughout the lifetime of the device, and shall bear the following information:

- SEC item number
- Rated voltage
- Rated frequency
- Manufacturer name and reference number
- Serial number
- Year of manufacture
- Country of origin
- SEC purchase order number
- Reference to SEC specification
- SEC monogram

7 Testing and Inspection

7.1 All equipment shall be type tested at SEC-approved independent testing laboratory in accordance with the latest standards and as specified herein. Test reports shall be submitted for SEC review and approval.

7.2 The equipment offered shall meet the type test requirements of the latest version of IEEE 495 or equivalent.

7.3 Type tests

7.3.1 Type test shall be performed in complete conformance with the applicable clauses of IEEE 495 or equivalent. It shall be performed at SEC approved laboratories and shall consider the environmental conditions applicable. In addition the SEC internal standard 10-SDMS-01 shall apply.

7.3.2 SEC reserves the right to attend and witness the tests.

7.3.3 SEC reserves the right to request the supplier/manufacturer to repeat the type test every five (5) years, or as needed should the supplied smart OHL fault indicators have frequent faults and failures.

7.3.4 As a special test conditions, operating temperature range test according to IEEE 495 shall be performed on the complete Fault Indicator device including the backup power supply.

7.4 Routine tests

Routine (Production) tests in conformance with the applicable clauses of IEEE 495 or equivalent shall be performed on all smart OHL fault indicators. Electronic copies of the test reports shall be submitted to SEC in USB thumb drive for each batch to be delivered prior to issuance of the releases.

In addition to the IEEE 495 production tests, the following tests shall be performed on samples:

- Communication test
- As a special testing requirement, the mounting and fitting test considering the design of standard OHL conductors as defined in SEC overhead line standard specification (10-SDMS-01) shall be implemented.

7.5 Sample inspection

Samples together with actual CAD drawings, user manual and routine test reports shall be submitted for inspection/evaluation prior to issuance of approval for mass production. The following attributes shall be checked:

- Dimensional verification
- Markings
- User Manual
- Hot-stick adapter
- Accessories for Manual Reset: magnet + hot-stick attachment or proximity local remote-control
- Packaging
- Functionality
- SIM Card Slot

8 Packing and Shipping

8.1 Packing and shipping requirement shall generally be as per latest revision of SEC General Requirements for Equipment/Materials, 01-SDMS-01 or as per purchase order requirements.

8.2 Each smart OHL fault indicator shall be packed in a box as a complete unit and shall be delivered ready for use. Accessories like hot-stick mounting adapters, manual reset (magnet + hot-stick adapter and/or proximity local remote-control) shall be supplied in a separate box with printed marking relating to the box of the OHL fault indicator. A minimum of one (1) of each accessory shall be provided for every 50 units of smart OHL fault indicator supplied.

8.3 Packing shall protect the OHL fault indicators against damage during shipment and site handling.

8.4 Suppliers shall coordinate with SEC Warehousing Department for additional packing, handling, and or shipping instructions, as applicable.

8.5 Each box shall be printed with the following information:

- Purchase Order Number/ Tender Number
- Smart OHL Fault Indicator Rating
- Manufacturer 's Name and Model/Type
- Year of Manufacture & gross weight
- SEC Item Code
- Position of slinging points and other relevant handling instructions)

8.6 Packing notes in Arabic and English shall be included in each case giving a description of the goods packed.

9 Guarantee

9.1 The vendor/manufacturer shall guarantee the equipment against all defects arising out of faulty design or manufacturing defects or defective material for a period of five (5) years from the date of delivery.

9.2 The supplier/manufacturer shall guarantee that the backup power supply provided in each smart OHL fault indicator have a minimum operating life of 10 years.

9.3 The supplier shall guarantee the uniformity of the products delivered with the approved samples.

10 Submittals

10.1 Submittals required with tender/inquiry

10.1.1 Summary in table form with the following information: list of items offered, manufacturer, origin, catalogue number, and quantity

10.1.2 Clause-by-clause compliance with the latest revision of SEC specification 38-SDMS-05

10.1.3 Manufacturer's Catalogue in English language

10.1.4 User Manual in both English and Arabic language

10.1.5 Certificate stating that the raw material has been sampled, tested and inspected in accordance with relevant standard specifications

10.1.6 Product type test reports and certificates carried out from SEC approved laboratories

10.1.7 Filled-up technical data schedule on each of the items offered

10.1.8 Manufacturer CAD drawings for each of the items offered

10.1.9 In case of separate cubicle or panel for master device a BoQ, detailed drawings, mounting accessories and external power supply.

10.1.10 Detailed description about what information or signals the fault indicator can provide and the analysis capabilities of the indicators processing unit

10.1.11 USB Flash Drive containing e-copy of all the documents mentioned above.

10.2 Vendor shall submit the following after the contract award:

10.2.1 Samples in compliance with Clause 7.3 of this specification

10.2.2 Quality assurance tests

10.2.3 Manufacturing and routine test schedules

10.2.4 Special tests, if applicable.

11 Technical data schedule

SMART OVERHEAD LINE (OHL) FAULT INDICATORS FOR OVERHEAD DISTRIBUTION NETWORK

SEC Inquiry No. _____ *Item No.* _____

No.	Description	SEC Specified Values	Vendor Values
1	**General**		
	Reference Manufacturing Standard	**	
2	**Design requirements**		
2.1	Maximum Housing Dimensions (l x w or Ø)	250mm x 180mm	
2.2	Ambient Operating Temperature Range	- 10°C to +75°C	
2.3	Degree of Protection (Minimum)	≥ IP65	
2.4	Maximum Conductor Diameter	Ø25mm	
2.5	Local Indicating Devices	Ultra-Bright Blinking LED	
	Visibility at Daylight (Distance)	100m	
	Visibility at Night (Distance)	500m	
2.6	Local Resetting Options	-	
	Automatic (seconds)	10 to 30	
	Minimum Primary Current Reset	3A	
	Time reset (hours)	2, 4, 8	
	Manual	Magnet or Remote-Control	
	Provision for Live Line Testing Provided	Yes	
2.7	Rated Operating Voltage (Line-to-Line)	Up to 36kV	
2.8	Rated Operating Frequency	60Hz	
2.9	Minimum Backup Power Supply Unit Life	10 Years	
2.10	Minimum Backup Power supply Unit Continuous Operational Life	1500 indicating hours	
2.11	Tripping Current	Up to 500A, in steps	
2.12	Minimum Fault Sensing (P-G)	≤ 15A	
2.13	Response Time to Prevent False Indication, milliseconds	≥ 80	
2.14	Inrush Current Restraint	Required	
2.15	Symmetrical Fault Current	25kA / 160ms	
2.16	Accessories	-	
	Hot-stick Mounting Adapter Provided	Yes /Not Applicable	
	Magnet+ Hot-stick Adapter Provided	Yes/ Not Applicable	
	Proximity Local Remote-Control Provided	Yes/ Not Applicable	
2.17	Communication Requirements	-	
	SIM Card Slot Available	Yes	
	SIM Card Size	Standard	

No.	Description	SEC Specified Values	Vendor Values
	Short-Distance Communication	Yes	
	Distance between Master and Slave devices	From 50 to 100 m	
	VHF/UHF radio	Yes/ Not Applicable	
	Wi-Fi	Yes/ Not Applicable	
	IEC 60870-5-101	Yes/ Not Applicable	
	IEC 60870-5-104	Yes/ Not Applicable	
	IEC 61850	Yes/ Not Applicable	
	DNP3.0	Yes/ Not Applicable	
	MODBUS	Yes/ Not Applicable	
	RF for local communication with handheld device	Option	
	Remote configuration from distribution control center	Option	
3	**Others**		
	Product is Type Tested	Yes	
	SEC Approved Laboratory	**	
	Date Tested	**	
	Manufacturer	**	
	Model/Type	**	
	Country of Origin	**	
	Submittals Required with Tender/Inquiry Included or Not?	**	

Smart OHL Fault Indicators

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		