सत्यमेव जयते

भारत सरकार GOVERNMENT OF INDIA
रेल मंत्रालय MINISTRY OF RAILWAYS

विशिष्टि संख्या: टीआई/एसपीसी/पीएसआई/एलसीएमएलए/0032
Specification No: TI/SPC/PSI/LCMLA/0032

तड़ित निवर्तक के लीकेज करंट परीक्षण हेतु तकनीकी विनिर्देश

Technical specification of
Leakage Current Monitor for Lightning Arresters

मार्च, 2025 में संशोधित Revised in: March, 2025

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अनुशंसित Recommended by	कार्यकारी निदेशक (कर्षण संस्थापन) Executive Director (TI)	10/03/25

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(ii) All clauses of this specification shall be enforced from 10.03.2025.
(iii) This specification supersedes the specification No. TI/SPC/PSI/LCMLA/0030 Revision 1.

SPECIFICATION FOR: Technical specification of Leakage Current Monitor for Lightning Arresters (LCMLA).

SPECIFICATION NUMBER: TI/SPC/PSI/LCMLA/0032

Amendment History

Revision Number	Revision	Total pages	Date of Issue	Reasons for Amendment/ Revision
0	TI/SPC/PSI/LCMLA/0030	07	April 2003	-
1	TI/SPC/PSI/LCMLA/0030 (Revision 1)	08	06.07.2010	-
2	TI/SPC/PSI/LCMLA/0032	09	10.03.2025	Online, wireless Leakage Current Monitor for Lightning Arresters

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Technical Specification of Leakage Current Monitor for Lightning Arresters

1.0 SCOPE

1.1 It is to be noted that the "Make in India" Policy of the Government of India shall be applicable.

1.2 This specification covers the supply, testing and commissioning of Resistive Leakage Current Monitoring Equipment for Metal Oxide Lightening Arresters for Sectioning and Paralleling Posts, Sub Sectioning and Paralleling Posts & Traction Substations on Indian Railways. Tenderers while quoting shall ensure that they have gone through this document and understood the requirements clearly.

1.3 The equipment should be complete with all accessories, considered necessary for its efficient operation & functionality. All such equipment, parts and accessories shall be deemed to be within the scope of supply, irrespective of being specifically mentioned or not.

1.4 The equipment should be commissioned by the successful tenderer, and the offer shall include deputing engineer(s) for adequate training towards handling, operation & testing to the satisfaction of the purchaser at the site.

1.5 The components, subsystems and accessories shall unless otherwise specified herein conform to the latest edition of respective Indian/International standards and specifications as mentioned in different clauses.

2.0 GOVERNING SPECIFICATION

2.1 The method of measurement principle should be as per Annex-D, method B2 of IEC: 60099-5:2018.

2.2 The components used in this equipment shall unless/otherwise specified, conform to the latest edition of respective Indian Standard specifications. Where relevant Indian Standards are unavailable, relevant International Standard Specifications of the country of manufacture shall be complied with.

3.0 SERVICE CONDITIONS

3.1 The equipment shall be suitable for outdoor use in dry arid and moist tropical climates and areas subjected to heavy rainfall, pollution due to industry and marine atmosphere and severe lightning in India. The maximum ambient temperature may reach 50°C, with maximum humidity reaching up to 100%. However, for the design of the equipment, a 50°C category temperature may be taken.

S. No.	Parameters	Value
1.	Maximum temperature of the air in the shade:	55^0C
2.	Minimum temperature of the air in the shade:	-10°C
3.	Max. temperature attainable by an object exposed	75^0 C

	to the sun:	
4.	Maximum relative humidity:	100%
5.	Annual rainfall ranges from:	1750 to 6250 mm
6.	Maximum no. of thunderstorm days per annum:	85 days
7.	Maximum no. of dust storm days per annum:	35 days
8.	Number of rainy days per annum:	120 days
9.	Basic wind pressure:	216 kgf/m^2
10.	Altitude above MSL:	2000 meters

4.0 CONSTRUCTIONAL FEATURES

4.1 GENERAL INFORMATION

4.1.1 The Resistive Leakage Current Monitoring Equipment should be portable for in-service measurements of the resistive leakage current of gapless-type Metal Oxide Surge Arresters (MOSA) to check the condition of surge arresters on a regular or trend-dependent basis. The value of the resistive component of the leakage current indicates the condition of the Metal Oxide Surge Arresters. An increased resistive leakage current establishes a higher risk of breakdown of the MOSA.

4.1.2 The measuring method implemented in the system should be based on the principle of third-order harmonic analysis of the leakage current with compensation for harmonics in the system voltage. Regarding the testing method it should comply with Annex-D of IEC 60099-5 "Diagnostic indicators of metal oxide surge arresters in service".

4.1.3 The measurement of leakage current or its components shall be done on MOSA fitted with an insulated base from the ground and connected to the ground through a single lead.

4.1.4 The equipment should be designed in such a way that consistent results of a resistive component of leakage current measurement shall be possible for the lightning arresters fitted on high gantries by simply providing the wireless field probe unit at a nearby base of LA level.

4.1.5 The in-built part of the Leakage Current Monitor (the Analyzer) should be online i.e., it should be able to measure and analyze the leakage current of Surge arresters in charged outdoor conditions without any need for shutdown. In addition to the above, all accessories including the Current Probe, Field Probe, connecting earthing wire etc. shall have to be properly screened to nullify the effect of interference in the charged switchyard.

4.2 TECHNICAL DETAILS

4.2.1 The Leakage Current Monitor Equipment shall consist of the following:

i. Current probe: The low-noise wireless clamp measures the total leakage current through the MOSA grounding lead. It shall be suitably shielded from EMI effects for repeatable results in switchyards for system voltage ranging from 25 kV up to 245 kV. The current probe should indicate the battery status in percentage and should have a built-in temperature sensor.

ii. Field probe: The wireless Field Probe is to be positioned near the base of the arrester to pick up the third harmonic capacitive current component due to harmonics in the system voltage. The field probe should indicate the battery status in percentage. A suitable Telescope rod of fibreglass of a minimum of 5 m for measuring the sampled data from the field probe shall be part of the supply.

iii. Leakage current measurement, recording & processing unit: The equipment shall be capable of using harmonic analysis of current and with compensation of the field probe signal to determine the resistive component of the leakage current through the MOSA as per IEC 60099-5: B-2 standard.

iv. Latest Laptop [Intel Core i7 16 GB RAM, DDR4 SDRAM, SSD 512 GB, Display 15.6" Full HD (1080 P) WLED (1920 x 1080), Internal 8X DVD-RW with dual layer write capability(optional), Video graphics card (ATI mobility Radeon/NVIDIA 4GB), Battery life of min. 10 hours back up time, Bluetooth, wireless, card reader] with required Data management software (windows compatible) latest version and programme to download data from the instrument through USB and to analyze and administer leakage current data.

v. The Leakage Current Monitor equipment should also include the following items /accessories:

a. Transport case for housing all the accessories during transportation.
b. Grounding wire for the instrument.
c. The Data cable to connect the instrument to the notebook/PC.
d. Data management system and software (Latest Windows-based).
e. Any other accessory/equipment considered necessary for the satisfactory working of equipment.
f. User manuals

4.2.2 By using arrester system data, entering/measuring ambient temperature and operating voltage, the leakage current values should automatically be normalized, so that measurements performed under different ambient conditions and voltage are easily comparable.

5.0 RATING & TECHNICAL PARTICULARS

5.1. The leakage current monitor should measure and display the following parameters in charged Switchyards conditions from 25 kV up to 245 kV:

i. Direct display of Total Leakage current of the L.A.
ii. Direct display of Resistive Leakage Current of the L.A.
iii. Direct display of Resistive Leakage current of the L.A. referenced to 20^{0}C and 70% of rated voltage.

5.2. The equipment shall be of compact design, lightweight, portable and handy to enable easy transportation. The equipment should be housed in a dust and weatherproof, sturdy metallic housing adequately shielded from electrostatic influence adhering to Class Open Lid IP 54 & closed lid IP 67. The surfaces of the box shall be painted with anti-corrosive paint. The equipment shall be suitable for measuring and indicating results in the following ranges:

The range of Measured Parameters should cover	▪ Total Leakage Current : 200 µA to 9 mA ▪ Resistive Leakage Current : 1 µA to 9 mA ▪ Field probe current : 20 µA to 0.9 mA
Accuracy of Measured Parameters	▪ Total Leakage Current : ± 1 % of the reading ▪ Resistive Leakage Current : ± 1 % of the reading ▪ Field probe current : ± 1 % of the reading
The resolution of Measured Parameters should cover	▪ Total Leakage Current : 1µA ▪ Resistive Leakage Current : 1µA ▪ Field probe current : 1µA

Temperature measurement	The kit should invariably measure the ambient temperature to compensate for the resistive current readings at temperatures other than 20°C. The temperature measurement through a built-in sensor shall have a manual over-ride facility to feed other temperatures, if necessary: • Ambient temperature range : -40 to +70 °C • Accuracy : ± 2 °C
Power Supply	The main unit should have 'Mains' and 'Battery' operation capability with a built-in battery charger. ▪ CT and FP units should be battery powered. ▪ Main unit voltage operation: 170 to 240 V AC, 50 Hz / 12 to 18 V DC. ▪ Battery operation: Internal rechargeable battery (NiMH or Li-ion) ▪ Capacity: Approx. 8 hours of battery backup on full load (i.e. with full configuration) while using the testing equipment.
Communication port	Suitable communication port for interfacing the equipment with PC/ Notebook computers for data transfer & configuration purposes.
Operating & storage temperature	-10^0 to $+70^0$C
Instruments Weight	10 Kg (Max.)

5.3 The Software package performing the following functions shall be supplied:

- Preparing measurements by defining each arrester and its type with operational parameters/arrester system data.
- Storing and Downloading recorded leakage current data.
- Keeping track of the arrester's history by presenting recorded data, e.g. by statistical analysis in tabular and graphical form.
- Evaluating a group of surge arresters, e.g., the same type of arresters in the same region.

5.4 The equipment's Database shall perform the following duties:

- To define the name of the substation, location and name/number of arresters, arrester type with system data etc.
- The equipment should have built-in memory sufficient to store a minimum of 1000 such IDs of arresters.
- The memory should be backed by a Lithium Battery having a life of 10 years so that the stored data is not lost when power is switched off.
- After measurements have been performed, the recorded data shall be stored in the right location in the database and be retrievable.
- Real Time Clock supported by battery backup to ensure date and time stamping of the measurements.

5.5 The equipment should have a built-in calibration signal generator that allows quick and simple verification of the kit calibration before critical measurements.

6.1 TESTS.

6.1 The inspection/checking of the equipment will be carried out by the purchaser's representative before dispatch of the equipment. This shall include verification of all the features, bill of material & other accessories of the equipment as per this specification. The following acceptability test is to be carried out:

a. **Visual Examination:** Inspection of the features indicated in the specification.
b. **Detailed Architecture and Features:** Verification of requirements as stipulated in Para 5.2 shall be carried out at the calibrated test bench at the firm's premises.
c. Transducer accuracy shall be verified over the entire range for linearity and accuracy.

6.2 The tenderer shall furnish complete technical details with the manufacturer's test certificates for the performance claimed. Performance monitored by Test Certificate to be submitted as categorised below:

a. Environmental test

IEC 60068-2-2	Dry Heat	Continuous operation at 55^{0}C for min. 16 hours
IEC 60068-2-78	Damp Heat test	At 40^{0}C and 95% RH in operational condition for 12 hours
IEC 60068-2-30	Cyclic Damp Heat test	High temp. at 55^{0}C and Low at 25^{0}C. Dwell time in high and low temp. for 3 hours. Transition for 1^{0}C/Min. and for 6 such cycles in operational condition.
IEC 60068-2-1	Cold Test	-10^{0}C operational condition for 16 hours
IEC 60068-2-2	Vibration shock	Sweep Freq.: 10Hz-150Hz-10Hz, Sweep rate- 1 octave/Min., Nos. of sweep cycles per axis (X, Y, Z)- 20 cycles.

b. EMI Emission test

IEC 61000-4-3	Radiated EM-Field test	30 V/m electric field strength
IEC 61000-4-6	Conducted disturbance induced by Radio Freq. Field	10 V, 150 kHz to 80 MHz
IEC 61000-4-8	Power frequency magnetic field immunity test	100 A/m of magnetic field strength (continuous duration sine wave)

c. Open Lid IP 54 & closed lid IP 67 test certificates.

6.3 Any other functional test on the equipment as per this specification considered necessary to verify its working and performance on-site shall also be arranged by the successful tenderer if required by the purchaser.

7 TECHNICAL DATA AND DRAWINGS.

7.1 The tenderer shall furnish guaranteed performance and other necessary technical parameters for the instrument.

7.2 The tenderer shall furnish their compliance or otherwise against each clause/sub-clause of the technical specification. If the tenderer wishes to deviate from the provision of any of the clause/ sub-clause, he shall furnish the full details with justification for such deviations.

7.3 The tenderer shall also furnish descriptive technical literature, assembly layout drawing, schematic diagram etc. for scrutiny by the purchaser.

8 TRAINING OF INDIAN RAILWAYS' ENGINEERS

8.1 The offer shall include organising the training of two engineers free of cost at the traction substation of a railway system. The total duration of training shall be 4 days.

9 COMMISSIONING

9.1 The instrument shall be supplied and commissioned by the supplier at the purchaser's premises and the performance shall be demonstrated to prove its working.

10 OPERATION AND MAINTENANCE INSTRUCTIONS.

10.1 The supplier shall supply four sets of instruction manuals for operation, troubleshooting guide and maintenance of the equipment free of cost. The manuals shall contain full particulars of various components, fully dimensioned drawings, circuit diagrams etc.

11 SPARES/SPECIAL TOOLS.

11.1 The Tenderer shall quote separately for the spares recommended for the maintenance of equipment, for a period of at least five years.

11.2 The tenderer shall quote the supply of special tools, if any, required for operation and maintenance.

11.3 Spare parts/ special tools, as ordered, shall be delivered along with the equipment.

12 GUARANTEE/WARRANTY

12.1 The manufacturer shall guarantee that the product will continue to conform to the description and quality as per this specification for a period of 30 months after the delivery or 24 months from the date of placement in service whichever shall be sooner, and this warranty shall survive notwithstanding the fact that the product may have been inspected, accepted and payment therefore made by the Purchaser.

12.2 The tenderer shall also quote separately for two years of servicing/maintenance of the instrument after the scheduled guarantee period is completed.

12.3 The supplier should have a fully equipped service centre with well-qualified service engineers to provide after-sales service in India.

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