

(FOR OFFICIAL USE ONLY)

SPECIFICATION NO. ETI/PSI/106(10/87)

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

TECHNICAL SPECIFICATION
FOR
CAPACITANCE BRIDGE & DISSIPATION - FACTOR BRIDGE
FOR
THE MEASUREMENT OF SOLID INSULATIONS & INSULATING OIL.

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OCTOBER 1987

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Technical specification for Capacitance & Dissipation - factor bridge for measurements of solid insulation and insulating oils of electrical equipment.

1. SCOPE.

1.1 This specification applies to a portable and compact instrument for measurements of capacitance and dissipation-factor (tan-delta) of insulations used in electrical equipment e.g. power transformers, instrument/booster transformers, switchgear, high voltage bushings etc. The instrument may also be used for measurement of dissipation-factor of insulating oils.

2. GOVERNING SPECIFICATION.

2.1 All components used in this bridge shall unless otherwise specified, conform to the latest edition of respective Indian Standard Specification. Where relevant Indian Standards are not available, relevant international standard specifications of the country of manufacture shall be complied with.

2.2 Assistance has been taken from the following standards, in preparation of this specification:-

- i. BS:4542-1970 - Determination of loss tangent and permittivity.
- ii. ASTM - D.150 - ⁴C-loss characteristics and permittivity (Dielectric constant) of solid electrical Insulating materials.

3. SERVICE CONDITIONS.

3.1 The instrument shall operate satisfactorily under the following environmental conditions:

- i. Ambient temperature = 45°C
- ii. Minimum temperature = 0°C
- iii. Maximum relative humidity = 100%
- iv. Annual rainfall = 1750 to 6250 mm
- v. No. of rainy days per annum = 120 days
- vi. Altitude = Not exceeding 1000m

3.2 The instrument shall be suitable for indoor use in coastal areas under normally polluted atmospheric condition. It may be subjected to normal vibrations and shocks encountered in a machine testing shop.

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4. CONSTRUCTIONAL FEATURES.

4.1 The test bridge shall be of compact design, portable and handy to enable easy transportation. It shall be enclosed in a dust and weather proof, sturdy metallic housing adequately shielded from electrostatic influence. The surfaces of the BOX shall be painted with anti-corrosive enamel.

4.2 The bridge shall be specially designed for quick, simple and accurate capacitance and dissipation factor measurements on bushings, transformers and insulating oil. It will be preferable if the bridge can be used for both low and high voltage measurements for better accuracy. The instrument shall be capable of 3 terminal measurements with guard and shall be direct reading, preferably digital type for capacitance in either microfarad (μF) or pico-farad (pF) and the dissipation factor (DF) displayed directly in per cent.

4.3 The bridge balance shall be achieved by using a centre scale null detector which shall be tuned, synchronous and filter phase sensitive. It shall also be suitable for grounded as well as ungrounded objects for indoor or outdoor use.

4.4 The bridge shall have facilities for LED display with automatic decimal for easy readout.

4.5 A stainless steel oil test cell and cell heater conforming to ASTM D-924 and IEC-250:1968 shall be provided as an accessory together with the bridge.

5. RATING AND OTHER PARTICULARS.

5.1 The bridge shall be suitable for measuring and indicating results in the following ranges:

i) Capacitance range & accuracy:

<u>Capacitance</u>	<u>Resolution</u>	<u>Accuracy</u>
100 pf range	0.1 pf	$\pm 0.1\%$ of reading ± 1 pf
1000 pf range	1 pf	$\pm 0.1\%$ of reading ± 1 pf
10000 pf range	10 pf	$\pm 0.1\%$ of reading ± 10 pf

ii) Dissipation-factor range & accuracy:

<u>Tan-delta factor</u>	<u>Resolution</u>	<u>Accuracy</u>
0 to 0.1 range	0.00001	$\pm 1.5\%$ of reading ± 0.00015
0.1 to 1 range	0.0001	$\pm 1.5\%$ of reading ± 0.0015

- iii) Test voltages: 0 to 3000 volts range
- iv) Power supply: 230 \pm 10% volts, 50 Hz, ac.

6. TESTS.

6.1 The bridge shall be inspected and tested at the firm's premises before despatch as per schedule to be mutually agreed upon between supplier and purchaser. The tests shall be witnessed by the purchaser's representatives.

6.2 The tenderer shall furnish complete technical details along with the manufacturer's test certificates for the performance claimed.

7. TECHNICAL DATA AND DRAWINGS.

7.1 The tenderer shall furnish guaranteed performance and other necessary technical parameters for the instrument in the proforma attached at Annexure A.

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 literatures, assembly layout drawing, schematic diagram etc. for scrutiny to the purchaser.

8. TRAINING OF RAILWAY ENGINEERS.

8.1 The offer shall include a short training schedule on the equipment at the manufacturer's works for two Engineers of Indian Railways, free of cost. The charges for to and fro travel to the manufacturer's works will be borne by Indian Railways.

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 free of cost four sets of instruction manuals for operation and maintenance of the equipment. The manuals shall contain full particulars of various components, fully dimensioned drawings, circuit diagram etc.

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11. SPARES/SPECIAL TOOLS.

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

11.2 The tenderer shall also quote for 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 supply of the equipment.

12. GUARANTEE.

12.1 The instrument shall be guaranteed for its trouble free performance for a period of 18 months from the date of commissioning or 24 months from the date of supply whichever period is longer.

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

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Schedule of Guaranteed Performance, Technical
and other particulars.

Sl. No.	Description of the items	Numerical values/particulars (to be furnished by the manufacturer)
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1. Name of the manufacturer
2. Country of origin
3. Standard specifications (if any)
on which the performance data
is based.
4. Type and type designation
(Schering Bridge or trans-
former ratio Bridge).
5. Is the complete unit is compact
& portable and suitable for
testing at site?
6. Capacitance:
 - a) Range
 - b) Accuracy
 - c) Resolution.
7. Dissipation factor:
 - a) Range.
 - b) Accuracy.
 - c) Resolution.
8. Test voltage.
9. Test frequency.
10. Power Supply System.
11. Which of the following test
configuration is possible:
 - a) Ungrounded specimen test:
- High to low.
 - b) Grounded specimen test:
- High to Ground.
 - c) Grounded specimen test:
- Low to Ground.

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d) Grounded specimen test:
i) High to Ground
ii) High to Low

e) Grounded specimen test:
i) Low to Ground,
ii) Low to High

12. Whether a guard wire is used?

13. Whether the Bridge is suitable for:

- a) Low voltage measurement alone.
- b) High voltage measurement alone.
- c) Both for Low and High voltage measurements.

14. Type of Detector used.

15. Size of the Bridge (in metric units)

16. Leads (approximate length of all leads and their materials, type etc.)

17. Weight of the complete unit (kg).

18. List of accessories included.

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