



**ODISHA POWER TRANSMISSION CORPORATION LIMITED**

# **TECHNICAL SPECIFICATION**

## **FOR**

**TESTING INSTRUMENTS AND MAINTENANCE KITS  
OTHER TOOLS & PLANTS  
&  
FURNITURE**

**TESTING INSTRUMENTS AND MAINTENANCE KITS AND OTHER T&P'S & FURNITURE**  
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## 1. GENERAL

The testing and maintenance equipment covered here are generally meant for carrying out testing and measurement at site and shall be complete with all materials and accessories. These shall be robust in design, so that they give accurate results even in adverse site conditions.

All equipment furnished shall be of reputed make, type tested and shall be subjected to acceptance and routine tests in accordance with the requirements stipulated under respective equipment specification.

At least two sets of descriptive leaflets, catalogues, outline drawing, principles of operation etc. shall be sent along with the offer, for all the equipment offered. Weight and dimensions of items should also be mentioned.

Four sets of inspection and calibration report, operation and maintenance manual shall be sent along with Despatch documents. One set will be kept inside the equipment.

In the event of bidder offering equipment manufactured by different manufacturers, it will be his responsibility to fully co-ordinate the activities of each manufacturer in such a way that the complete equipment contracted for, is manufactured, supplied and guaranteed for successful operation.

## 2. TRAINING

Necessary training shall be provided to Employer's personnel for using and maintaining the equipment at Employer's premises.

## 3. CLIMATIC CONDITION

The equipment covered under this specification shall be suitable for operation under climatic condition stated else where in the specification. The offered equipment as such shall be suitable for satisfactory operation under the tropical climate.

### 3. 100 KV AUTOMATIC TRANSFORMER OIL BREAKDOWN VOLTAGE TEST SET

The equipment shall be suitable for operation at 240 volts 50 Hz. Single phase AC supply.

The BDV test kit shall be of automatic type and shall be as per IEC 156/95 as well as other international standards. This kit shall be operated through mains power supply and through battery.

The test set shall have the following feature & specification

- Lockable gap settings of electrodes for precision measurement.
- Automatic measurement of oil temperature with the help of built in temp. Sensor.
- Colour display with backlight.
- Test chamber shall be large fitted with oil drain for easy cleaning.
- High visibility test chamber
- Shall have dual redundant micro switch for safe operation.
- Voltage calibrator to be provided for checking of output voltage.
- The output voltage : 0-100 kV rms with an resolution of 0.1 kV
- Voltage measurement accuracy : 0-100 kV  $\pm$  1 kV
- Measurement of Oil temperature during testing : 0-100 degree centigrade
- Temperature resolution : 1° centigrade
- Switch over time on flash over : < 10  $\mu$ S
- User can select various programs for testing
  - IEC 156/95
  - ASTM 1816-04-1/2/ASTM877-02A
  - EN60156

- Display : Bright LCD
- Power Supply: The equipment shall be suitable for operation at 240 volts 50 Hz. Single phase AC supply.
- **Guaranteed technical particulars for Transformer Oil BDV test kit:**

Sl No	Description	Yes / No
1	Specify the MAKE, Model, Details of accessories considered No and Country of Manufacturing.	
2	Whether the transformer oil BDV kit is microprocessor based	
3	The kit shall be portable with battery operated as well as mains operated.	
4	The output voltage is of 100 kV rms	
5	The feature accuracy and resolution are as per specification asked	
6	The kit shall be tested as per IEC 156/95 standards for testing of oil The kit shall consists of setting gauge of 2.5 mm	
7	The kit meets the GENERAL Technical specification of clause I.	
8	Technical data sheet, literature is enclosed along with the offer which is as per GTP	

#### **4. 5KV AUTOMATIC INSULATION TESTER ( MAINS & BATTERY OPERATED)**

The microprocessor based kit is heavy Duty Battery& Mains Operated Insulation Resistance tester for power transformer to measure the insulation resistance automatically and shall able to display absorption index, Polarization index, DAR, Step Voltage and Dielectric Discharge test.

##### **Technical Requirement.**

1. Instrument shall be Mains and Battery operated.
2. Voltage Range 50V to 1KV in 10V steps, 1KV to 5KV/2.5 KV in 25 V steps
3. Resistance range : 10 K $\Omega$  to 15 T $\Omega$ .
4. Resistance range for each rated voltage shall be indicated in the offer. Instrument shall display direct reading of voltage across the test piece when the test is in progress.
5. Instrument shall display leakage current during measurement.
6. Short Circuit current **6mA**.
7. It shall have Breakdown or 'Burn' mode. Interference Rejection 1mA r.m.s per KV test voltage to a maximum 4mA r.m.s
- 8 Accuracy: Better than 2%; Noise Rejection Current: Min 6 mA and above.
- 9 Instrument shall have additional filter option for time constant selection

**Test Time:** Timer control & display facilities

Display: LCD 3 digit Digital /analog backlit display for resistance, voltage, leakage current, capacitance, battery status, timer constant and elapsed time of the test. Data Storage: On board memory min.32 KB

Capacity

Safety Standard : EN61010-1:2001 CATIV 600 V

EMC Standard : EN61326-1: 1998 for use in heavy

Test set shall have high performance ‘Guard terminal’ for accurate measurement in presence of surface leakage.

Current Measurement : 0.01 nA to  $\pm 5$  mA

Capacitance Measurement : 1 nF to 50  $\mu$ F

Test time shall be selectable from 1 second to 99 minutes

Capacitor charging time shall be  $\leq 5.0$  Seconds per  $\mu$ F at 3mA

Capacitor discharge time shall be  $\leq 5.0$  Seconds per  $\mu$ F to discharge from 5000V to 50 V

**Voltage Measurement range:** 50 to 600V DC or AC; 0 to 5000 V DC when testing Instrument shall have high voltage warning display when input voltage across the terminal is above 50V.

**The lead length shall be minimum of 15 mtrs each in order to test up to 400 KV Transformers.**

Suitable calibrator shall be provided with the instrument.



#### **Guaranteed Technical Particular (Insulation Tester)**

Sl.no		YES / NO
1	Voltage selection – 50V to 1KV in 10V steps, 1KV to 5KV/ in 25 V steps	
2	Instrument shall be Mains and Battery operated	
3	Instrument shall measure the resistance range 10 K $\Omega$ to 15 T $\Omega$ .	
4	Instrument Shall have Short Circuit current 6mA and above	
5	<b>Insulation resistance range Digital</b> Digital display : up to 15 T $\Omega$ . Analogue display: up to 15T $\Omega$ .	
6	Instrument shall have Breakdown or ‘Burn’ mode	
7	Guard Terminal accuracy of 2% guarding 500K Ohm leakage with a 100M Ohm load	
8	The instrument shall performs automatic tests and measure Insulation Resistance, current, capacitance, Polarization Index, Step voltage tests, DAR & Dielectric Discharge.	
9	Does instrument has stable output source under low load condition? Does instrument provides 5KV output voltage even at 10Mohm load?	

10	Instrument shall measure Capacitance: up to 50 $\mu$ F	
11	The kits accuracy and resolution is as per specification asked	
12	Suitable calibrator provided for calibration	
13	Does the kit offered is suitable for testing transmission line insulation in double circuit line ,when one line parallel to it in charged condition?  If, No, Have quoted for line insulation measurement?  Instrument offers 6ma and above noise current cancellation capability?	
14	Does the kit dependent on battery for its operation and testing?	
15	If, YES for point no 12, provided the details of battery?	
16	The kit meets the GENERAL Technical specification of clause I.	
17	The kit full fills safety, EMI/EMC compatibility for safe working at substation of equipment and human being.	
18	Technical data sheet, literature is enclosed along with the offer which is as per GTP	
19	What is instrument IP rating?(preferably better than IP65)	
20	CAT safety rating as per IEC1010-1:2001(shall be CATIV600)	
21	Specify the Make, Model , Details of accessories considered & Origin of Manufacturer of the equipment	

## 5. OIL SAMPLING BOTTLE

Oil Sampling bottles shall be suitable for collecting oil samples from transformers, for testing of the oils (BDV, Dissolved Gas Analysis, resistivity etc). Bottles shall be robust enough, so that no damage occurs during frequent transportation of samples from site to laboratory.

Oil sampling bottles shall be made of stainless steel having a capacity of 1 litre.

Oil sampling bottles shall be capable of being sealed gas-tight and shall be fitted with cocks on both ends.

The design of bottle and seal shall be such that loss of hydrogen shall not exceed 5% per week.

An impermeable oil-proof, plastic or rubber tube of about 5 mm diameter, and of sufficient length shall also be provided with each bottle along with suitable connectors to fit the tube on to the oil sampling valve of the equipment and the oil collecting bottles respectively.

## 6. RELAY TOOLS KITS (ALSO REFER THE SPECIFICATION OF PCM)

The relay test kit shall consist of the following minimum items:

1. Test plugs for use with testing equipment
2. Special type test plugs for using with modular type cases
3. Screw driver set with multiple fixing feature
4. Long nose pliers
5. Wire cutting pliers and stripper
6. Ordinary pliers
7. Adjustable wrench

8. Soldering irons of
  - Watts rating - 1 No.
  - Watts rating - 1 No.
  - Watts rating - 1 No.
9. De-soldering pump
10. Printed Circuit Card-extender; Printed circuit card - 'Puller' Suitable for all supplied relays
11. Test leads (Pair with 2 Mts. length) - 1 set
12. Shorting plugs, 'pistol' prods (2 Nos.) - 1 set

## 7. **SF6 GAS LEAK DETECTOR**

The SF6 gas leak detector shall meet the following requirements

The detector shall be free from induced voltage effects.

The sensing probe shall be such that it can reach all the points on the breaker where leakage is to be sensed. Latest standard in this effect may be followed.

## 8. **DIGITAL MULTI- METER**

The Digital Multi-meter shall have high-precision 50,000 count or more DMM with all of the functions and features required for advanced testing in complex power and electrical applications.

**The following measurement can be done by the digital multimeter:**

DC Voltage, AC Voltage, DC Current, AC Current, Resistance, Frequency, Temperature, Capacitor, Duty

Cycle ratio, Decibel (dBV, dBm), Continuity Check, Diode Test, Low Power, Low Power, Measures

Resistance under low measurement current. Effective value (root mean square value) detection (RMS) and

mean value Detection (MEAN) can be switched during AC voltage or AC current measurement.

The kit shall have following characteristics:

- a. 0.02% basic DC accuracy
- b. Large display with 50,000 or more counts
- c. Dual display for double indication for AC and DC, V and Hz, etc.
- d. True-RMS Measurements AC and AC+DC
- e. Wide AC Frequency bandwidth from 10Hz to 100kHz
- f. True-RMS or MEAN value detection mode can be selected
- g. Fast Peak Hold response time of 250μs
- h. Low Power  $\Omega$  for resistance measurements on sensible electronic circuits by a low and safe test current
- i. User calibration function

The kit shall be able to test parameters like Voltage, Current, Frequency, temperature, capacitance, and voltage detection, resistance, inductance, The kit shall have following functions:

- Display : 50000 or more count, 5-digit display
- AC Voltage : 60 mV to 1000 V, 6 ranges
  - Basic accuracy:  $\pm 0.2\%$  rdg.  $\pm 25$  dgt. (True RMS, crest factor 3)
- Frequency characteristics: 20 Hz - 100 kHz
- AC Current : 600  $\mu$ A to 10A in 4 ranges

- Accuracy:  $\pm 0.6\%$  rdg.  $\pm 5$  dgt. (True RMS, crest factor 3)
- Frequency : AC V, DC+AC V, AC A measurement, at pulse width 1  $\mu$ s or more (50 % duty ratio)  
99.999 Hz (0.5 Hz or more) to 500.00 kHz, 5 ranges,
  - Basic accuracy:  $\pm 0.005\%$  rdg.  $\pm 3$  dgt. (True RMS, crest factor 3)
- DC Voltage : 60 mV to 1000 V, 6 ranges
  - Basic accuracy:  $\pm 0.025\%$  rdg.  $\pm 2$  dg
- DC Current : 600.00  $\mu$ A to **10A**, 4 / 6 ranges
  - Basic accuracy:  $\pm 0.6\%$  rdg.  $\pm 10$  dgt.
- Resistance : Range-500  $\Omega$  to 4 M $\Omega$ 
  - Accuracy:  $\pm 0.05\%$  rdg.  $\pm 5$  dgt
- Capacitance : 1.000 nF to 100.0 mF, 9 ranges,
  - Basic accuracy:  $\pm 1.0\%$  rdg.  $\pm 5$  dgt
- Continuity check: Continuity threshold: 20/50/100/500  $\Omega$ , Response time: 10 ms or more
- Diode check : Open terminal voltage: 4.5 V or less, Testing current 1.2 mA or less,
  - Threshold of forward voltage: 0.15 V to 3 V, seven stages
- dB level : Standard impedance setting (dBm), 4  $\Omega$  to 1200  $\Omega$ , 20 stages
- Temperature : K: -40.0  $^{\circ}$ C to 800.0  $^{\circ}$ C  
Add accuracy of the Thermocouple probe to main unit accuracy:  $\pm 0.5\%$  rdg.  $\pm 3$   $^{\circ}$ C
- $\pm 0.025\%$  DC V basic accuracy, wide 20 Hz to 100 kHz AC V frequency characteristics
- Includes terminal shutter mechanism for accident prevention (prevents erroneous test lead insertion)  
Measures large currents with optional clamp probe
- USB communications function supports PC measurements shall be available.
- Broad -15 (5 $^{\circ}$ F) to 55 $^{\circ}$ C (131 $^{\circ}$ F) operating temperature range.

#### Safety Features

- Complies with IEC 61010-1 CAT III , 1000V, CAT IV 600V
- Terminal shutter to prevent incorrect test leads' insertion in current terminals
- Overload protection of for voltage 1000 V DC / 1000 V rms AC
- Overload protection for current shall be given by fuse.

### **Guaranteed technical particulars for Digital Multimeter**

Sr. No	Description	YES/NO/ REMARK
1	The Digital Multi-meter shall have high-precision 50,000 count or more DMM with all of the functions and features required for advanced testing in complex power and electrical applications.	
2	The following measurement can be done by the digital multimeter: DC Voltage, AC Voltage, DC Current, AC Current, Resistance, Frequency, Temperature, Capacitor, Duty Cycle ratio, Decibel (dBV, dBm), Continuity Check, Diode Test, Low Power, Low Power, Measures resistance .under low measurement current. Effective value (root mean square value) detection (RMS) and mean value Detection (MEAN) can be switched during AC voltage or AC current Measurement.	
3	The kit shall have following characteristics:	



	<ul style="list-style-type: none"> <li>a. 0.02% basic DC accuracy</li> <li>b. Large display with 50,000 or more counts</li> <li>c. Dual display for double indication for AC and DC, V and Hz, etc.</li> <li>d. True-RMS Measurements AC and AC+DC</li> <li>e. Wide AC Frequency bandwidth from 10Hz to 100kHz</li> <li>f. True-RMS or MEAN value detection mode can be selected</li> <li>g. Fast Peak Hold response time of 250<math>\mu</math>s</li> <li>h. Low Power <math>\Omega</math> for resistance measurements on sensible electronic circuits by a low and safe test current</li> <li>i. User calibration function</li> </ul>	
4	AC Voltage: 60 mV to 1000 V, 6 ranges Basic accuracy: $\pm 0.2$ % rdg. $\pm 25$ dgt	
5	Frequency characteristics: 20 Hz - 100 kHz AC Current: 600 $\mu$ A to 600 mA, 10A Accuracy: $\pm 0.6$ % rdg. $\pm 5$ dgt.	
6	Frequency: AC V, DC+AC V, AC A measurement, at pulse width 1 $\mu$ s or more (50 % duty ratio) 99.999 Hz (0.5 Hz or more) to 500.00 kHz, 5 ranges, Basic accuracy: $\pm 0.005$ % rdg. $\pm 3$ dgt.	
7	DC Voltage: 60 mV to 1000 V, 6 ranges Basic accuracy: $\pm 0.025$ % rdg. $\pm 2$ dgt.	
8	DC Current: 600.00 $\mu$ A to 600.00 mA/ 10A, 4 / 6 ranges Basic accuracy: $\pm 0.05$ % rdg. $\pm 5$ dgt. / $\pm 0.6$ % rdg. $\pm 10$ dgt.	
9	Resistance: Range-500 $\Omega$ to 4 M $\Omega$ Accuracy: $\pm 0.05$ % rdg. $\pm 5$ dgt	
10	Capacitance: 1.000 nF to 100.0 mF, 9 ranges, Basic accuracy: $\pm 1.0$ % rdg. $\pm 5$ dgt	
11	Continuity check: Continuity threshold: 20/50/100/500 $\Omega$ , Response time: 10 ms or more	
12	Diode check: Open terminal voltage: 4.5 V or less, Testing current 1.2 mA or less	
13	Threshold of forward voltage: 0.15 V to 3 V, seven stages, dB level :Standard impedance setting (dBm),	
14	Temperature : 0 $^{\circ}$ C to 800.0 $^{\circ}$ C	
15	Technical data sheet, literature is enclosed along with the offer which is as per GTP	
16	Pls. mention the type of battery required for operation	
17	Specify the Make, Model, Details of accessories considered & Origin of Manufacturer of the equipment	

#### 9. **DIGITAL CLAMP METER (TRUE RMS AC/DC)**

**Instrument shall have following feature and technical specification  
(True RMS AC/DC Digital clamp Meter)**

## Technical Specifications

AC current	100.0/1000A (45Hzto66Hz:±1.5%rdg.±5dgt.)
AC voltage	0-750Voltage ((±1.3%rdg.±5dgt.)
DC current	100.0/ 1000A (±1.5%rdg.±5dgt.)
DC voltage	0-1000V (±1.3%rdg.±4dgt.)
Resistance	0-40Mohm (±2.0%rdg.±4dgt.)
Continuity	420 ohm (±2.0%rdg.±6dgt.) Threshold level : Less than 50W ±40ohm (Buzzer sound)
AC measurement	MEAN value(3288) / True RMS(-20)
Maximum rated voltage to earth	CAT iV 600V
Display update rate	400ms ±25ms
Range switching	<u>Auto range</u> / Manual range 5 count or less (current measurement only)
Zero suppression	

### Safety Features

- Complies with IEC 61010-1 CAT III , 1000V, CAT IV 600V
- Terminal shutter to prevent incorrect test leads' insertion in current terminals
- Overload protection of for voltage
- Overload protection for current shall be given by fuse

### Guaranteed technical particulars for True RMS AC/DC Digital clamp Meter

Sl No	Description	Yes/No
1	The kit shall measure averaging/true RMS reading of current and voltage	
2	Range of AC current measurement: 400mA, 4A, 30A	
3	Range of DC current measurement: 4A, 30A	
4	The accuracy and resolution is as per specification.	
5	Jaw opening size is 23 mm	
6	Technical data sheet, literature is enclosed along with the offer which is as per GTP	
7	Pls. mention the type of battery required for operation	
8	Specify the Make, Model , Details of accessories considered & Origin of Manufacturer of the equipment	

## 10. DIGITAL EARTH RESISTANCE TESTER

The kit shall be microprocessor-controlled with self-diagnostic features. This instrument shall be portable 3 & 1/2 digits, Digital earth meter and is suitable to measure earth resistance, specific ground resistivity.

This features automatic control system of injected current & an alarm warning that the current is not enough in order to achieve a reliable measurement. This meter is powered up by in built chargeable battery.

Measurement range is  $0.01 \Omega$  to  $2 \text{ k } \Omega$ . It Shall be able to measure resistance of single and multiple electrodes mesh system, plates, earth strips etc. and resistivity by four pole method, in up to 400 KV A.C switch yard under energized conditions.

Earth Tester is a digital automatic Earth Resistance meter that allows measuring Earth Resistance by 2 Pole, 3 pole and 4 pole methods. It shall also able to measure soil resistivity through 4 wire measurement. The test current shall be minimum 40 mA.

The measurement frequency shall be in various selections of more than 60 Hz & up to 1500 Hz and the test current shall be minimum of 40 mA.

The kit shall able to work in the charged switchyard condition of 400 kV.

The following indication and precautions shall be given by the equipment.

1. A sharp and intermittent audible signal indicates anomalies in the circuit.
2. It shall be Immunity to Interference: The operation frequency will not coincide with any harmonics of the industrial frequency in order to minimize the effect of parasitic currents present in the surveyed soils. Suitable arrangement shall be incorporated in the instrument to take care of immunity system.
3. Measurement ranges: 2, 20; 200;2000
4. Accuracy: minimum  $\pm 2\%$
5. Battery status checking: Possible to verify the battery charge status under normal use

Conditions.

6. Audible Alarm: Warning signal for any abnormalities.
7. The kit shall able to display resistance of auxiliary rod, frequency of test current, voltage and Frequency of interference (noise) residual resistance
8. The kit shall be supplied with following accessories:
  - a. 4 Auxiliary electrodes(50cm long Augur style spikes ),
  - b. Hexagonal shape, Galvanized steel, 1 rod extraction tool(if required),
  - c. A.C Adapter for the battery charger (universal type),
  - d. Connection cable: 40 mtrs red lead,40 mtrs blue lead, 20 mtrs green lead,20 mtrs black lead, 5 mtrs green lead (earth electrode)etc,4 mm shrouded plug and large croc clip,50mtrs measuring tape, carry case and any other materials /leads required to be supplied along with the instruments.
  - e. Necessary clamp for measurement in 2 pole methods.

The kit shall possess following safety and applicable standards:

- IEC 61010-1 , IEC – 61010-031, IEC 61557-1.5, IEC 61326
- CAT-III300V,CAT IV 150V

**Guaranteed Technical Particular (Earth Resistance Tester)**

Sl. NO	Description	YES / NO
1	Equipment is microprocessor based.	
2	Equipment is self-diagnostic features & alpha numerical display.	
3	Battery operated ( rechargeable)	
4	Earth resistance range and accuracy as per specification	
5	Measurement Frequency shall be as per specification	
6	Accessories as per specification.	
7	Test current- Minimum 40 mA and test frequency from any of these or in various selections of more than 60 Hz & up to 1500 Hz.	
8	Measures earth resistance in 2 pole, 3 pole and 4 pole method	
09	The kit meets the GENERAL Technical specification of clause I.	
10	The kit full fills safety, EMI/EMC compatibility for safe working at substation of equipment and human being.	
11	Specify the Make, Model, Details of accessories considered & Origin of Manufacturer of the equipment	

**11. Discharge Rods:**

Discharge rods shall be good quality and as per the latest relevant standard. Required length of PVC good insulation flexible copper cable, required clamp connected at the end of wire shall be connected. The top portion of the discharge rod shall be adjustable to fit in for proper gripping by screwing from the bottom side. The entire handle shall be of latest insulating materials for the safety of the user. The discharge rod shall be reliable, durable and shall meet the safety requirement of the users.

**12. Rubber Hand Gloves:**

Good quality rubber gloves for using during operation of isolators and earth switch. Latest standard for the rubber gloves shall be followed. The gloves shall be reliable, durable and shall meet the safety requirement of the users.

**13 Portable Emergency Light:**

Reputed make (BPL/CGL/Bajaj) portable emergency light, having twin tube, shall be supplied to each sub-station. It shall have chargeable battery (durable) and having provision of selection switch for selecting single or double tube. It shall have chargeable feature during not in use and automatically switch on in the event of power failure. CFL tubes are preferred. It shall have provision of wall hanging/table mounting and shall be durable one. Latest standard in this effect shall be followed.