

**TSGENCO  
4 X 270 MW BHADRADRI TPS**

**VOLUME II B**

**TECHNICAL SPECIFICATION  
FOR  
ELECTRICAL LAB EQUIPMENT**

**SPECIFICATION NO. : PE-TS-411-556-E002, REV. 0**



**BHARAT HEAVY ELECTRICALS LIMITED  
POWER SECTOR PROJECT ENGINEERING MANAGEMENT  
NOIDA, 201301**

	4X270 MW BHADRADRI TPS	Doc. No. PE-TS-411-556-E002	
		Volume	Section
	TECHNICAL SPECIFICATION FOR ELECTRICAL LABORATORY EQUIPMENTS	IIB	
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	<b>TOTAL NO. OF SHEETS</b>	<b>= 39</b>
	<b>(INCLUDING COVER/ SEPARATOR SHEETS)</b>	

**IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT THERE ARE NO TECHNICAL DEVIATIONS.**

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 BIDDER'S STAMP & SIGNATURE  
 (REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS')

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### **INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS**

1. Two signed and stamped copies of the following shall be furnished by all bidders as technical offer :
  - a) Unpriced Price Schedule (Annexure-A as enclosed with the specification) with bidder's signature and company stamp.
  - b) Datasheet-B filled with required details along with bidder's signature and company stamp.
  - c) A copy of the sheet "Instructions to Bidders for Preparing Technical Offer" with bidder's signature and company stamp.
  - d) A copy of sheet "List of Contents" with bidder's signature and company stamp.
  - e) General arrangement drawing showing constructional features, accessories, connections, range and rating, mounting arrangement, space requirement etc.
  - f) Technical leaflets/ Catalogues on following
    - i) Testing of equipment
    - i) Instruments
    - ii) Misc. Equipment
2. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.
3. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
4. Any changes made by the bidder in the price schedule with respect to the item description/ quantities, notes etc. from those given in Annexure-A to Section-C of specification [Bill Of Quantities] shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).
5. Bidder to furnish "No deviation" against each item quoted by them unless specifically indicated in Deviation Schedule sheet.

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**BIDDER'S STAMP & SIGNATURE**  
**(REFER INSTRUCTION NO. 1 OF ABOVE)**



TITLE

**PREAMBLE**

SPECIFICATION NO. PE-TS-411-556-E002

VOLUME IIB &amp; III

SECTION -

REV. NO. 00

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SHEET 1 OF 1

1.0 The Tender document contains three (3) volumes. The bidder shall meet the requirements of all three volumes.

1.1 **VOLUME - I**                      **CONDITIONS OF CONTRACT**

This consists of four parts as below:-

**Volume – IA**                      This part contains Instructions to bidders for making bids to BHEL.

**Volume – IB**                      This part contains General Commercial Conditions of the Tender & includes provision that vender shall be responsible for the quality of item supplied by their sub-vendors.

**Volume – IC**                      This part contains Special Conditions of Contract.

**Volume – ID**                      This part contains Commercial conditions for Erection & Commissioning site work, as applicable.

1.2 **VOLUME – II**                      **TECHNICAL SPECIFICATIONS**

Technical requirements are stipulated in Volume – II, which comprises of:-

**Volume – IIA**                      General Technical Conditions.

**Volume – IIB**                      Technical Specification including Drawings, if any.

1.2.1 **VOLUME – IIB**

This volume is sub-divided in to following sections:-

**Section – A**                      This section outlines the Intent of Specification

**Section – B**                      This section provides “Projection Information”.

**Section – C**                      This section indicates Technical Requirements specific to Contract, not covered in Section - D


**Section – D**                      This section comprises of Technical Specifications of Equipments Complete with Data Sheets A, B, C.

**Data sheet - A :-**                      Specific data and other requirements pertaining to the equipments.

**Data sheet - B :**                      Specific Data to be filled by bidder (Data Sheet - B is Contained in Volume - III).

**Data sheet – C :-**                      Indicates data / documents to be furnished after the award of Contract as per agreed schedule by the vendor (as applicable).

2.0 This requirements mentioned in Section – C / Data Sheet – A of Section – D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section – D.

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**SECTION- A**  
**SCOPE OF ENQUIRY**

1. This specification covers the design, manufacture, inspection and testing at manufacturer's work, proper packing and delivery to site of **ELECTRICAL LABORATORY EQUIPMENTS** as mentioned in different sections of this specification for **4X270 MW BHADRADRI TPS**.
2. It is not intent to specify herein all the details of design and manufacture. However the equipment shall confirm in all respect to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation up to vendors guarantee.
3. The general terms and condition, instruction to tenderer and other attachment referred to elsewhere are hereby made part of the tender specification.
4. The tenderer shall be responsible for and governed by all requirements stipulated herein after.
5. The offer should be complete with technical data, catalogue, brochures and drawings, as applicable.
6. The bid shall be in English language and MKS system of unit.
7. Deviation, if any should be brought out very clearly on deviation sheet enclosed with specification only. Otherwise it is presumed that the tender offer is in line with what has been stated/asked for in this specification.
8. Qualification data: in order to be able to present to the client the provision of the equipment offered, the bidder is requested to elaborate details of experience, capabilities reference list etc. in this offer.



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SECTION – B

PROJECT INFORMATION



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## INTRODUCTION

4x270 MW Bhadradi TPS is being set up by Telangana State Electricity Corporation Limited (TSGENCO) at Manuguru in the district of Khammam, Telangana, India.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on BHEL/Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

## APPROACH TO SITE

**The distance from Manuguru to Major cities in state:** Hyderabad-345KM, Warangal-180km, Bhadrachalam-38km, Kothagudem-70km and Khammam-130km, Vijayawada-195km.

**District:** KHAMMAM

**State:** TELANGANA

**Nearest Airport:** The nearest airport is Vijayawada Airport but the most used airport is the Hyderabad International Airport.

**Nearest Railway Station:** Manuguru railway station is 10KM from nearby town. However Warangal/Vijaywada railway Station is major railway station near to Manuguru.



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1. **Owner** TSGENCO
2. **Owner Consultant** DESEIN PRIVATE LIMITED, NEW DELHI
3. **Project Title** 4X270 MW Bhadradi TPS
4. **Location** 16 Km from Manuguru Railway station
5. **Nearest Railway Stn.** Manuguru
6. **Temperature**
  - a. Mean daily minimum ambient temperature during oldest month of the year=11.5 Deg.C
  - b. Mean daily minimum ambient temperature during hottest month of the year=45.1 Deg.C
7. **Rainfall**  
Intensity of rainfall @ 80 mm/hr considering heaviest fall in 24 hrs
8. **Wind Data**
  - a. Basic wind speed at 10m height  
44 m/sec
  - b. Wind pressure As per IS: 875 Part III- 1987
9. **Seismic Zone** Zone III as defined in IS:1893 (part-1)-2002 according to Indian Standard Seismic Zoning Map

10.0	<b>Power Supply</b> The power supplies for distribution and auxiliaries shall be as under:	
	a) In plant generation	16.5kV $\pm 5\%$ , 3ph, 50Hz $\pm 5\%$ , high resistance earthed.
	b) MV distribution	6.6kV $\pm 6\%$ , 3ph, 3w , 50 Hz, + 5 % to - 5%, Non-effectively earthed
	c) LT distribution	415V $\pm 10\%$ , 3ph, 4W, 50Hz + 5% to -5%, Effectively earthed
	d) Motor rated above 160kW	6.6kV $\pm 6\%$ , 3 ph 50Hz +5% to -5%.
	e) Motor rated 160kW and below all motorized actuators.	415V $\pm 10\%$ , 3 ph, 50Hz +5% to -5%.
	f) For motors equal and below 30kW winding heating	24V AC $\pm 10\%$ , 50 Hz %, [to be generated in 415V switchgear by vendor]
	g) DC Motors	220V DC + 10% to - 15%, 2 wire ungrounded system
	h) Control supply for relay panel/	6.6kV 220V DC + 10% to - 15%, 2 wire



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	breakers/415V breakers and DC emergency lighting.	ungrounded system
	i) UPS for instrumentation & Control system	240V AC $\pm 1\%$ , 1 ph, 50Hz $\pm 0.5\%$ 2 Wire AC system
	j) Control supply for 415V Motor contactors/AC Control circuits [to be generated in MCC /panel by vendor]	110V AC $\pm 10\%$ , 50Hz + 5% to -5%.
	k) Diesel Generator emergency supply	415V $\pm 10\%$ , 3ph, 3W, 50Hz +5% to -5%.
<b>11.0</b>	<b>Fault levels</b>	
	a) 400kV	40kA rms for 1 sec
	b) 6.6kV	40 kA rms for 1 sec.
	c) 415V	50 kA rms for 1 sec.
	d) DC Supply	25 kA

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**SECTION-C**  
**SPECIFIC REQUIREMENTS**

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## 1.0 SCOPE OF SUPPLY

Electrical Laboratory Equipment mentioned in this section along with all essential accessories required for the successful operation of the equipment.

The bill of quantities shall be as per enclosed Annexure – A with technical specification.

Technical requirements of Electrical Laboratory Equipment shall be as per Annexure – II of Section-C with technical specification.

## 2.0 CODES AND STANDARDS

Some of the standards, which shall generally be followed, are listed below. Other applicable Indian standards for any component part, even if not covered in listed standards shall be followed.


- i) IS – 6103 Method of test for specific resistance (resistivity) of electrical insulating fluid.
- ii) IS – 6700 Requirements of general purpose Cathode Ray Oscilloscope.
- iii) IS – 722 Specification for AC electricity meters.
- iv) IS – 8143 Specification for plugs & keys for resistance boxes.
- v) IS – 6104 Method of test for interfacial tension of oil against water.
- vi) IEC-51 Direct acting indicating analogue electrical measuring instruments and their accessories.
- vii) Any other relevant National/ International standards as mentioned in the Annexure – II of Section-C with technical specification.

## 3.0 DESIGN CRITERIA:

- 3.1 Electrical Laboratory Equipment shall be used for testing various electrical equipment/ devices during Commissioning, Operation and Maintenance of power plant.
- 3.2 The Equipment will be kept in a clean but hot, humid and tropical atmosphere when not in use. Equipment will be placed in dust laden, hot, humid atmosphere during its use.
- 3.3 For continuous operation at specified rating, temperature rise of various equipment/ components shall be limited to the permissible value stipulated in the relevant standards and this specification.

## 4.0 SPECIFIC REQUIREMENTS & RATINGS:

- 4.1 The Bidder may note that the equipment range, rating, quantities as detailed herein, are the minimum requirement only. All accessories for the equipment not covered here, if necessary for satisfactory and trouble free operation of the equipment, shall be quoted by the Bidder.
- 4.2 Equipment's shall be complete with applicable accessories like power supply, mains leads, screened guard test leads, screened line test leads, earth leads, connectors and clips leather carrying case, input card, clip on current transformers with measurement leads and connectors, suitable hand spikes, main adopter, spare fuses, range extending devices, acoustic calibrator, extension cable input lead, microphones of suitable capacities, vibration pickup, probe pick up cable, camera, external hull detector, hammer, test cell with spherical and mush room type electrodes, spacing gauges, stirrers, inductive sensing heads suitable for different cable sizes etc.
- 4.3 The instrument shall be suitable for satisfactory operation at an ambient temp. from 0°C to 50°C.
- 4.4 The Analog instruments shall be provided with knife-edge pointer and anti – parallax mirror.

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- 4.5 Instrument/ meters suitable for DC supply should be provided with re-chargeable batteries, chargers and low battery charge indication.
- 4.6 All bidders to be advised to quote only 'one' make/model against each equipment best to suit specification requirement.
- 4.7 The instrument shall be suitable for hand held operation, rugged in construction and suitable for field use.
- 4.8 Power supply for AC operating instruments shall be 240V AC, 50Hz, single phase.
- 4.9 **Bidder to note that "In case any recommended make / model become obsolete or is stopped manufacturing by manufacturer, next higher make / model of the same company may be considered for ordering / supply at contract stage and no additional cost shall be paid by BHEL to supplier. Bidder is required to furnish confirmation that "next higher make / model is technical equivalent or better" in case of above condition.**

#### 5.0 TESTS:


- 5.1 All acceptance and routine tests as per relevant standards and specification shall be carried out by the manufacturer. Charges for all these routine and acceptance tests for all the material shall be deemed to be included in the bid price.
- 5.2 Equipment shall be completely assembled, wired, adjusted and tested in factory as per the latest edition of relevant standards.
- 5.3 Bidder shall follow his standard procedure for quality control. However the said procedure/ quality checks shall be submitted for purchaser's approval.

#### 6.0 DRAWING DATA & MANUAL:

- 6.1 To be submitted with the bid
- Compliance to Technical requirement of various equipments as specified in technical specification. Also, bidder to furnish Data Sheet – B.
  - General arrangement drawing showing constructional features, accessories, connections, range and rating, mounting arrangement, space requirement etc.
  - Technical leaflets/ Catalogues on following
    - Testing of equipment
    - Instruments
    - Misc. Equipment
  - Deviation sheet (if any)

The Bidder may note that the drawing, data and manual listed herein are minimum requirement only. The Bidder shall ensure that the other necessary write-ups, curves and information required to fully describe the equipment are submitted with the bid.

- 6.2 To be submitted after award of contract for BHEL/customer approval:
- General arrangement drawing showing constructional features, accessories, connections, range and rating, mounting arrangement, space requirement etc.
  - Detail instructions for application, assembly & testing of equipments.
  - Wiring and schematic diagrams.
  - Tests Reports and calibration curve
  - Technical Catalogues & leaflets.
  - Instruction manual of individual equipment
  - Data sheet-C soft copy in excel format and hard copy.

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Technical documentation such as Technical Particulars, GA sectional drawings, Technical leaflets, Catalogues etc. are required to be submitted within 2 weeks of LOI by the successful bidder for BHEL approval.

6.3 Instruction manual of individual equipment

The manual shall clearly indicate in English the installation and connection method, check list of the tests to be carried out before commissioning of equipment. Maintenance and Calibration method shall also be provided in the manual.

6.4 Number of copies of document/data to be submitted by the successful bidder shall be as per enclosed ANNEXURE – I.

6.5 Bidder to furnish all user instruction manuals, maintenance, handling, installation manuals & all test reports complete in all respect in bound volumes & soft copies to BHEL / BHEL's customer at the time of handing over the same to BHEL / BHEL's Customer.

6.6 Bidder to note that quoted item cost shall include cost of main item, cost of all accessories required for successful operation of equipment and testing cost of all acceptance & routine test as per relevant standard. Test certificates/ Test reports shall be furnished by bidder to BHEL at contract stage for review/acceptance. No additional cost for the same shall be payable by BHEL.

7.0 **PACKING:**

The equipment shall be properly packed in Galvanized sheet steel trunk/box with proper lock & key arrangement.

8.0 **DELIVERY:**

The delivery of Equipment shall be completed as per NIT (Notice Inviting Tender)

9.0 Bidder shall furnish unit rate for each item in the "Schedule of prices for Electrical Lab Equipment" enclosed in Technical Specification as Annexure –A. Purchaser reserves the right to add/ delete any item during detailed engineering as finally required for the project. Unit rate quoted shall be applicable for price adjustment in such cases.

10.0 All the equipment components shall be procured from reputed manufacturers and make of equipment shall be subject to the approval of BHEL/ BHEL's Customer.

11.0 The modality of approval of technical documentation & priority of supply shall be mutually discussed & agreed upon with successful bidder in kick – off meeting after placement of LOI.

12.0 **Demonstration & Handing over to BHEL / BHEL's Customer**


The bidder shall be responsible for demonstration of the supplied equipment at site to BHEL / BHEL's customer and ensure handing over the same to the satisfaction of BHEL / BHEL's Customer.

Bidders to identify the equipment requiring commissioning by expert(s) from vendor.

The lump sum charges for the same shall be indicated in the price schedule separately, enclosed as "Annexure- B".

13.0 **Performance Guarantee**

The bidder shall guarantee that the equipment offered shall meet the requirement as stipulated in this specification and as confirmed by them in Technical Data Sheet. In case the performance of equipment is not as per performance guarantee, the bidder will have to replace the equipment at site free of cost.

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**ANNEXURE - I**

(VENDOR DRAWING/DOCUMENT SCHEDULE)

S. NO.	DESCRIPTION	THROUGH DMS	HARD PRINTS	CD-ROMs
1	Docs. /drgs. for approval (First submission)	YES	-	-
2	Docs. / drgs. for approval (Second & subsequent submission till approval)	YES	-	-
3	Final approved docs. / drgs. for Distribution	YES	As per NIT	As per NIT

	<b>DESIGN MEMORANDUM FOR ELECTRICAL LAB EQUIPMENT 4 X 270MW BHADRADRI TPS ANNEXURE-II</b>	DOC NO. PE-DC-411-556-E002
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**Annexure-II of SECTION-C**  
**TECHNICAL REQUIREMENTS**

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## 1. Insulation Tester (Megger)

### i. Insulation Tester 5 KV : 2 Nos


Purpose:	For Checking the Insulation level, Polarization index, Di-electric absorption ratio, Step Voltage, di-electric discharge, of HV/EHV Electrical equipments in Switchyard.
Test Voltages:	5 KV DC either continuously or variable in steps of 500/1000/2500/5000 V
Display :	Digital Display
Display information:	Resistance, Voltage, Leakage current.
Mega Ohm Range:	1 TΩ or More
Noise Rejection:	4 mA and software filtering.
Charge Current:	5 mA.
Accuracy :	± 5 %.
Safety Standards:	IEC 61010-1, IEC 60364
EMI/EMC Standards:	IEC 61326-1
Ingress Protection:	IP 54
Interface:	RS 232/USB
Data Storage:	Yes
Power Supply:	240 V, 1 Phase, AC and Rechargeable DC Battery of 4Hrs continuous capacity.
Accessories:	15 M length Test leads set with insulated clips, RS 232/USB cable, Carrying case, software, Instruction manual, Test/Calibration certificates.

### ii. Insulation Tester 2.5 KV : 1 No

Purpose:	For Checking the Insulation level, Polarization index of HV/MV Electrical equipment
Test Voltages:	2.5 KV DC either continuously or variable in steps of 500/1000/2500 V
Display :	Digital or Analogue Display
Display information:	Resistance, Voltage.
Mega Ohm Range:	1 TΩ or More
Accuracy :	± 5 %.
Safety Standards:	IEC 61010-1,
EMI/EMC Standards:	IEC 61326-1
Ingress Protection:	IP 54
Safety Standards:	As per IEC
Power Supply:	240 V,1 Phase ,AC and Rechargeable DC Battery.
Accessories:	Test leads set with insulated clips, Carrying case, Instruction manual, Test/Calibration certificates.

### iii. LV Insulation Tester 1000V : 5 No

Purpose:	For Checking the Insulation level, Polarization index of LV Electrical equipment
Test Voltages:	1000 V DC variable in steps of 500/1000 V

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Display : LCD 3 ½ Digit and/or Analogue.  
 Display information: Resistance, Voltage, Leakage current, capacitance & Battery Status.  
 Mega Ohm Range: 1000 MΩ  
 Accuracy : ± 3%.  
 Safety Standards: As per IEC  
 EMC Standards: IEC 61326-1  
 Power Supply: 240 V, 1 Phase, AC and Hand Crank  
 Accessories: Test Leads, Carrying case, Instruction manual, Test/Calibration certificates.

**iv. LV Insulation Tester 500V : 10 No**


Purpose: For Checking the Insulation level, Polarization index of LV Electrical equipment  
 Test Voltages: 500 V DC variable in steps of 250/500V  
 Display: LCD 3 ½ Digit and/or Analogue.  
 Mega Ohm Range: 500 MΩ  
 Accuracy : ± 3%.  
 Safety Standards: As per IEC  
 EMC Standards: IEC  
 Power Supply: Battery operated or Hand Crank  
 Accessories: Test Leads, Carrying case, Instruction manual, Test/Calibration certificates.

**2. Battery operated Insulation Tester (Megger) : 4 Nos**

Purpose: For Checking the Insulation level, Polarization index of HV & LV Electrical equipment  
 Test Voltages: 1000 V DC variable in steps of 500/1000  
 Display : LCD 3 ½ Digit and/or Analogue.  
 Mega Ohm Range: 500 MΩ or More  
 Accuracy : ± 3%.  
 Safety Standards: IEC 61010-1  
 EMC Standards: IEC  
 Power Supply: 240 V, 1 Phase, AC and Re-chargeable Battery.  
 Accessories: Test Leads, Carrying case, Instruction manual, Test/Calibration certificates.

**3. Mega Ohmmeter 10 KV : 1 No**

Purpose: For Checking the Insulation level, Polarization index, Di-electric absorption ratio, Step Voltage, di-electric discharge, of HV/EHV Electrical equipments in Switchyard.  
 Test Voltages: 10 KV DC either continuously or variable in steps of 500/1000/2500/5000/10000 V  
 Display : Digital/Analogue Back lit Display  
 Display information: Resistance, Voltage, Leakage current & Battery Status.

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Mega Ohm Range:	1 TΩ or More
Noise Rejection:	4 mA and software filtering.
Charge Current:	5 mA.
Accuracy :	± 5 %.
Safety Standards:	IEC 61010-1, IEC 60364
EMI/EMC Standards:	IEC 61326-1
Ingress Protection:	IP 54
Interface:	RS 232/USB
Data Storage:	YES
Power Supply:	240 V, 1 Phase, AC and Rechargeable DC Battery
Accessories:	15 M length Test leads set with insulated clips, RS 232/USB cable, Carrying case, software, Instruction manual, Test/Calibration certificates.

#### 4. Clip on Ammeter :

##### i. Clip on Ammeter (AC): 5 Nos

Purpose:	For carrying out AC/DC Current measurements
Range:	200A/600A (for AC) and DC (Available range)
Accuracy :	±2 % to ±3 %.
Resolution:	0.1A/1A
Voltage test range :	Upto 600V AC/DC.
Resistance Range:	200 Ω .
Power Supply:	Alkaline Battery.
Min.Safety Standards:	IEC 61010-1 and IEC 61010-2-31
Accessories:	Carrying case, Instruction Manual, Battery


##### ii. Clip on ammeter (DC): 2 Nos.

Purpose:	For carrying out AC/DC Current measurements
Measuring Method:	Dual integration Method with true RMS reading.
Measuring Function:	DC Current, AC Current (true RMS)
Display:	3½digit LCD
Display functions:	Min.Hold, Max.Hold and Data Hold.
Range:	AC/DC 200 mA, 2000mA, 10A
Accuracy :	±2 % to ±3 %.
Resolution:	0.1mA/1mA/0.01A
Power Supply	Alkaline Battery.
Min.Safety Standards:	IEC 61010-1 and IEC 61010-2-31.
Accessories:	Carrying case, Instruction Manual, Battery

#### 5. Digital ducter Ohmmeter : 1 No

##### Low resistance digital Ohmmeter (Micro-Ohmmeter)

Purpose:	For carrying out measurements in charged EHV(>400 KV)
Range:	Upto 200 Ohm available starting from 1μΩ.
Accuracy :	±0.2 % to ±0.5 %.
Current test range :	0-10 A.

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Display:	Digital
Safety Standards:	IEC 61010-1
EMI/EMC Standards:	IEC 61326-1
Ingress Protection:	IP 54
Power Supply:	240 V,1 Phase ,AC
Accessories	supplied with built in charger, main leads, Test leads of 15M Length, operating manual, test/calibration certificate, mounted in a light weight portable case with clip on clamps and voltage leads for 4 wire measurement system.

#### 6. Analog Multimeters (AVO Meters): 5 Nos

Purpose:	For carrying out measurements of Electrical parameters (Voltage, Current and Resistance)
1. DC Voltage	0-600 Volts .Accuracy $\pm 2\%$
2. AC Voltage	0-600 Volts. Accuracy $\pm 3\%$
3. DC Current	0-10 Amps Accuracy $\pm 1.5\%$
4. AC Current:	0-10 Amps,. Accuracy $\pm 3\%$
5. Resistance:	0-20 M Ohm, Accuracy $\pm 3\%$
6. Accessories:	The instrument shall be housed in a Bakelite/Standard enclosure having multiple Scale, and supplied with leather carrying case, Probes, Instruction Manual and warranty certificate..

#### 7. AC Milli- ammeter: 2 Nos


Purpose:	For Calibration of Meters and Transducers.
Type:	RMS Measurement, Digital type, Desktop model, 3½ Precision Display.
Range:	0-1 A in multi range with smallest range.
Accuracy :	$\pm 1.5\%$ .
Power Supply:	Battery/AC
Accessories:	Rugged carrying case, Mains leads, Probes, etc.,

#### 8. AC Milli- Voltmeter : 2 Nos

Purpose:	For Calibration of Meters and Transducers.
Type:	RMS Measurement, Digital type, Desktop model, 3½ Precision Display.
Range:	0-250 V in multi range.
Accuracy :	$\pm 0.5\%$ .
Power Supply:	Battery/AC
Accessories:	Rugged carrying case, Mains leads, Probes, etc.

#### 9. Substandard Frequency Meter: 1 No

Purpose:	For Frequency Measurement
Range:	45-55 Hz
Accuracy Class :	$\pm 0.2\%$
Scale Length:	no less than 100 mm.

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Input Voltage: 63.5/120/240/415 V AC  
Accessories: Rugged carrying case, Mains leads, Probes, etc.,

**10. Digital Time Counter: 2 No**

Purpose: intended to use in substation  
Time Range: 0-999.99 Sec  
Resolution: 1 milli second  
Accuracy Class :  $\pm 0.05\%$   
LVD/EMC Standards: CE Marking/Standard  
Supply Voltage: 220 V  $\pm 10\%$  AC/DC  
Trigger: Potential free NO/NC contact or voltage application for start/Stop.  
Accessories: Rugged carrying case, Manual etc.,

**11. High Voltage Discharge rods: upto 39.5 KV : 5 Nos and Upto 420 KV 6 Nos.**


Purpose: For Earthing of Equipments  
Brief Description: Class F insulated, having non-linear carbon film resistor with negative temperature co-efficient, Non Hygroscopic.  
Dimensions:  
a. ID: 25 mm  
b. OD 31 mm  
c. Length: 1250 mm (main rod and each extension)  
d. Total Length: 3.4 Meters (Upto 39.5 KV ) & 5 Meters (Upto 420 KV )  
e. Discharge Hook: 100 mm dia on 12.5 mm dia copper rod.  
f. Earth lead: Flexible braided copper  
g. Voltage rating: up to 420 KV  
h. Accessories: Portable earthing equipment, Line clamps, Insulated operating stick, earth leads etc.,

**12. Portable cable core identification Kit: 2 Nos**

- i. The equipment shall be capable of identifying 16 or more cores in a multicore cable. The display shall be either LED or LCD.
- ii. The instrument will consist of two units namely sender and receiver. The receiver unit shall be protected against in-advertant connection of live terminals.
- iii. The instrument shall be capable of identifying faulted cores.
- iv. Power Supply: Batteries

**13. Phase Sequence indicator: 5Nos**

Purpose: To indicate Phase rotation sequence of 3 phase power circuits and motors.  
Voltage: 50 to 500V (Line to Line)  
Frequency : 25 – 60 Hz.  
Scale Length: no less than 100 mm.  
Accessories: The instrument shall have encapsulated circuitry incorporating neon indicators for phase continuity/phase sequence and shall

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be supplied with carrying case, colour coded and insulated 1 meter long fused leads with clip Probes, Manuals, warranty certificate etc.

**14. Portable recording meters: 2 Nos**

The recording meter shall be of multi speed and direct acting/ transducer interfaced. Chart width of the recorder shall not be less than 100mm. These recorders shall be electric clock wounds

AC Voltage: 0-125 volts  
AC Current: 1 mA to 10 Amps  
Frequency: 45-55 Hz  
Kilowatts: 1-5 amps (of CT secondary), 110 volts, 3 phase and 220 V signal phase  
KVAR: 1-5 amps (of CT secondary), 110 volts, 3 phase and 220 V signal phase  
Accuracy: +/- 2.5% of the full scale.

Single recorder unit with separate transducer units shall also be considered.

**15. Moving Iron Ammeters (0-5A range): 6 Nos**


Purpose: for Current Measurements  
Range: 0-1A and 0-5A (Duel Scale)  
Frequency : 45 – 55 Hz.  
Accuracy: ±1%  
Accessories: The instrument shall be housed in a Bakelite/Standard enclosure and shall be supplied with Rugged carrying case, Probes, Manuals, warranty certificate etc.,

**16. Moving Iron Ammeters (0-100 A range): 6 Nos**

Purpose: for Current Measurements  
Range: 0-10A/25A/50A/100A (Quadruple Scale)  
Frequency : 45 – 55 Hz.  
Accuracy: ±1%  
Accessories: The instrument shall be housed in a Bakelite/Standard enclosure and shall be supplied with Rugged carrying case, Probes, Manuals, warranty certificate etc.

**17. Precision Portable Digital Frequency Meter: 1 No**

Purpose: for Measurement of Frequency and calibration of Frequency Meters  
Range: 0-100 KHz/0-1000Hz.  
Resolution: 1KHz/0.1 Hz.  
Maximum Load: 5mA  
Accuracy: ±0.5% of reading.  
Display: LED Display

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Auxiliary Power Input: 230V,1Ph, 50Hz, AC.

Accessories: The instrument shall be housed in a rugged and shall be supplied with carrying case, Test leads, Battery, Manuals, warranty certificate etc.

**18. Portable Multi range Capacitance meter: 2 Nos**

Range: 0-199.9 pico farads  
0-199.9 Nano Farads  
0-199.9 Micro- farads  
0-1999 Micro farads in Multi range

Accuracy:  $\pm 0.5\%$  upto 200 Micro Farads & 2% or better for higher ranges.

**19. Digital Tachometer (Non-Contact type)(Photoelectric optical): 2 No**

Purpose: for Measuring RPM.  
Features: HOLD/ LOW Battery Indication.  
Type: Non-Contact, Photo Electric Optical  
Range: 10-99999 RPM  
Resolution: 0.1RPM to 999 RPM.  
Accuracy:  $\pm 0.1\%$  to  $\pm 0.15\%$ .  
Display: 5 Digit LED Display  
Optical Range: up to 300 mm  
Auxiliary Power Input: Battery  
Accessories: The instrument shall be supplied with carrying case, Battery, Manuals, warranty certificate etc.

**20. Relay Repair Tool Kit: 3 No**


Comprising following Minimum tools:

- i. Spring Setting Tool
- j. Inspection Mirror and torch
- k. Ring Spanners
- l. Box Spanners
- m. Contact Pressure Guage
- n. Factor Gauges
- o. Test Plugs and link Plugs
- p. Screw drivers
- q. Nose Pliers
- r. Scissors.

**21. Universal Bridge (LCR-Q\_Bridge): 1 No**

Purpose: For measurement of capacitance, inductance, and resistance for precise accuracy by using ac bridges. These bridges are composed of capacitors, inductors, and resistors in a wide variety of combinations. These bridges are operated on the principle of a dc bridge called a WHEATSTONE BRIDGE.

Capacitance : 1pF to 1000 $\mu$ F

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Accuracy :  $\pm 0.3\%$  of the reading or better  
 Resolution : 1 pico farad  
 Inductance :  $1\mu\text{H}$  to 1000H  
 Resolution : 1 micro henry  
 Accuracy :  $\pm 0.3\%$  of the reading or better  
 Resistance :  $0.001\Omega$  to  $1\text{M}\Omega$   
 Resolution : 0.1 milli ohm  
 Accuracy :  $\pm 0.3\%$  of the reading or better  
 Q-Factor : 0 to 10 at 1 kHz  
 Internal Oscillator : 1 kHz  $\pm 5\%$   
 Frequency range for all measurements  
 Internal Oscillator : 1 kHz  $\pm 5\%$   
 Mains Input 240V 50 Hz 1 Phase AC (and)/or Battery operated.

#### 22. Standard Current transformer : 4 Nos

Primary current : 50-1500A in multiple ranges  
 Secondary current : 5A preferably with a duplicate 1A secondary  
 Voltage rating : 1000V /50Hz  
 Class of accuracy :  $\pm 0.2\%$   
 VA burden : 10 VA  
 Suitable for primary conductor threading /terminal connections

#### 23. Standard Potential transformer : 2 Nos


Voltage Grade : 650 V  
 Primary Voltage: 415/240/110 V  
 Secondary Voltage : 110V/63.5V  
 Frequency : 45-55Hz  
 Accuracy Class :  $\pm 0.2$   
 Burden : 10 VA

#### 24. Primary Injection Kit: 1 No

Purpose: For Commissioning application requiring high current injection, fully automatic with display and trolley  
 Input Voltage: 0-240 V, 1 Ph.  
 Output current in Amps: 0- 4000A at 24 KVA  
 No of Ranges: 3 or above  
 Period in Seconds: 0- 999.99  
 Resolution in Seconds: 0.001  
 Accuracy: 0.1% + 2 Digits  
 CTs: Standard class CT's of accuracy 0.5  
 Accessory 10 M length cable

#### 25. Secondary Injection Kits: 3 Nos

Power Supply: 240VAC,50Hz, 1phase

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Output current:	0-5A/10A/100A continuously variable Selector switches provided
AC Voltage Output:	0-240V AC, 180VA
VA Rating (for current circuit):	500VA
Relay operation sensing:	Through NO/NC contacts of relay under test
Range of timer:	0-9999 seconds
Resolution of timer:	0.1 ms in lowest range
Accuracy of timer:	±0.1%of reading
AC voltage output:	0-240 V conti. Variable Continuous operation for 5 minutes in all ranges provided
Metering:	Ammeter (0-5A CT operated, CT Class 1.0) Class 1.5 FS, Analog Display Voltmeter 0-240V Class 1.5 FS, Analog Display Time Interval Meter 0 – 9999Sec Resolution in lowest range 0.1mSec. Digital LED Display
Accessory:	Input Power Cord , Spare Fuses , Neon Indicating Lamps ,Standard length Test Leads
Secondary Injection kits shall have following features:	
1. Auxiliary output for testing directional relays.	
2. Integrated custom timer for testing IDMT relays or Circuit breakers.	
3. Automatic protection against current or thermal overloads.	
4. Digital display of output current or voltage and time.	

#### **26. Single Phase Auto Transformer (Variac) : 10 Nos**

Purpose:	For stepless, breakless & continuous control of AC voltage & therefore for various parameters, dependent on AC voltage.
Input Voltage:	240 V, 1 Ph, 50/60 Hz.
Output Voltage:	0- 240/0-270 V Continuously variable.
Current Rating:	20 A Continuous.
Model Type:	Portable type with sheet steel enclosure for floor / table use.
Standards:	Conforming to IS 5142.
Accessories:	The instrument shall be provided with Mains lead, Manual, Warranty certificate etc.

#### **27. Three Phase Auto Transformer (Variac) : 10 Nos**

Purpose:	For stepless, beakless & continuous control of AC voltage & therefore for various parameters, dependent on AC voltage.
Input Voltage:	415 V, 3Ph, 4 wire, 50/60 Hz.

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Output Voltage:	0- 415/0-470 V Continuously variable.
Current Rating:	15 A Continuous (Minimum).
Model Type:	Portable type with sheet steel enclosure for floor / table use.
Standards:	Conforming to IS 5142.
Accessories:	The instrument shall be provided Mains lead, Manual, Warranty certificate etc.

### 28. Di-Electric Loss Factor Test Set (Tan-Delta Test Kit): 1 No

Input Power Supply:	240V, 50Hz 1 Phase AC
Output Voltage:	0 to 12 K Volts Continuously adjustable
Capacitance range:	0.06 microfarad at 10kV up to 1. 2 $\mu$ F at 2.4 KV ( with CTS-RE )
Display	Backlit LCD Display for indicating Test Status & Test Results
Data storage	Can store up to 70 readings and memory can retain the readings even when instrument is switched off
Interface port	RS 232
Accessories	1.Set of Range Extension Transformer and Reactors to achieve capacitance range up to 0.6 $\mu$ F at 10 KV. 2.Oil Test Cell & Oil Test Cell Heater 3.Mains power Cables and Test Cables 4.Carrying Cases
Calibrator	HV calibrator, 5KV
Bridge:	Self balancing type
Features:	The bridge shall be designed for quick, simple and accurate low voltage capacitance and dissipation factor tests. The equipment shall be complete with accessories to measure sensitivity of insulating oil

### 29. Earth Resistance Tester : 2 Nos

Purpose:	To measure earth electrode resistance and soil resistivity in substation/switchyard having low earth values.
Power Supply	From Batteries.
Earth Test Technique:	2 Pole, 3 Pole and 4 Pole earth measurement Ac.
Earth Resistance:	0-20 /20-200/200-1000/1000-10000 Ohm.
Resolution:	0.01/0.1/1/10 Ohm.
Accuracy:	$\pm$ 5%.
Test Frequency:	Frequency 128 HZ
Test Current	20 mA
Maximum Output voltage	< 50 V (RMS)

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Noise Rejection:	40 V
Display:	3½ Digit Alpha numeric Display
Standards:	IEC
Accessories:	Whether and dust proof case to IP 54, O& M manual, 4 GI Spikes, Hammer, 4 sets of cable on a cable winder, Crocodile clip test wire.

### 30. 100 KV Fully Automatic Oil Breakdown Voltage Test Set : 1No

Purpose:	To test Di-electric strength of Transformer oil
Brief Description	Fully automatic, complete with transportation trolley, oil test vessel with electrodes, PTFE agitator/lift-off sticks, gap gauges, mains cable, Operation manual, calibration certificate, Warranty certificate etc.
Test Voltage	0-100 KV (RMS)
Accuracy:	±3%
Resolution:	0.1 KV
Switch off response current	< 4mA.
Switch off Response time	< 6 mS
Rate of rise of test voltage	0.5/1/2/3/5KV per Sec
Controls	Manual, Automatic, Mains ON/OFF, HT On/Off, Hold, Stirrer ON/Off, Reset Switch
Features:	Fully automatic option to select a) Stand time, b) Stir time, c) rate of rise of voltage, d) No of tests carried out as per standards
Indications:	Door open, Wait time, HT on, KV rise, Stir Time, Stand time, Temperature and BDV.
Beeps	Beeps on Break down and test completion.
Safety features	interlock on HV Test Chamber, Zero Start protection, Double Ground Protection.
Key Pad:	Quick test Selection through Key Pad.
Display	Alpha Numeric Digital display.
Applicable standards:	IEC 156, IS 6792, ASTM D 877, ASTM D1816, BS 5874,
EMI/EMC Standards	IEC

### 31. Power analyser : 1No

Purpose:	for Measurement of Power in Single and three phase Circuits at the same time.
Input Voltage	upto 600 V,AC/DC
Current:	upto 2000 A 0-5 A range shall also be provided for measuring power from CT Secondary.
Frequency range:	45-55 HZ
Accuracy:	±2.5%
Accessories:	The instrument shall be supplied with Rugged carrying case, Probes, Manuals, warranty certificate etc.,

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### 32. High Voltage Testing Kit : 4 Nos

**i. 5kVA (DC) High Voltage testing Kit: 1 No.**

Output: 15KVDC

**ii. 1kVA (DC) High Voltage testing Kit: 1 No.**

Output: 25KVDC

**iii. 150kVA (AC) High Voltage testing Kit: 1 No.**

Output: 0-70 KVAC

**iv. 10kVA (AC) High Voltage testing Kit: 1 No.**

Output: 0-25 KVAC

Duty cycle of all the High Voltage Kits shall be 15 Min ON & 15 Min OFF.

Input voltage 220V/230V, 50 Hz, single phase

Brief Description: The HV transformer shall be either dry type or hermetically sealed liquid filled type. The equipment shall be portable roller / trolley mounted shall be protected against short-circuits and overloads. A control desk incorporating all necessary indication, annunciation, protection and control equipment shall be provided. It shall be possible to switch on the high voltage only when the control setting is at the minimum. The instrument shall be provided with accurate indications of high voltage and the leakage current. Discharge rods and supplied along with the instrument. Any other essential accessory may be quoted separately.

### 33. DC Earth Fault locator : 2 Nos

Frequency of injected signal upto 20 Hz (lesser than specified value) to avoid interference with the DC ripples.

Open circuit signal strength not more than 15 volts (RMS)

Receiver sensitivity: 25 kilo ohms fault resistance


Frequency Resolution: 1 Hz

Frequency Accuracy:  $\pm 0.1\%$  of full scale

It shall be capable of detecting earth faults where fault resistance is as high as 25-kilo ohms. The instrument shall operate by injecting a low frequency. Low voltage signal to the DC system

### 34. Portable Digital Multimeters : 10No

Purpose:	For Measurement of Electrical parameters.
Functions:	SELECT, RANGE, HOLD/LIGHT, REL, HZ, MAX/MIN
Display	6000 Count LCD display with white backlit.
Power Supply	Alkaline Batteries, with low battery indication and auto power off function.
Protection:	Fuse Protection for mA and A input terminals.
Accessories	Pair of Test leads, User Manual, calibration certificate, Warranty certificate Battery, Fuses and Carrying Bag.

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**Measurements:**


- |                           |  |
|---------------------------|--|
| 1. DC Voltage             | <b>mV Range:</b> 60/600 mV, 0.01/0.1 mV resolution, ±1% Accuracy.<br><b>V Range:</b> 6/60/600/1000V, 0.1/0.1/10/100/1000mV resolution, ±1% Accuracy. |
| 2. DC Current             | <b>Range:</b> 60mA/600mA/6A/20A, 0.01/0.1/1/10 mA Resolution, ±1.2 % Accuracy.   |
| 3. AC Voltage             | <b>mV Range:</b> 60/600 mV, 0.01/0.1 mV resolution, ±2% Accuracy.<br><b>Voltage Range:</b> 6/60/600/750V, 0.1/10/100/1000mV resolution, 2% Accuracy. |
| 4. AC Current             | <b>Range:</b> 60mA/600mA/6A/20A, 0.01/0.1/1/10 mA resolution, ±2 % Accuracy.   |
| 5. Resistance             | <b>Range:</b> 600 Ω/6KΩ/60KΩ /600KΩ/6MΩ/60MΩ, 0.1 Ω/1Ω/10Ω/100Ω/1KΩ /10KΩ resolution, ±3 % Accuracy.   |
| 6. Capacitance            | Auto <b>Range</b>  |
| 7. Frequency              | Auto <b>Range</b>  |
| 8. Diode Test             | <b>Range:</b> 6V, 1mV resolution, Test current < 1mA.  |
| 9. Continuity Test        | <b>Range:</b> 600 Ω, 0.1Ω resolution, Beeps < 60 Ω .   |
| 10. Applicable standards: | CE & IEC 61010-1, IP54   |
| 11. EMI/EMC Standards     | EMC 2004/104/EC  |

**35. Portable Three phase substandard wattmeter : 6 Nos**

Voltage Range: 110/240/440 Volts  
Current Range: 1/5 Amps  
Power factor: 1.0 (Unity)  
Accuracy: 0.5% of full scale  
Frequency : 45Hz to 55 Hz  
with carrying case and connecting wires / leads

**36. DC Milli Ammeter : 2Nos**

Purpose: for Current Measurements  
Range: 0- 300 mA.  
Resolution: 0.5%.  
Accuracy: ±1% of Full Scale  
Type: Table Mounted, Digital Type, 3½Digit Precision LCD Display.  
Accessories: The instrument shall be supplied with Rugged carrying case, Probes, Manuals, warranty certificate etc.,

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**37. DC Milli Voltmeter : 2Nos**

Purpose: for Voltage Measurements  
Range: 0- 500V AC & DC in Multi range and shall have one range to measure mV.  
Accuracy:  $\pm 1\%$  of Full Scale  
Type: Table Mounted, Digital Type,  $3\frac{1}{2}$ Digit Precision LCD Display, RMS measurement.  
Accessories: The instrument shall be supplied with Rugged carrying case, Probes, Manuals, warranty certificate etc.,

**38. DC Moving Coil Micro-Ammeter : 1No**

Purpose: for Current Measurements  
Range: 0- 500  $\mu$ A and 0-1 mA ( Dual Scale)  
Accuracy:  $\pm 1\%$   
Accessories: The instrument shall be housed in a Bakelite/Standard enclosure and shall be supplied with Rugged carrying case, Probes, Manuals, warranty certificate etc.,

**39. DC Moving Coil Milli Ammeter : 1No**


Purpose: for Current Measurements  
Range: 0- 500 mA and 0-1000 mA ( Dual Scale)  
Accuracy:  $\pm 1\%$   
Accessories: The instrument shall be housed in a Bakelite /Standard enclosure and shall be supplied with Rugged carrying case, Probes, Manuals, warranty certificate etc.

**40. Portable Light Intensity Meter (Lux Meter) : 1No**

Purpose: for measuring Lux level.  
Range: 0-3000 Lux in multiple ranges.  
Accuracy:  $\pm 5\%$  of reading.  
Accessories: The instrument shall be supplied with Rugged carrying case, Selenium Photo cell, leads of sufficient length, Manuals, warranty certificate etc.

**41. AC Voltage/Current Source : 1No**

Purpose: for calibration of meters/ electrical instruments.  
Input Power: 230 V, 50 Hz, 1 Phase  
Voltage Ranges: 200mV, 2V, 20V, 200V, 1000V  
Load: 10mA  
Current Range: 20mA, 200mA, 2A, 20A, 50A  
Burden: 50VA  
Frequency Range: 45 to 55 HZ  
Accuracy:  $\pm 1\%$  of Setting.  
Accessories: The instrument shall be of Table Mounted type and shall be supplied with Rugged carrying case, test leads, Manuals, warranty certificate etc.,

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**42. Portable Hand Held infra-red Temperature Scanner: : 1No**

Purpose:	for precision measurement of Temperature.
Features:	<ul style="list-style-type: none"> <li>i. Voice recording and alarm facility</li> <li>ii. Double Ocular View finder and clear CCD Lens.</li> <li>iii. Multi Spot (Min 4) Temperature measurement.</li> <li>ii. High end image analysis software</li> <li>iii. Generation of report and trend analysis.</li> <li>iv. Alarm on Screen if Temp crosses set Temp.</li> </ul>
Range:	10 °C to 1000°C in multiple ranges.
Detector Type:	Uncooled Focal Plane Array.
Thermal Sensitivity:	0.08°C @ 30°C.
Frame Rate:	50 Hz
Field of View:	20" X 20" Spectral
Response:	8 to 14 Microns
Ambient Temperature:	0-50 Deg C.
Battery Operation:	at least for two hours.
Accuracy:	±4% of reading.
Accessories:	The instrument shall be supplied with Rugged carrying case, Battery, Soft ware, Manuals, warranty certificate etc.

**43. Portable reference meter and Phantom Load test set: 1 set**

Solid state portable reference meter suitable for calibration of commercial grade energy meters (both active and reactive). Accuracy class of commercial grade energy meter shall be 0.5% or better.

Accuracy class of the reference meter.

- Active 0.2% or better.
- Reactive 0.2% or better

Range of current : 10 mA to 10 A direct, 50 mA to 100 A


Range of test voltage : Star connected 50-280 volts.

Delta-connected 90-490 volts

Suitable for single phase - 2 wire and 3-phase - 3 & 4 wires. At the time of calibration of the energy meters, it should be possible to read the following:

- Test Voltage
- Test Current
- Power

The portable reference meter must be furnished with compatible single phase /three phase phantom load test set of up to 10 Ampere rating with phase shift of -30° lead to +120° lag in suitable steps along with necessary accessories and carrying case. Power supply of Single phase 240 V and 110 / 440 V, 3 phase shall be used for the phantom load test set.

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#### 44. Transformer Turns ratio Tester : 1No


Purpose:	To test Turns ratio, Phase deviation, excitation current of 1 Phase and Three phase Power/Instrument Transformers and shall be suitable to use in places having EHV interference.
Brief Description:	Fully automatic, Micro-processor based, with local digital display complete with transportation case, Operation manual, calibration certificate, Warranty certificate etc.
Ratio Range	0.8:1 to 1000:1
Excitation Voltage	8V, 40 V and 80 V
Excitation current:	0-500 mA with accuracy of $\pm 2\%$ of the reading.
Single Phase Test	Yes
Automatic Three Phase test	Yes
Vector Group	Yes
Display	8.4 " VGA Display.
Ratio accuracy:	$\pm 0.1\%$ to $\pm 0.3\%$ .
Safety/EMC/Vibration	
Standards:	IEC 1010-1, CE& ASTM D999.75
Interface:	RS 232/USB
Ingress Protection:	IP 65
Data Storage	>10000
Power Source:	230 V ,1 Phase, AC, 45-55 HZ.
Data Displayed:	Vector Group, Phase, Tap Position, Ratio, Ratio Deviation, % error V/s Name plate with pass/fail indication.
Accessories:	HV/LV cables, Mains lead, clamps, 15M test leads, Full version Software etc.

#### 45. Three Phase Shifter: 1 No

Power Supply (Input Voltage):	415, 50Hz
Output Voltage:	Same as input voltage $\pm 3\%$
Phase Shift:	0 to $\pm 180^\circ$ or 0 to $360^\circ$
VA Rating:	500VA

#### 46. Kelvin Double Bridge: 2 Nos

Resistance range:	0.02 micro ohm – 1.1 ohm
Resolution	0.02 micro ohm
Accuracy	$\pm 0.5\%$ of reading or $\pm 1$ slide wire division whichever is greater
Maximum test current	25 A
Power supply for DC Source:	1 Phase, 240 V AC.

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#### 47. Portable Protective Relay Test Kit (4 Voltages and 6 currents): 1 Nos

**Purpose:** For testing various types of electromechanical, static and numerical/microprocessor based protective relays, MCCBs etc.

Brief Description: Microprocessor-based user-friendly with digital signal processing. Having large LCD display with programmable menu. Having programmable output current & voltage waveforms and phase angles. Having following additional features and specifications:

Input Power	: 90-250V, 1 Ph, 50 Hz
Outputs	: One ac Current 0-100A
One ac Voltage	: 0-300V
One ac Voltage/Current	: 0-240V/0-2.5A
Output Frequency	: Selectable from 16.66 Hz – 300 Hz
Output ac Voltage	: 0-360 deg. independently controlled
Phase shift	
Reading Accuracy	: ±1% for AC/DC Volts, Current ±0.5 deg. In phase angle ±0.02% in power factor ±1.5% in active/reactive power ±0.005% in time
Memory	: Nonvolatile RAM
Interface	: RS port for PC and parallel printer port

#### 48. Digital Sound Level Meter: 1No

Purpose: For measuring Sound level


Brief Description: Having condenser type microphone, frequency and time weighting functions, AC & DC outputs supplied with 9V battery and calibration screw driver.

#### 49. AC Cable Fault Locator (upto 11kV): 1No

Purpose: For locating cable fault

Brief Description: Working on pulse reflection (echo) technique. Capable of discriminating between inter-core and core to earth fault with facility to detect high resistance faults (>10 ohms) complete with surge generator, acoustic receiver, input filters, head phones etc.

Input	: 240V, 1 phase, 50 Hz
Range	: 10 nano sec. To 2000 ns
Impedance range	: 25 ohms to 100 ohms
Surge Generator	: 15KV, 100 mA, <512 joules,
Capacity	: 10-20 pulses per minute
Display	: Backlit LCD

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**50. Portable Hand held Hydrogen Gas Leakage Detector: 1 No**

Purpose: For detection of TP Hydrogen gas leakage

With audio visual indication

Sensitivity : 50 to 100 ppm

**51. Portable Circuit Breaker Motion Analyser: 1 No**

Purpose: Measuring opening & closing time of circuit breaker

Brief Description: For analyzing performance of SF6/Vacuum/air Circuit breakers. Microprocessor-based capable of measuring, recording and printing opening/closing times and velocity, coil currents, dynamic contact resistance of main/aux. & arcing contacts, pole discrepancy etc. The instrument shall have user-friendly menu driven software for easy operation and reduced set up time. It shall have communication ports for down loading of data from memory on to a PC. It should have a built-in DC battery and printer.

Other specifications shall be as follows:

Input Supply : 110-240V, 50Hz with built in DC battery backup with charger

Current injection : up to 100A DC

Timing Range : 0-9.99 S. with a resolution of 0.1 ms and accuracy of  $\pm 0.01\%$

Number of channels : 12 analog 24 digital

Display : 16 character alphanumeric LCD

**52. DIGITAL STROBOSCOPE: 1 No**

Purpose: RPM Measurement, inspection & observation of rotating parts.

Input Supply : 110-240V, 50Hz

RPM : 100 – 10000

Display : LCD or LED

Accuracy : 0.1%

**4 X 270 MW MANUGURU TPS**  
**PACKAGE- ELECTRICAL TESTING LAB EQUIPMENT**

**BOQ-CUM PRICE SCHEDULE (ANNEXURE-A)**

S.NO.	ITEM DESCRIPTION	QTY	Unit	UNIT RATE (Rs.)	TOTAL PRICE (Rs.)
1	Insulation Tester (Megger):				
	i.    Insulation Tester 5 KV	2	No.		
	ii.   Insulation Tester 2.5 KV	1	No.		
	iii.  LV Insulation Tester 1000V	5	No.		
	iv.   LV Insulation Tester 500V	10	No.		
2	Battery operated Insulation Tester (Megger)	4	No.		
3	Mega Ohmmeter 10 KV	1	No.		
4	Clip on Ammeter :				
	i.    Clip on Ammeter (AC)	5	No.		
	ii.   Clip on ammeter (DC)	2	No.		
5	Digital ducer Ohmmeter	1	No.		
6	Analog Multimeters (AVO Meters)	5	No.		
7	AC Milli- ammeter	2	No.		
8	AC Milli- Voltmeter	2	No.		
9	Substandard Frequency Meter	1	No.		
10	Digital Time Counter	2	No.		
11	High Voltage Discharge rods:				
	upto 39.5 KV	5	No.		
	and Upto 420 KV	6	No.		
12	Portable cable core identification Kit	2	No.		
13	Phase Sequence indicator	5	No.		
14	Portable recording meters	2	No.		
15	Moving Iron Ammeters (0-5A range)	6	No.		
16	Moving Iron Ammeters (0-100 A range)	6	No.		
17	Precision Portable Digital Frequency Meter	1	No.		
18	Portable Multi range Capacitance meter	2	No.		
19	Digital Tachometer (Non-Contact type)(Photoelectric optical)	2	No.		
20	Relay Repair Tool Kit:	3	No.		
21	Universal Bridge (LCR-Q_Bridge)	1	No.		
22	Standard Current transformer (50-1500 A)	4	No.		
23	Standard Potential transformer	2	No.		
24	Primary Injection Kit	1	No.		
25	Secondary Injection Kits	3	No.		
26	Single Phase Auto Transformer (Variac)	10	No.		
27	Three Phase Auto Transformer (Variac)	10	No.		
28	Di-Electric Loss Factor Test Set (Tan-Delta Test Kit)	1	No.		
29	Earth Resistance Tester	2	No.		

30	100 KV Fully Automatic Oil Breakdown Voltage Test Set	1	No.			
31	Power Analyser	1	No.			
32	High Voltage Testing Kit :					
	i. 5kVA (DC) High Voltage testing Kit	1	No.			
	ii. 1kVA (DC) High Voltage testing Kit	1	No.			
	iii. 150 kVA (AC) High Voltage testing Kit	1	No.			
	iv. 10 kVA (AC) High Voltage testing Kit	1	No.			
33	DC Earth Fault locator	2	No.			
34	Portable Digital Multimeters	10	No.			
35	Portable Three phase substandard wattmeter	6	No.			
36	DC Milli Ammeter	2	No.			
37	DC Milli Voltmeter (0-500 V)	2	No.			
38	DC Moving Coil Micro-Ammeter	1	No.			
39	DC Moving Coil Milli Ammeter	1	No.			
40	Portable Light Intensity Meter (Lux Meter)	1	No.			
41	AC Voltage/Current Source	1	No.			
42	Portable Hand Held infra-red Temperature Scanner	1	No.			
43	Portable reference meter and Phantom Load test set	1	set			
44	Transformer Turns ratio Tester	1	No.			
45	Three Phase Shifter	1	No.			
46	Kelvin Double Bridge	2	No.			
47	Portable Protective Relay Test Kit (4 Voltages and 6 currents)	1	No.			
48	Digital Sound Level Meter	1	No.			
49	AC Cable Fault Locator (upto 11kV)	1	No.			
50	Portable Hand held Hydrogen Gas Leakage Detector	1	No.			
51	Portable Circuit Breaker Motion Analyser	1	No.			
52	DIGITAL STROBOSCOPE	1	No.			

**NOTE :-**

- 1) EQUIPMENT TO BE SUPPLIED ALONG WITH ESSENTIAL ACCESSORIES FOR SUCCESSFUL OPERATION OF EQUIPMENT AT SITE .i.e. CLAMPS, CLIPS,LEADS ,CARRYING CASE etc.
- 2) ALL EQUIPMENTS SHALL BE SUPPLIED WITH VALID CALIBRATION CERTIFICATE, WHEREVER APPLICABLE.
- 3) IN ADDITION TO NORMAL PACKING OF THE EQUIPMENTS, THE EQUIPMENTS TO BE PROPERLY PACKED IN GALVANIZED SHEET STEEL TRUNK/BOX WITH PROPER LOCK & KEY A



4X270 MW BHADRADRI TPS

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## TECHNICAL SPECIFICATION FOR ELECTRICAL LABORATORY EQUIPMENTS

SECTION

Rev. : 00

**DATA SHEET-B**

ITEM No.	ITEM DESCRIPTION	QTY. (no.)	MAKE	MODEL No	COUNTRY OF MANUFACTURE	EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO)	ADDITIONAL ACCESSORIES RECOMMENDED	REMARKS
1	Insulation Tester (Megger):							
	i. Insulation Tester 5 KV	2						
	ii. Insulation Tester 2.5 KV	1						
	iii. LV Insulation Tester 1000V	5						
	iv. LV Insulation Tester 500V	10						
2	Battery operated Insulation Tester (Megger)	4						
3	Mega Ohmmeter 10 KV	1						
4	Clip on Ammeter :							
	i. Clip on Ammeter (AC)	5						
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5	Digital duxter Ohmmeter	1						
6	Analog Multimeters (AVO Meters)	5						
7	AC Milli- ammeter	2						
8	AC Milli- Voltmeter	2						
9	Substandard Frequency Meter	1						
10	Digital Time Counter	2						
11	High Voltage Discharge rods:							
	upto 39.5 KV	5						
	and Upto 420 KV	6						
12	Portable cable core identification Kit	2						



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13	Phase Sequence indicator	5						
14	Portable recording meters	2						
15	Moving Iron Ammeters (0-5A range)	6						
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26	Single Phase Auto Transformer (Variac)	10						
27	Three Phase Auto Transformer (Variac)	10						
28	Di-Electric Loss Factor Test Set (Tan-Delta Test Kit)	1						
29	Earth Resistance Tester	2						
30	100 KV Fully Automatic Oil Breakdown Voltage Test Set	1						
31	Power Analyser	1						



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32	High Voltage Testing Kit :							
	i. 5kVA (DC) High Voltage testing Kit	1						
	ii. 1kVA (DC) High Voltage testing Kit	1						
	iii. 150 kVA (AC) High Voltage testing Kit	1						
	iv. 10 kVA (AC) High Voltage testing Kit	1						
33	DC Earth Fault locator	2						
34	Portable Digital Multimeters	10						
35	Portable Three phase substandard wattmeter	6						
36	DC Milli Ammeter	2						
37	DC Milli Voltmeter (0-500 V)	2						
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43	Portable reference meter and Phantom Load test set	1						
44	Transformer Turns ratio Tester	1						
45	Three Phase Shifter	1						



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46	Kelvin Double Bridge	2						
47	Portable Protective Relay Test Kit (4 Voltages and 6 currents)	1						
48	Digital Sound Level Meter	1						
49	AC Cable Fault Locator (upto 11kV)	1						
50	Portable Hand held Hydrogen Gas Leakage Detector	1						
51	Portable Circuit Breaker Motion Analyser	1						
52	DIGITAL STROBOSCOPE	1						

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