

1 X 370 MW YELAHANKA CCPP

VOLUME IIB

**TECHNICAL SPECIFICATION FOR
ELECTRICAL LABORATORY EQUIPMENTS
SPECIFICATION NO.: PE-TS-409-556-E002**



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

	DOCUMENT TITLE TECHNICAL SPECIFICATION FOR ELECTRICAL LABORATORY EQUIPMENTS 1 X 370 MW YELAHANKA CCPP	SPECIFICATION NO. PE-TS-409-556-E002	
		VOLUME II B	
		SECTION	
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SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

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COMPLIANCE CERTIFICATE

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.
2. There are no deviation with respect to specification other than those furnished in the 'schedule of deviations'
3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
4. 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.
5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in Annexure-A [BOQ-Cum-Price schedule] of the specification shall not be considered (i.e., technical description & quantities as per specification shall prevail).
6. All essential accessories for each electrical laboratory equipment required for testing various electrical equipment /devices during Commissioning, Operation and Maintenance of power plant to be ensured by bidder in their offer.

BIDDER'S STAMP & SIGNATURE

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1.0 SCOPE

- 1.1 Design, manufacture, inspection and testing at manufacturer's work, proper packing and delivery to site of Electrical Laboratory Equipment as mentioned in different sections of this specification.
- 1.2 General technical requirements of the Electrical Laboratory Equipment are indicated in Section – II. Project specific technical requirements/changes are listed in section-I.
- 1.3 Electrical Laboratory Equipment shall be supplied along with all essential accessories required for the successful operation of the equipment.
- 1.4 Detailed technical parameters of Electrical laboratory equipment are listed in Annexure – I of Section-I.

2.0 BILL OF QUANTITIES

Quantity requirement shall be as per 'BOQ cum price schedule' enclosed in NIT.

3.0 SPECIFIC TECHNICAL REQUIREMENT

Sr. No.	Reference Clause No. of Section-II (if any)	Specific Requirement/Change
1)	Clause 1.10 of section II	List of equipments shall be as per Annexure – I of Section-I

4.0 DRAWING & DOCUMENTS TO BE SUBMITTED

4.1 Following documents/drawings for each Electrical Laboratory Equipment shall be submitted after placement of order for BHEL & customer's approval in addition to the documents/drawings listed in clause No. 8.2 of section-II:

Sl. No.	Drawings/Document description	Drawings/Document Number
1	Technical Data Sheet	PE-V0-409-556-E001
2	Catalogue	PE-V0-409-556-E002

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ANNEXURE-I OF SECTION – I

DETAILED TECHNICAL PARAMETERS

1. LV Insulation Tester 1000V : 5 No

Test Voltages: 1000 V DC variable in steps of 500/1000 V
 Display : LCD 3 ½ Digit
 Mega Ohm Range: 1000 MΩ
 Accuracy : ± (3 % + 5 digit)

2. Mega Ohmmeter 10 KV : 1 No

Test Voltages: 10 KV DC either continuously or variable in steps of 500/1000/2500/5000/10000 V
 Mega Ohm Range: 1 TΩ or More
 Accuracy : ± (5 % + 5 digit)

3. Clip on ammeter (DC): 2 Nos.

Display: 3½digit LCD
 Range: upto 10A
 Accuracy: ±2 % to ±3 %
 Resolution: 0.01A

4. AC Milli- ammeter: 2 Nos

Type: Digital type
 Range: 0-1 A in multi range with smallest range.
 Accuracy: ±1.5%

5. AC Milli- Voltmeter : 2 Nos

Type: RMS Measurement, Digital type, Desktop model, 3½ Precision Display.
 Range: 0-20 V in multi range.
 Accuracy : ±0.5 %.

6. Substandard Frequency Meter: 1 No

Range: 45-55 Hz
 Accuracy Class : ±0.2 %
 Scale Length: no less than 100 mm.
 Input Voltage: 63.5/120/240/415 V AC

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7. High Voltage Discharge rods (Upto 230 KV) :6 Nos.

- a. Length: 1250 mm (main rod and each extension)
- b. Voltage rating: up to 230 kV, class F insulated
- c. Total length: 5 m (upto 230kV)

8. 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.

9. Precision Portable Digital Frequency Meter: 1 No

- Range: 0-100 KHz/0-1000Hz.
- Accuracy: $\pm 0.5\%$ of reading.
- Display: LED Display
- Resolution: 1 KHz/0.1 Hz.
- Auxiliary Power Input: 230V, 1Ph, 50Hz, AC.

10. Digital Tachometer (Non-Contact type) (Photoelectric optical): 2 Nos

- 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: LCD Display

11. Relay Repair Tool Kit: 3 Nos

Comprising following Minimum tools:



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- i. Spring Setting Tool
- ii. Inspection Mirror and torch
- iii. Ring Spanners
- iv. Box Spanners
- v. Contact Pressure Guage
- vi. Factor Gauges
- vii. Test Plugs and link Plugs
- viii. Screw drivers
- ix. Nose Pliers
- x. Scissors.

12.Universal Bridge (LCR-Bridge): 1 No

Capacitance : 1pF to 1000 μ F
Accuracy : $\pm 0.3\%$ of the reading or better
Resolution : 1 pico farad
Inductance : 1 μ H to 1000H
Resolution : 1 micro henry
Accuracy : $\pm 0.3\%$ of the reading or better
Resistance : 0.001 Ω to 1M Ω
Resolution : 1 milli ohm
Accuracy : $\pm 0.3\%$ of the reading or better
Q-Factor : 0 to 10 at 1 kHz
Mains Input 240V 50 Hz 1 Phase AC (and)/or Battery operated.

13.Standard Current transformer : 4 Nos

Primary current : 50-1500A in multiple ranges
Secondary current : 5A
Voltage rating : 1000V /50Hz
Class of accuracy : +/- 0.2%

14. Three Phase Auto Transformer (Variac) : 10 Nos

Input Voltage: 415 V, 3Ph, 4 wire, 50/60 Hz.
Output Voltage: 0- 415/0-470 V Continuously variable.
Current Rating: 15 A Continuous (Minimum).

15. Earth Resistance Tester: 2 Nos

Earth Resistance: 0-20 /20-200/200-1000/1000-10000 Ohm.
Resolution: 0.01/0.1/1/10 Ohm.
Accuracy: $\pm(5\%+5\text{digit})$

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Accuracy: $\pm(5\%+5\text{digit})$
 Display: $3\frac{1}{2}$ Digit Alpha numeric Display
 Test Current 20 mA
 Maximum Output voltage < 50 V (RMS)

16.100 KV Fully Automatic Oil Breakdown Voltage Test Set: 1No

Test Voltage 0-100 KV (RMS)
 Accuracy: $\pm 3\%$
 Resolution: 0.1 KV
 Display Alpha Numeric Digital display.

17.Clamp on Wattmeter: 1No

Input Voltage: up to 600 V, AC/DC
 Current: up to 2000 A,
 0-1 A and 0-5 A range shall be provided for measuring
 power from CT Secondary.
 Frequency range: 45-55 HZ
 Accuracy: $\pm 1.5\%$

18. 5kVA (DC) High Voltage Testing Kit: 1 No

Output: 15KV DC
 Duty cycle of all the High Voltage Kits shall be 15 Min ON & 15 Min OFF.
 Input voltage 220V/230V, 50 Hz, single phase.

19.Portable Digital Multimeters : 10No

- DC Voltage **mV Range:** 60/600 mV,
 $\pm 2\%$ Accuracy.
V Range: 6/60/600/1000V, $\pm 1\%$ Accuracy.
- DC Current **Range:** 60mA/600mA/6A/20A,
 $\pm 2\%$ Accuracy.
- AC Voltage **mV Range:** 60/600 mV,
 $\pm 2\%$ Accuracy.
Voltage Range: 6/60/600/750V, $\pm 2\%$ Accuracy.
- AC Current **Range:** 60mA/600mA/6A/20A,
 $\pm 2\%$ Accuracy.
- Resistance **Range:** 600 Ω /6K Ω /60K Ω /600K Ω /6M Ω /60M Ω ,
 $\pm 3\%$ Accuracy.

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20. 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

21. DC Milli Ammeter: 2Nos

Range: 0- 300 mA.

Accuracy: $\pm 1\%$ of Full Scale

Type: Digital

22.DC Milli Voltmeter: 2Nos

Range: 0- 50V AC & DC in Multi range

Accuracy: $\pm 1\%$ of Full Scale

Type: Digital

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

Range: 10 $^{\circ}\text{C}$ to 999 $^{\circ}\text{C}$ in multiple ranges.

Response: 8 to 14 Microns

Ambient Temperature: 0-50 Deg C

Field of View: 20" X 20" Spectral

Accuracy: $\pm 4\%$ of reading

24.Portable reference meter and Phantom Load test set: 1 set

Portable reference meter: 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

Phantom load test set : Three phase load test set

Current rating: 1 A / 5 A/ 10 A

Phase shift: 0 to ± 180 Deg

Power supply: 110/440V, 3Ph

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25.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 ± 1 slide wire division whichever is greater
Power supply for DC Source: 1 Phase, 240 V AC.

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SECTION-II

STANDARD TECHNICAL SPECIFICATION

1.0 TECHNICAL REQUIREMENTS

- 1.1 Basic technical requirements for Electrical Lab Equipment shall be as indicated in this section, in addition to technical requirements specified in Section-I.
- 1.2 The intent of specification is not 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.
- 1.3 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.
- 1.4 The instrument shall be suitable for satisfactory operation at an ambient temperature from 0°C to 50°C
- 1.5 The Analog instruments shall be provided with knife-edge pointer and anti – parallax mirror.
- 1.6 Instrument/ meters suitable for DC supply should be provided with re-chargeable batteries, chargers and low battery charge indication.
- 1.7 The Bidder to quote only ‘one’ make/model against each equipment best to suit specification requirement.
- 1.8 The instrument shall be suitable for hand held operation, rugged in construction and suitable for field use.
- 1.9 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.
- 1.10 Standard list of Electrical Lab Equipment as per CEA guidelines is enclosed as per Annexure-III of Section –II. This list of Equipment shall be applicable only if Annexure-I of Section-I is not defined.

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- 1.11 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.

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 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 TESTS:

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- 4.1 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.
- 4.2 Equipment shall be completely assembled, wired, adjusted and tested in factory as per the latest edition of relevant standards.
- 4.3 Bidder shall follow his standard procedure for quality control. However the said procedure/ quality checks shall be submitted for purchaser's approval.

5.0 PACKING:

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

6.0 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 charges for the same has been fixed as per Annexure- I of Section-II.

7.0 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.

8.0 DRAWING DATA & MANUAL

8.1 To be submitted with the bid as technical offer:

- Compliance to Technical parameters of various equipment as specified in Annexure-I of Section-I in Data Sheet – B (as enclosed).
- Technical leaflets/ Catalogues/Product Manual of the Equipment

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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.

8.2 To be submitted after award of contract for BHEL/customer approval:

- a) General arrangement drawing showing constructional features, accessories, connections, range and rating, mounting arrangement, space requirement etc.
- b) Detail instructions for application, assembly & testing of equipment.
- c) Wiring and schematic diagrams (if applicable).
- d) Tests Reports and calibration curve
- e) Instruction manual/ O&M manual of individual equipment

8.3 Instruction manual/O&M 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.

8.4 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.

8.5 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.

8.6 Test certificates/ Test reports shall be furnished by bidder to BHEL at contract stage for review/acceptance. BHEL/BHEL's customer may witness the testing of equipment (if required). For imported Electrical Lab Equipment only test certificates shall be submitted.

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ANNEXURE-I OF SECTION – II

DEMONSTRATION & HANDING OVER CHARGES

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**SCHEDULE OF PRICES FOR DEMONSTRATION & HANDING OVER TO
BHEL / BHEL'S CUSTOMER**

SL. NO.	DETAILS	ACTIVITY	UNIT CHARGES
1	LUMP SUM ALL INCLUSIVE CHARGES PER VISIT FOR EXPERIENCED / CAPABLE ENGINEER (EXCEPT DAILY CHARGES)	1 VISIT	20000/-
2	LUMP SUM ALL INCLUSIVE CHARGES FOR EXPERIENCED / CAPABLE ENGINEER PER DAY	1 DAY	5000/-

Note:

- TOTAL CHARGES = (Charges as per S.No.1) + [No. of Days(*) x Unit Charges as per Sl. No. 2]
- Bidder to note that provision of maximum 3 visits amounting to total 9 man days is envisaged for respective bidders.

*: To be certified by BHEL site

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ANNEXURE-II OF SECTION – II

DATA SHEET-B

1X370 MW YELAHANKA								
TECHNICAL SPECIFICATION FOR ELECTRICAL LABORATORY EQUIPMENTS								
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DATA SHEET-B (Annexure-II of Section-II)								
NOTE :-								
1) EQUIPMENT TO BE SUPPLIED ALONG WITH ESSNTIAL 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 APLICABLE.								
3) All equipment shall be properly packed in Galvanized sheet steel trunk/ box with proper lock & key arrangement except for equipment which are trolley mounted or are already available in rugged steel/wooden box packing. Further, any damage (reading error/calibration error/broken parts/missing parts etc) found on receipt at site, leading to replacement of parts/whole item, shall be to bidder's account								
Item description	Whether Quoted or not (Yes/No)	Make	Model no	Country of Manufacture	Authorizatio n letter (attached or not)	Bidder to indicate the parameters of offered model against each parameter mentioned in the tender specification so that it can be concluded that offered model is meeting all requiremnets as specified in technical specification	Catalogue (attached or not)	Remarks
1. LV Insulation Tester 1000V : 5 No								
Test Voltages:1000 V DC variable in steps of 500/1000 V								
Display : LCD 3 ½ Digit								
Mega Ohm Range: 1000 MΩ								
Accuracy : ± (3 % + 5 digit)								
2. Mega Ohmmeter 10 KV : 1 No								
Test Voltages: 10 KV DC either continuously or variable in steps of 500/1000/2500/5000/10000 V								
Mega Ohm Range: 1 TΩ or More								
Accuracy : ± (5 % + 5 digit)								
3. Clip on ammeter (DC): 2 Nos.								
Display: 3½digit LCD								
Range: upto 10A								
Accuracy: ±2 % to ±3 %								
Resolution: 0.01A								

Item description	Whether Quoted or not (Yes/No)	Make	Model no	Country of Manufacture	Authorization letter (attached or not)	Bidder to indicate the parameters of offered model against each parameter mentioned in the tender specification so that it can be concluded that offered model is meeting all requirements as specified in technical specification	Catalogue (attached or not)	Remarks
4. AC Milli- ammeter: 2 Nos								
Type: Digital type								
Range: 0-1 A in multi range with smallest range.								
Accuracy: $\pm 1.5\%$								
1. AC Milli- Voltmeter : 2 Nos								
Type: RMS Measurement, Digital type, Desktop model, 3½ Precision Display.								
Range: 0-20 V in multi range.								
Accuracy : $\pm 0.5\%$.								
6. Substandard Frequency Meter: 1 No								
Range: 45-55 Hz								
Accuracy Class : $\pm 0.2\%$								
Scale Length: no less than 100 mm.								
Input Voltage: 63.5/120/240/415 V AC								
7. High Voltage Discharge rods (Upto 230 KV) :6 Nos								
a. Length: 1250 mm (main rod and each extension)								
b. Voltage rating: up to 230 kV, class F insulated								
c. Total length: 5 m (upto 230kV)								
8. 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 wound								
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: $\pm 2.5\%$ of the full scale.								

Item description	Whether Quoted or not (Yes/No)	Make	Model no	Country of Manufacture	Authorization letter (attached or not)	Bidder to indicate the parameters of offered model against each parameter mentioned in the tender specification so that it can be concluded that offered model is meeting all requirements as specified in technical specification	Catalogue (attached or not)	Remarks
9. Precision Portable Digital Frequency Meter: 1 No								
Range: 0-100 KHz/0-1000Hz.								
Accuracy: $\pm 0.5\%$ of reading.								
Display: LED Display								
Resolution: 1 KHz/0.1 Hz.								
Auxiliary Power Input: 230V, 1Ph, 50Hz, AC								
10. Digital Tachometer (Non-Contact type) (Photoelectric optical): 2 Nos								
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: LCD Display								
11. Relay Repair Tool Kit: 3 Nos								
Comprising following Minimum tools: i. Spring Setting Tool ii. Inspection Mirror and torch iii. Ring Spanners iv. Box Spanners v. Contact Pressure Gauge vi. Factor Gauges vii. Test Plugs and link Plugs viii. Screw drivers ix. Nose Pliers x. Scissors.								

Item description	Whether Quoted or not (Yes/No)	Make	Model no	Country of Manufacture	Authorization letter (attached or not)	Bidder to indicate the parameters of offered model against each parameter mentioned in the tender specification so that it can be concluded that offered model is meeting all requirements as specified in technical specification	Catalogue (attached or not)	Remarks
12. Universal Bridge (LCR-Q Bridge): 1 No								
Capacitance : 1pF to 1000μF Accuracy : 0.3% of the reading or better Resolution : 1 pico farad								
Inductance : 1μH to 1000H Resolution : 1 micro henry Accuracy : 0.3% of the reading or better								
Resistance : 0.001Ω to 1MΩ Resolution : 1 milli ohm Accuracy : 0.3% of the reading or better								
Q-Factor : 0 to 10 at 1 kHz								
Mains Input 240V 50 Hz 1 Phase AC (and)/or Battery operated								
13. Standard Current transformer : 4 Nos								
Primary current : 50-1500A in multiple ranges								
Secondary current : 5A								
Voltage rating : 1000V /50Hz								
Class of accuracy : +/- 0.2%								
14. Three Phase Auto Transformer (Variac) : 10 Nos								
Input Voltage: 415 V, 3Ph, 4 wire, 50/60 Hz.								
Output Voltage: 0- 415/0-470 V Continuously variable.								
Current Rating: 15 A Continuous (Minimum).								
15. Earth Resistance Tester: 2 Nos								
Earth Resistance: 0-20 /20-200/200-1000/1000-10000 Ohm.								
Resolution: 0.01/0.1/1/10 Ohm.								
Accuracy: ±(5%+5digit)								
Display: 3½ Digit Alpha numeric Display								
Test Current 20 mA								
Maximum Output voltage < 50 V (RMS)								

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16. 100 KV Fully Automatic Oil Breakdown Voltage Test Set: 1No								
Test Voltage 0-100 KV (RMS)								
Accuracy: $\pm 3\%$								
Resolution: 0.1 KV								
Display Alpha Numeric Digital display.								
17. Clamp on Wattmeter: 1No								
Input Voltage: up to 600 V, AC/DC								
Current: up to 2000 A,								
0-1 A and 0-5 A range shall be provided for measuring power from CT Secondary.								
Frequency range: 45-55 HZ								
Accuracy: $\pm 1.5\%$								
18. 5kVA (DC) High Voltage Testing Kit : 1 No.								
Output: 15KV DC								
Duty cycle of all the High Voltage Kits shall be 15 Min ON & 15 Min OFF.								
Input voltage 220V/230V, 50 Hz, single phase.								
19. Portable Digital Multimeters : 10 No								
1. DC Voltage mV Range: 60/600 mV, $\pm 2\%$ Accuracy. V Range: 6/60/600/1000V, $\pm 1\%$ Accuracy.								
2. DC Current Range: 60mA/600mA/6A/20A, $\pm 2\%$ Accuracy.								
3. AC Voltage mV Range: 60/600 mV, $\pm 2\%$ Accuracy. Voltage Range: 6/60/600/750V, $\pm 2\%$ Accuracy.								

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4. AC Current Range: 60mA/600mA/6A/20A, ±2 % Accuracy.								
5. Resistance Range: 600 Ω/6KΩ/60KΩ /600KΩ/6MΩ/60MΩ, ±3 % Accuracy.								
20. 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								
21. DC Milli Ammeter: 2 Nos								
Range: 0- 300 mA.								
Accuracy: ±1% of Full Scale								
Type: Digital								
22. DC Milli Voltmeter: 2 Nos								
Range: 0- 50V AC & DC in Multi range								
Accuracy: ±1% of Full Scale								
Type: Digital								
23. Portable Hand Held infra-red Temperature Scanner:1No								
Range: 10 0C to 9990C in multiple ranges.								
Response: 8 to 14 Microns								
Ambient Temperature: 0-50 Deg C								
Field of View: 20° X 20° Spectral								
Accuracy: ±4% of reading								

Item description	Whether Quoted or not (Yes/No)	Make	Model no	Country of Manufacture	Authorization letter (attached or not)	Bidder to indicate the parameters of offered model against each parameter mentioned in the tender specification so that it can be concluded that offered model is meeting all requirements as specified in technical specification	Catalogue (attached or not)	Remarks
24. Portable reference meter and Phantom Load test set: 1 set								
Portable reference meter: 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								
Phantom load test set : Three phase load test set								
Current rating: 1 A / 5 A/ 10 A								
Phase shift: 0 to +/- 180 Deg								
Power supply: 110/440V, 3Ph								
25. 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 ± 1 slide wire division whichever is greater								
Power supply for DC Source: 1 Phase, 240 V AC.								