

RAJASTHAN RAJYA VIDYUT UTPADAN NIGAM LIMITED

2X660 MW SURATGARH STPS, STAGE-V, UNIT # 7 & 8

VOLUME II B

**TECHNICAL SPECIFICATION
FOR
ELECTRICAL LAB EQUIPMENT**

SPECIFICATION NO. : PE-TS-392-556-E001, REV. 0



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

	2X660 MW SURATGARH STPS, STAGE-V, UNIT # 7 & 8	Doc. No. PE-TS-392-556-E001	
		Volume	Section
		IIB	
	TECHNICAL SPECIFICATION FOR ELECTRICAL LABORATORY EQUIPMENTS	Rev. : 00 DATE-01.09.14	
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TOTAL NO. OF SHEETS		= 63
(INCLUDING COVER/ SEPARATOR SHEETS)		

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

 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) Deviation schedule sheet
 - f) General arrangement drawing showing constructional features, accessories, connections, range and rating, mounting arrangement, space requirement etc.
 - g) 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.

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

	TITLE PREAMBLE	SPECIFICATION NO. PE-TS-392-556-E001	
		VOLUME IIB & III	
		SECTION -	
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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 **2X660MW SURATGARH STPS, STAGE-V, UNIT# 7 & 8.**
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

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME II SECTION – B
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan GENERAL PROJECT INFORMATION		SHEET 1 OF 3

1.0	Owner	Rajasthan Rajya Vidyut Utpadan Nigam Ltd., Jaipur
2.0	Consulting Engineer	TATA Consulting Engineers Ltd. 73/1, St. Marks Road, Bangalore – 560 001 Tel : 080 – 6622 6000 Fax : 080 – 22274874
3.0	Location of the plant	Prabat Nagar, Suratgarh Sriganganagar district, Rajasthan.
4.0	Latitude and longitude	Latitude : 29 deg. 10 min. N Longitude : 74 deg.01 min. E
5.0	Elevation above mean sea level	186 m (approximate)
6.0	Climatic conditions	
6.1	Temperatures : Monthly basis	
	Mean of daily max.	32.8 deg.C (in the month of May)
	Mean of daily min.	17.6 deg.C (in the month of Jan)
6.2	Temperatures : Annual basis	
	Mean of daily max.	32.3 deg.C
	Mean of daily min.	19.6 deg.C
	Highest temperature recorded	50 deg.C
	Lowest temperature recorded	(-) 2.8 deg.C
	Design Ambient Temperature for Electrical Equipment design	50 deg C
6.3	Relative humidity	Varies between 21% and 81%
6.4	Annual average rain fall	312 mm
6.5	Annual mean wind speed :	4 km / hr.
7.0	Wind load	

ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME II SECTION – B
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan GENERAL PROJECT INFORMATION		SHEET 2 OF 3

	Calculations for wind effect shall be in accordance with IS:875-1987(Part-3) taking into account the following:	
	a) Basic wind speed = 47 m/sec	
	b) Factor K1 = 1.07	
	c) Category of terrain = Category 2	
	d) K3 – as per IS 875	
8.0	Seismic data (As per IS: 1893 latest issue)	
	a) Zone	Zone II
	Designs & design coefficients shall be based on IS 1893:2002	
	Design condenser cooling water inlet temperature	33 Deg C
9.0	Auxiliary power supply:	
	Auxiliary electrical equipment to be supplied against this specification shall be suitable for operation on the following system:	
	a) For motors rated 160 kW and below.	415V AC, 3-phase, 3-wire effectively earthed.
	b) For motors rated above 160 kW and up to 1500 kW	6600V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
	c) For motors rated above 1500kW	11000V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
	d) For motor control centres	415V AC, 3-phase, 3/4-wire effectively earthed.
	e) DC motor starters, DC solenoids, DC alarm control and protection	220 V DC, 2-wire unearthed
	f) AC control & protective devices	110 V 1 phase, 50Hz, 2 wire AC supply. The single phase 110V AC supply shall be derived by VENDOR by providing 415V / 110 V Control transformers of adequate rating with MCCB / MCB on both the primary and secondary sides.
	g) Uninterrupted power supply	230 V, 1-phase, 50 Hz, 2-wire, AC

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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.

ANNEXURE-I

DRAWING/DOCUMENT DISTRIBUTION LIST

All documents & drawings shall be in English and in metric units

SI		TCE	RRVUNL- EC	RRVUNL -SITE	BHEL SITE	PMG BHEL	PEM/ UNITS/ PSER	REMARKS
1	Master list of drawings / doc (duly indicating sch of submission)	Soft copy	Soft copy	-	-	Soft copy	S	
2	Drawings / doc for Approval/Information (First Submission)	Soft copy	Soft copy	-	-	Soft copy	S	
3	Return with comments/approval	S	Soft copy	-	-	Soft copy	Soft copy	
4	Drawings / Documents for approval (second & subsequent submissions till approval)	Soft copy	Soft copy	-	-	Soft copy	S	
5	Drawings / documents for distribution (Approved by RRVUNL, in cat. A or G)	Soft copy	Soft copy	Soft copy	3 prints + Soft copy	Soft copy	S	
6	Erection Drawings / documents	-	1 print+ Soft copy	3 prints+ Soft copy	Soft copy	Soft copy	S	
7	FINAL Erection / Installation Manual for distribution	-	1 prints+ Soft copy	3 prints+ Soft copy	3 prints+ Soft copy	Soft copy	S	
8	As built Drawings / documents	-	1 print+ Soft copy	3 prints+ Soft copy	2 prints+ Soft copy	Soft copy	S (As applicable)	
9	Operation & Maintenance Manual	-	1 prints + Soft copy	3 prints+ Soft copy	2 prints+ Soft copy	Soft copy	S	
10	Performance & functional Guarantee test reports	-	1 prints + Soft copy	3 prints + Soft copy	2 prints + Soft copy	Soft copy	S	
11	Type Test Certificate	Soft copy	1 prints+ Soft copy	3 prints+ Soft copy	2 prints+ Soft copy	Soft copy	S	
12	Commissioning & Performance Procedure Manual	-	1 prints+ Soft copy	3 prints+ Soft copy	2 prints+ Soft copy	Soft copy	S	
13	Project Completion Report	-	1 prints+ Soft copy	3 prints+ Soft copy	2 prints+ Soft copy	Soft copy	S	

NOTES:

1. The above schedule of submission does not include Docs/Drgs. of quality assurance/inspection and delivery/dispatches.
2. Date of submitting soft copy is to be taken as date of submission.
3. S – Source for generation of document.

** BHEL – PSER will provide computer with internet mail facility along with A-3 printer and A-0 drawing plotter at RRVUNL, Jaipur Office (Vidyut Viniyamak Bhawan) and at the RRVUNL, Suratgarh Site.

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Annexure-II of SECTION-C
TECHNICAL REQUIREMENTS

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1. Insulation Tester (MEGGER):

i) Insulation Tester (5 kV) : 1No.

Test voltages: 5kV DC either continuously variable or variable in steps of 500/1000 Volts

Voltage stability: $\pm 3\%$ of rated output

Scale length More than 100 mm

Mega ohm Range: 0.1 to 100,000 Mohms either on multiple scales or provided with suitable range multiplier.

Accuracy: $\pm 2\%$ of full scale or better

ii) Insulation Tester (2.5 kV) : 1 No.

Test voltages: 2.5kV DC either continuously variable or variable in steps of 500/1000 Volts

Voltage stability: $\pm 3\%$ of rated output

Scale length More than 100 mm

Mega ohm Range: 0.1 to 50,000 Mohms either on multiple scales or provided with suitable range multiplier.

Accuracy: $\pm 2\%$ of full scale or better

2. Mega Ohmmeter 10 kV : 1 No.

Test voltages: 0-10 kV DC either continuously variable positive grounded

Mega ohm Range: 1.5 to 200,000 Mohms

Accuracy: A. Megaohm meter $\pm 2\%$ of full scale
B. Voltmeter 2% of full scale

Voltage stability: $\pm 3\%$ of rated output

3. Clip on Ammeter AC and DC : 2 + 2 Nos.

Multirange, precision clip on ammeter for AC/DC current measurement without circuit interruption

Range: 0.2/0.5/1.0/2.0/5.0/10.0/20.0 Amps

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Accuracy: A. $\pm 2.5\%$ of full scale $\pm$ Amp. For DC current
B. ± 2.5 of full scale for AC current

4. DC clamp on meter : 1 No.

Suitable for measuring for DC current. Range: 10mA to 100A

5. Digital Ductor Ohmmeter: 1 No.

Very low resistance digital ohmmeter

Range: 1 micro ohm to 19.99 ohms in multiranges

Resolution: 1 micro ohm in the lowest range

Accuracy: $\pm 0.25\%$ of the reading
 $\pm$ LSD

Accuracy class of the reference meter

Active: 0.2% or better

Reactive: 0.5% or better

Range of test current: 1-50 amps

Range of current: 50 milli amperes onwards measurement

Range of test voltage: Star connected 50-320V. Delta connected 80-560V

Suitable for single 2 wire, 3-phase 3 and 4 wires should be possible to read the following:

At the time of calibration of the energy meters, it should be possible to read the following:

- Test voltage
- Test current
- Power

The quotation of portable reference meter must be accompanied with compatible single phase/three phase phantom load test set of upto 10 amperes current rating with phase shift of -30° lead to $+120^\circ$ lag in suitable steps along with the necessary accessories and carrying case. Power supply range: single phase 240V and 110/420V, 3 phase shall be used for the phantom load test set.

6. Analog multi-meters (AVO meters): 5 nos.

The instrument shall be suitable for measurement of the following:

DC voltage: 0-1000 volts with a lowest scale of 0-100 millivolts

AC voltage: 0-1000 volts with a lowest scale of 0-3 volts

DC current: 0-10 amperes with a lowest scale of 0-50 microamps

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AC current: 0-10 amperes with a lowest scale of 0-10 microamps

Resistance: 0-20 mega-ohms
0-200 kilo-ohms
0-2 kilo-ohms

Insulation resistance: Upto 200 mega-ohms

Accuracy:

- DC range +1% of full scale
- AC ranges +2% of full scale at 50 Hz

Resistance reading sensitivity: +5% of center scale

DC ranges: 20,000 ohms per volt

AC ranges: 100-2000 ohms per volt

The instrument must be equipped with high speed cut out with fuse for overload protection.

7. Interfacial Tension Meter : 1 No.

For precise measurement for both surface and interfacial tension of liquids by ring method.

Range of measurement: ± 90 dynes/cm

Accuracy: ± 0.1 dynes/cm or better

Resolution: Less than 0.05 dynes/cm or better

Zero drift: Less than 0.10 dynes/cm in 24 hours

Material for ring: Platinum Iridium

8. AC milli ammeter : 2 Nos.

Laboratory precision type, moving iron milliammeter

Range: 0-12 amps in multi ranges with a lowest range of 0-150 milliamps

Accuracy: $\pm 0.5\%$ of full scale

The instrument shall be suitable for voltages upto 750 volts.

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9. Sub-standard Frequency meter: 1 No.

Laboratory precision type instrument

Range:	45-55 Hz
Accuracy class:	±0.2% of full scale
Scale length:	No less than 100 mm.
Input voltage:	120/240 V AC

10. Digital Time Counter: 2 Nos.

Time Range:	0-100 seconds
Lowest range:	0-100 milliseconds
Resolution:	1 millisecond
Accuracy:	+0.002% + 1 LSD
Display:	LED/ACD
Supply voltage:	240V AC, 50 Hz, single phase
Input:	Potential free No/NC contacts or voltage application /removal for start and stop

Manual start/stop and resetting facilities shall be provided in the time counter.
The instrument shall be effectively shielded for avoiding stray field interference.

11. HV discharge rods :

- a) Upto 39.5kV -- 3 Nos.
- b) From 132kV to 420 kV – 3 Nos.

The discharge rods shall be suitable to discharge dead busbars/cables etc. for indoor use. The rods shall have built in resistance of suitable value to discharge dead busbars/cables upto 18kV.

The length of the insulating rod (handle) shall be enough for safe clearances. Flexible copper leads (with connectors) of sufficient cross-section shall be provided for earthing.

12. Portable Cable Core Identification Kit – 2 Nos.

The equipment shall be capable of identifying 18 or more cores in a multi-core cable. The display shall be either LED or LCD.

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The instrument will consist of two units namely sender and receiver. The receiver unit shall be protected against in-advertant connection of live terminals.

The instrument shall be suitable for floating or earthed system and shall be capable of identifying faulted cores.

13. SF6 (Sulphur Hexafluoride) & Halogen Gas detectors- 2 Nos.

The instrument shall be potable, hand held easy to use gas leak detector capable of detecting traces of SF6 & Halogen gas.

Sensitivity: 3 to 5 ppm of Gas in air

Indication: Visual- LED
Audio- Beeper

Response: Instantaneous

14. Hydrogen Gas detectors- 2 Nos.

The instrument shall be potable, hand held easy to use gas leak detector capable of detecting traces of Hydrogen gas.

Sensitivity: 50 to 100ppm of hydrogen in air

Indication: Visual- LED
Audio- Beeper

Response: Instantaneous

15. Phase Sequence Indicator-3 Nos.

The instrument shall indicate the phase rotation of 3 phase voltage.

Voltage ranges: 50-500 volts (line to line)

Frequency range: 45-55 Hz

16. Portable recording meters – 2 Nos.

AC voltage: 0-125V

AC current: 1MA to 10 amps

Frequency: 45-55 Hz

Kilowatts: 1-5 amps, 110 volts, 3 phase and 240 V single phase

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KVAR: 1-5 amps, 110 volts, 3 phase and 240 V single phase

The recording meters shall be multi-speed and direct acting/transducer interfaces. Chart width of the recorder shall not be less than 100 mm. The recorder shall be electric clock wound.

Accuracy: $\pm 2.5\%$ of the full size

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

17. **Moving Iron Ammeters (0-5 Amps) – 2 Nos.**

Accuracy class: 1% or better

Scale length: More than 100 mm

Frequency range: 45-55 Hz

18. **Moving Iron Ammeters (0-100 Amps) – 6 Nos.**

Accuracy class: 1% or better

Scale length: More than 100 mm

Frequency range: 45-55 Hz

19. **Portable Selective Level Meter with Tracking Level Generator and Impedance and Return Loss Measurement Attachment – 1 No.**

- Frequency: 200 Hz to 620 kHz for both balanced and unbalanced inputs
- Level:
 - a) Voltage level: 120 dB to +21 dBm
 - Selective wide band: 70 dB to +21 dBm
 - b) Power level: 120 dB to +21 dBm
 - Selective wide band: 70 dB to +21 dBm
- Selective band widths :
 - Channel measurements : 3.1 kHz to 1.74 kHz
 - Channel noise measurements : 24 Hz
 - Pilot measurements
- Frequency tuning : 1 Hz
- Resolution : ± 1 Hz for ϕ less than or equal to 100 kHz
- Accuracy : ± 10 Hz for ϕ greater than 100 kHz
- Level accuracy : ± 0.1 dB/dBm

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- Input impedance : 75 ohms unbalanced and 150/600 ohms balanced
- Power supply: : 240V, 45-55 Hz single phase

The instrument shall have facilities for rechargeable battery operation using internal charger

- Selectivity

For 3.1 kHz filter Delta ϕ : ± 2 kHz greater than or equal to 60 dB

For 24 Hz filter Delta ϕ : ± 70 Hz greater than or equal to 40 dB

The tracking level generator shall be suitable for frequency tuning and display through the level generator.

Output impedance : Unbalanced 75 ohms
Balanced 150/600 ohms

Accessories shall include the following:

Impedance and Return Loss Measurement Attachment having the following specifications:

Impedance range : 50-100 ohms (impedance)

Accuracy +/-10%

Frequency range: 300 Hz to 620 kHz

Measurement range : 40 db (+/-db) 60-1000 ohm (return loss measurement)

20. Selective level Oscillator – 1 No.

Having the same specification as those for Tracking level Generator but with independent selectivity.

Signal balance ratio measurement attachment.

Balanced Attenuator

Transportation covers

Battery pack etc.

21. Precision Portable Digital Frequency Meter – 1 No.

Frequency range: 20 Hz – 620 kHz in multirange

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Resolution: 0.01 Hz in the lowest range

Accuracy: +0.05% + 1 LSD

Sensitivity: 20mV- upto 20 kHz
15mV-20kHz to 100 kHz
150mV-100kHz to 200 kHz

Input characteristics

Coupling AC coupled

Impedance 10 Megaohm in all ranges

Capacities less than 100 pico farads

22. Power Factor Meter- 2 Nos.

Portable hand held power factor meter to read directly power factor on single/split/three phase system from zero to unit lead/lag.

Current: Current input shall be through clip on device necessitating no circuit interruption. The clip-on device shall be suitable for cable dia. of 50 mm maximum.

Accuracy: $\pm 3\%$ of full scale

23. Portable Capacitance Meter- 2 Nos.

Range: 0-200 picofarads
0-200 nano farads
0-2000 micro farads in multi-ranges

Accuracy: $\pm 0.5\%$ upto 20 microfarads
 $\pm 2\%$ above 20 microfarads

24. Vibration Level meter- 1No.

The instrument has a common input for microphone and vibration pick-up, shall be equipped with an industrial type of microphone. The instrument shall have a AC/DC output for cable vibration and chart recording respectively.

Vibration measurement ranges:

Displacement 0-3000 microns peak to peak

Amplitude in overlapping ranges

Velocity 0-3000 mm/second

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25. Sound Level meter- 1No.

Sound measurement

Range 50-130 dB in multiple over lapping ranges

Frequency 10 Hz to 10 kHz

The instrument shall be suitable for operation with an ambient temperature from 20-65°C.

26. Digital Tachometer (Non-contact type) (Photo electrical optical)- 2 Nos.

Speed Range: 100-19999 rpm

Display: LED/LCD

Resolution: 0.1 rpm in the lower ranges

Accuracy: ± 1 rpm upto 4000 rpm
 ± 3 rpm above 4000 rpm

The instrument shall be suitable for measurement of speed with the probe at a distance of 30mm.

27. Universal bridge (LCR-Q-Bridge)-1 No.

Precision laboratory type

Range of measurement

- a) Capacitance: 1 picofarad to 1000 micro farads
Resolution: 1 pico farad
Accuracy: $\pm 0.3\%$ of the reading or better
- b) Inductance: 1 micro henry to 1000 henries
Resolution: 1 micro henry
Accuracy: $\pm 0.3\%$ of the reading or better
- c) Resistance: 0.001 ohms to 1.0 mega ohms
Resolution: 0.1 milli ohms
Accuracy: $\pm 0.3\%$ of the reading or better
- d) Q-factor: 0-10 at 1 kHz
Internal Oscillator: 1 kHz $\pm 5\%$

Frequency range for all the measurements

Internal Oscillator: 1 kHz $\pm 5\%$

External Oscillator: 40 Hz to 20 kHz

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28. Relay repair tool kit- 3 Nos.

The relay repair tool kit comprises of:

- Spring setting tool
- Inspection mirror and torch
- Ring spranners
- Burnishing tool
- Contact pressure gauge

All these items shall be housed in a plastic wallet. This shall be suitable for the relays offered.

29. Standard Current Transformer (50-1500A)- 2 Nos.

Primary current: 50-1500A in multiple ranges range

Secondary current: 5A preferably with a duplicate 1A secondary

Voltage rating: 1000V 50 Hz

Class of accuracy: $\pm 0.2\%$

VA burden: 10VA

Suitable for primary conductor threading/terminal connections

30. Standard current transformer (10-100A)- 2 Nos.

Primary current range: 10-100A in multiple ranges range

Secondary current: 5A preferably with a duplicate 1A secondary

Voltage rating: 1000V 50 Hz

Class of accuracy: $\pm 0.2\%$

VA burden: 10VA

Suitable for primary conductor threading/terminal connections

31. Standard potential transformer -2 Nos.

Primary current: 500/400/240/110V

Secondary current: 110/110V/1.732 (110/63.5V)

Class of accuracy: 0.2

Burden: 10VA

Frequency: 45-55 Hz

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32. Primary Injection Set- 1No.

Output current: 0-5000A

Input: 240V AC± 10%, 50 Hz single phase

Type: Portable (the control unit & transformer unit shall be separate)

10M Length test leads

NB: Any additional facilities like potential circuit for testing directional relays timer etc. shall be clearly brought out.

33. Automatic relay test set (portable type)

The test set shall be able to test the latest numerical relays, eg from Doble, Omicron, Freza etc.

Relay Secondary Injection Testing Set

- a) 0-100A 2 Nos.
- b) 0-30A 1 No.

Suitable for testing current, voltage, time and power relays

Input: 240V AC, 50 Hz single phase AC

Output current: 0-100A continuously variable in multiple ranges

AC voltage output: 0-250 V continuously variable

The set shall be suitable for continuous operation for 5 minutes in all ranges. The instrument shall be provided with an in built electronic digital timer of range 0-100 seconds with a resolution of 1 millisecond.

Accuracy: ±0.1 of the reading

Facility for timer start/stop from NO/NC contacts and voltage/current application/removal and from external switch shall be provided.

Provision for setting the current with the relays under tests wired up but short-circuited may be incorporated.

Same as above but the current rating 0-30A.

34. Circuit Breaker analyser- 1 No.

The instrument shall be portable and easy to operate, rugged in construction and immune to hostile electrical fields such as those encountered in EHV areas. Suitable for measuring of breaker (220/400kV) closing /tripping time & travel of the contact including measurement of

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TC & CC. It should be possible to test all the three phases of the circuit breaker (hydraulic/pneumatic/spring operated together).

The output shall be a clear graphical record preferably on plain paper or any other paper having indefinite shelf life available ex-stock on demand and does not require any storage facility.

Analogue inputs 4 analogue inputs per phase

Contact inputs: Upto 8 contact pairs per phase (1 contact pair is 1 main break + 1 resistor break)

Event input

The instrument shall be suitable for providing trip signal and isc he signal output. Provision for selecting record length shall be provided on the front panel of the instrument. Shall be suitable for all types of circuit breakers and a selection of trigger signals.

35. Three Phase Auto transformer (VARIAC)

- a) 4A 3 Nos.
- b) 8A 3 Nos.
- c) 28A 3 Nos.

Input: 415V, 50 Hz, 3 phase (line to line)

Output: 0-480V, line to line

10 amps continuously variable

The Auto transformer shall be of rugged construction dry type and shall be provided with castor wheels.

A voltmeter with selector switch shall be provided in the output circuit.

36. Dual Trace Portable Storage Oscilloscope with camera (and associated PC & software) (0-100kHz) – 1 No.

The oscilloscope shall be portable dual trace (twin beam) 4 channel storage type.

The instrument can be either analogue or digital. It shall be suitable for 240V, 50Hz, single phase supply. A general purpose camera with mounting adapter and corrector lens shall be supplied. All essential accessories like probes, Polaroid film, protection cover etc. shall be supplied.

37. Portable Moisture Meter – 1 No.

Portable instrument for field measurement of moisture content in oil (mineral/synthetic). The instrument shall work on the principle of coulometric karl isher titration. The display shall be in micrograms/milligrams/ppm percent of water.

Range: 10 micrograms to 10 milligrams of water
Sensitivity: 10 micrograms or 1% whichever is more

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38. Low Voltage insulation Tester (Megger)

- a) 500V – 5 Nos.
- b) 1000V – 2 Nos.

Test Voltage: 100/250/500/1000V DC
Megaohm Range: 20/50/100/200 megaohms

The instrument shall have a brushless hand-cranked AC generator with rectifier for the test voltage. The instrument shall have an in-built continuity range and shall have an AC voltage measuring 0-500 volts.

39. Earth Resistance Testers (Four terminals) – 2 Nos.

Portable instrument with test spikes for measurement of earth resistance

Earth resistance: 0.01-300ohms in multi ranges measurement range

Accuracy: $\pm 1\%$ of range in use.

Ambient temperature: 0-40°C range

Power source in built hand cranked AC Generator

40. High Voltage Testing kit

- a) 0-70kV AC/DC, 10 KVA- 2 Nos.
- b) 0-25 kV AC/DC, 25 KVA- 2 Nos.

Input voltage 240V, 50 Hz, single phase

- Test voltage
- i. 0-150kV DC, 5 KVA
 - ii. 0-25kV DC, 1 KVA
 - i. 0-70kV AC, 10 KVA
 - ii. 0-25kV AC, 25 KVA

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. 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 leakage current. The HV terminals shall be corona-free. Discharge rods shall be supplied along with the instrument. Any other essential accessory may be quoted separately.

41. Clamp-on Wattmeter – 1 No.

Portable hand-held 1 clamp-on type instrument for measurement of power in single and three phase circuits without any interruption in the power circuit.

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Input Voltage: Upto 500 volts 3 phase, 50 Hz

Current: Upto 1000 amperes

Frequency Range: 45-55 Hz

Accuracy of measure: $\pm 2\%$ or better at unity power meant factor

42. DC Earth Fault locator – 2 Nos.

The DC earth fault locator shall be capable of locating the earth faults in live unearthed DC systems. It shall be suitable for locating the fault without losing the integrity of the system.

It shall be capable of detecting earth faults where fault resistance is as high as 25 kilohms. The instrument shall operate by injecting a low frequency low voltage signal to the DC system at the main DC DB from a transmitted unit and tracing it with an inductive receiver and sensing head to the fault.

Frequency of injected 10-12Hz to avoid signal interference with the DC ripples Open circuit signal not more than 15V strength.

Receiver sensitivity 25kilo ohms fault resistance

Both the transmitter and receiver shall be battery operated and portable. The instrument shall also be capable of detecting earth faults in machine windings.

Cable earth fault locator

The locator shall be able to detect the faults in the cable & give location of faults.

43. Vibration Meter – cum – Analyser – 1 No.

Measurement range: Displacement 0 to 2 mm Velocity 0 to 1000 mm/s
Acceleration 0 to 100 mm²/s

Frequency range: 10 to 1000 Hz

Power supply battery operated: 200-240V, 50 Hz, single phase AC supply

Environmental Temp. range: 0 to 40°C

Relative humidity: Upto 95%

44. Portable digital multimeters (True RMS type)- 6 Nos.

Suitable for measurement of the following:-

a) DC Voltage: 0-2.5mV/10/25/100/250/500/1000/2500 volts with a resolution of 1mV or better

Accuracy: $\pm 0.2\%$ or the reading

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- Response time: Less than 1 sec.
- Input impedance: Not less than 10-Mohms in all the ranges
- b) AC voltage: 0-2.5mV/10/25/100/250/500/1000/2500 volts, 40-60 Hz with a resolution of 1mV or better
- Accuracy: $\pm 0.75\%$ of the reading
- Response time: 5 sec or better
- Input impedance: Not less than 10-Mohms in all the ranges
- c) DC current: 0-200 μ A / 2000 μ A / 20mA /200mA /200A
- Accuracy: $\pm 0.75\%$ of the reading
- Response time: Less than 1 sec.
- d) AC current: 0-200 μ A / 2000 μ A / 20mA /200mA /200A, 40-60 Hz
- Accuracy: $\pm 1.5\%$ of the reading
- Response time: 5sec or better.
- e) Resistance: 0-200 ohms / 2ohms / 20kohms / 200kohms / 2Mogohms / 20Mogohms/200Mohms
- Accuracy: $\pm 0.2\%$ upto Kilohm ranges and $\pm 2\%$ for Megaohm ranges
- Display: 3 ½ digit LCD

Overload and surge-voltage protection shall be provided in the instrument. The instrument shall be battery operated with a facility mains adapter.

The accessories shall include but not limited to the following:

- Leather carrying case
- Measuring leads
- Mains adapter
- Spare fuses (4Nos.)

The instrument shall be suitable for an ambient temp. range of 0-40 deg. C

45. Analogue multimeter (Portable)-- 3 nos

- Voltage range: 0-2.5mV /10/25/100/250/500/1000/2500 V AC/DC
- Current range: 0-10mA /100mA /250mA /1A /10A AC/DC
- Resistance range: 0- 2 Ω /200 Ω /200k Ω /20M Ω /200M Ω

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46. Three Phase Sub Standard Wattmeter (Portable) – 6 Nos.

Voltage Range: 110/240/420 Volts

Current Range: 1 / 5 Amp

Power Factor: 1.0 (unity)

Accuracy: $\pm 0.5\%$ of full scale

This instrument shall be suitable for single phase, 2 wire, 3 phase, 3 and 4 wires, balanced and unbalanced load. The instrument shall be free from the effect of stray fields.

Suitable leather carrying case, connecting leads and any other essential accessories may be supplied.

47. DC milliammeter – 2 Nos.

Laboratory, precisions type moving coil milliammeter

Voltage: 0-750 Volts

Current Range: 0 – 300 milli amps in multi ranges

Range: 0 – 15 Amperes in multi ranges with a lowest range of 2 milli amps or Better

Accuracy: $\pm 0.5\%$ of full scale or better

The instrument shall be provided with knife – edge pointer and anti-parallax mirror suitable leather carrying case and essential accessories may be supplied.

48. DC Millivoltmeter – 2 Nos.

Laboratory, precisions type moving coil milli voltmeter

Voltage: 0-500 Volts in multi ranges with a lowest range of 0-75 millivolts

Accuracy: $\pm 0.5\%$ of full scale

The instrument shall be provided with knife edge pointer with anti parallax mirror, and leather carrying case.

49. DC Moving Coil Micro Ammeter - 1 No.

Range: 0-300microamps

Class of Accuracy: 1 % or better

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Scale length: not less than 10 mm

The instrument shall be provided with knife edge pointer with anti parallax mirror, and shall also be provided with a leather carrying case.

50. DC Moving Coil Milli Ammeter- 1 No.

Range: 006-60 milliamps

Class of Accuracy: 1.0 %

Scale length: not less than 100 mm

The instrument shall be provided with knife edge pointer with anti parallax mirror, and shall also be provided with a leather carrying case.

51. Digital Phase Angle (Power Factor) meter – 2 Nos.

Voltage Range: 0-600 Volts extendable up to 30kV with suitable probes

Current Range: 10MA to 5A extendable up to 600A using clip on Devices

Power Supply: Battery / Mains operated

Measurement Range: $\pm 180^\circ$ C

Voltage shape: sinusoidal

Accuracy: $\pm 1\%$

Accessories shall include but not limited to the following

- Voltage probe up to 30kV
- Clip on ammeter up to 60A
- Test leads
- Leather carrying case

NB input voltage range extension optical phase device suitable upto 420 kV may be separately quoted. However the same will not be considered for bid evaluation.

52. Platinum RTD Digital Temperature Indicator - 1 No.

Display: LED/LCD

Temperature measurement range: -100 o 550° C

Resolution up to 200° C above 200° C: 0.1° C

Above 200° C: 1.0° C

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Accuracy: $\pm 1^{\circ}\text{C}$

Ambient Temperature: $0-40^{\circ}\text{C}$

The instrument shall be battery operated preferably rechargeable type. The probes for surface and immersion temperature measurement shall be supplied with the instrument. Any additional probes shall be quoted separately. The probes shall be platinum resistance type conforming to international standards.

The instrument shall be supplied in suitable carrying case. "Low Battery" indication shall be provided in the instrument. The battery charger shall be suitable for 240V AC, 50 Hz single phase operation.

53. Portable Light Intensity Meter (Lux Meter) - 1 No.

Measuring Range: 0-2000 Lux in multi ranges with a lowest range of 0-300 or better

Accuracy: $\pm 5\%$ of reading

Sensor Selenium photo cells with leads of suitable length

This instrument shall be corrected for angle of incidence and shall have colour correction by colour correcting filter.

Indication: Analog / Digital

The instrument shall be provided with a suitable leather carrying case.

54. Battery Operated Insulation Tester (Megger): 2 Nos.

Test Voltage: 0-1000 V DC either continuously variable or variable in steps covering 50 / 150 / 500 volts

Insulation resistance: 0-2000 mega ohms

Accuracy: $\pm 2\%$ of full scale

Ambient (Temp: $0-40^{\circ}\text{C}$

Scale Length: More than 10 mm

Power supply: Rechargeable nickel – Cadmium batteries with in built charger operating at 240 50 Hz, single phase supply.

NB: Separate charging unit may also be considered accessories shall include but not limited the following

- Carrying Case
- Test leads of 3 meters length with connectors and clamps
- Spare Fuses

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55. Precision Manual Scanning Radio meter – 1 No.

For precision measurement of temperature/ scanning of high temperature locations from a distance.

Temperature measurement range: 0-1000 °C

Ambient temperature: 0-40°C

Field of View: upto 3°C

Accuracy: +/-1% of reading +1°C

Infrared response: 0-14 microns

Power supply preferably rechargeable: The instrument shall be battery operated

All essential accessories shall be supplied with the instrument. The instrument shall be supplied with a leather carrying case.

56. AC voltage / current standard – 1 No.

Prevision, Stable AC voltage / current source, providing voltage ranges from 100 millivolts to 100 volts in multi-ranges and current ranges from 10 milli amps to 10 amps. In multi ranges.

Output voltage or current setting to be provided on the front panel dial with display

Accuracy: + / - of the setting

Frequency: 40 to 400 Hz either continuously variable or Variable in suitable steps

Power input 240 V, AC, 50 HZ single phase

57. Single phase auto transformer (VARIAC)

a) 4 Amp - 3 Nos.

b) 8 Amp - 3 Nos.

c) 28Amp- 3 Nos.

Input: 240V, 50 Hz Single phase

Output: 0-260 Volts single phase

10 / 30 amps continuously variable

The auto transformer shall be rugged construction, dry type and shall be provided with castor wheels, a voltmeter with selector switch shall be provided in the output circuit.

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58. Cable Fault location set – 1 No.

The Portable Cable Fault Locator shall be a self-contained unit capable to detect condition and fault of underground distribution and transmission power cable that comprising of (a) Surge Generator (b) DC Tester / Burner (c) Arc Reflection Filter, (d) Surge Pulse Coupler and (e) Voltage Decay

59. Partial discharge Test set (contact loss) Portable type -- 1 No.

Sensitivity: 5pC
Dynamic Range: 0-60dB Total
Bandwidth: 300 KHz to 70MHz
Sampling Frequency: 30MHz or 33nS

60. Thermal Image Camera (portable) – 1 No.

Camera shall be suitable to monitor the thermal image of the equipment & analyse the results in PC/computer.

Temperature range : -20°C to +1000°C
Operating temperature range : -20°C to +50°C
Detector Type : Uncooled Focal Plane Array

61. Variable frequency source – 1 No.

For testing of frequency relay: 1-200Hz
Output signal voltage : 110/220V AC
Aux supply : 240V AC

62. 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°
VA Rating: 500VA

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63. Special equipment for testing lightning Arrestors (Both gapped and gap less) – 1No.

Current Measurement Ranges: Fundamental: 1.999mA & 19.99mA
3rd Harmonic: 199.9μA & 1999μA

Filters : Response of the third harmonic filter:
< - 60 dB at 50 Hz;
0 dB at 150 Hz;
< - 20 dB at 250 Hz and higher frequencies.

Accuracy : 50 Hz measure, rms and peak value: total maximum of
± 5 % from 0.1 to 10 mA.
150 Hz rms measure: total maximum of ± 10 % from 10
to 1000 μA.

Accessory : Current Clamp, Hard Carrying Case

64. Dew Point Meter – 1 No.

Range of measurement for: -30 to +50 deg C (dew point)
-20 to +70 deg C (Temperature)
0 to 100 % RH (Relative Humidity)

Accuracy : Dew Point: ±1°C to ±4°C in different ranges
Temperature: ±0.5°
RH: ±2 %RH (+2 to +98 %RH)

Resolution : 0.1 % RH
0.1 Deg C (to + 200 Deg C)
1.0 Deg C (above 200 Deg C)

Type : Portable handheld type

Display : LCD

Accessories : Probe, Hard Carrying Case, Battery Loaded in the
Instrument

65. Vacuum Measurement Meter – 1 No.

Output Voltage : Variable 0 to 60 KV DC

Voltmeter : Range: 0-60KV
Resolution: 0.1KV
Accuracy: ±1.5% of Full Scale

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Ammeter : Range: 0-9.99mA
 Resolution: 0.01mA
 Accuracy: $\pm 1.5\%$ of Full Scale
 Ripple Max. : 7%
 Accessories : Cables, Clamps & Clips etc.

66. A.C. Milli Volt Meter – 2 Nos.

Purpose: For Calibration of Meters and Transducers.
 Type: RMS Measurement, Digital type, Desktop model, $3\frac{1}{2}$ 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.

67. Kelvin Double Bridge – 1 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
 Maximum test current: 25 A
 Power supply for DC Source: 1 Phase, 240 V AC.

68. Microprocessor based automatic Pensky Martin flash point apparatus- 1 no.

Pensky Martin Flash Point Apparatus is widely used for determination of closed cup Flash Point of Fuel Oil, Cut Back asphalts, other Viscous material and suspension of solids having a flash point about 49°F.

The assembly of Pensky Martin Point Apparatus rests in Air Bath which is covered with Dome shape metal top. The cup is fitted with insulated handle and locking arrangement near cup plange. The assembly rests on a round shaped heater with different temperature regulation system suitable for operation on 220 Volts AC mains.

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69. Microprocessor based gas Chromatograph and Data station- 1 no.

Set shall be suitable for analysis of various gases mentioned below which are generated due to various types of fault occurring in the transformer. Gas chromatograph along with gas extraction apparatus using mercury.

Gasses analysed: Hydrogen, Nitrogen, CO₂, Methane etc.

Gas analyser shall be suitable for DGA analysis of transformer oil. Any incipient or developing fault/abnormality inside transformer is accompanied with generation of fault gasses like Hydrogen, CO₂, methane etc. The presence of these gases can be determined in transformer oil and fault can be diagnosed.

Accessories: Standard accessories to be supplied, Gas extraction apparatus. All hardware & chemicals required for dissolved gas analysis will be supplied with the equipment.

70. Microprocessor based Dielectric Strength analyser- 1 no.

Input Voltage: 240V, 50 Hz, single phase

Output Voltage: 0-100 kV either continuously variable or adjustable steps.

The instrument should be micro-processor controlled and fully automatic capable of sequential testing. The instrument should be provided with all the safety features and self-check facility. It should be possible to keep the test voltage at any level for any amount of time for voltage withstand test.

The set must have inbuilt memory to save the test results.

The set should have inbuilt printer to facilitate printing of results.

Accessories:

- Porcelain Oil Cell
- Magnetic Stirrer
- Gap Gauge
- 2 Nos. of Print Rolls

71. Microprocessor based Coulometric Karl Fischer monitor meter- 1 no.

Automatic microprocessor based instrument based on Karl Fischer Titration Principle

Sensitivity: 1 ppm

Range: 1 to 100 ppm

Automatic titration. Must be provided with printer to print test results. The set should utilize Chemicals and Reagents available indigenously.

72. Microprocessor based Dielectric Constant & Tan delta meter - 1 no.

Portable Capacitance & Tan Delta set for indoor & outdoor Testing of various equipment like cables, insulators, transformers, etc.

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Capacitance Range: 0-1.1 μ F to facilitate Generator Testing (Range extension inductors to be supplied)

Bridge Capacitance Range: 0-5 μ F

Tan-Delta Range: 0 to ± 10

Power Loss: 0 to 2kwatts

Milliwatts Resolution: 0.001

Power Supply Rating: 0 to 12kv, 100mA Continuous, 200mA Max.

Display: LCD Backlit Panel and keyboard

Interface: RS-232 Port provided for printer interface.

Accuracy:

Capacitance: $\pm 0.2\%$ Readings & ± 10 pf

Tan delta: $\pm 1.0\%$ Rdg $\pm 0.02\%$ F.S

Frequency: ± 0.02 Hz

Resolution

Capacitance: 0.01pf

Tan Delta: 0.0001%

Frequency: 0.01Hz

Software: Windows Based Analysis software to be provided

Accessories: All Standard Accessories to be provided. Cables etc. to be included.

Accessories Required:

- HV Calibrator
- Oil Test cell & Oil cell heater to facilitate Tan Delta Measurement at 27°C & 90°C
- Standard Capacitor

73. Infrared distance temperature indicator- 2 nos.

Display: LCD

Temperature Measurement Range: -200 To +600°C

Resolution:

Upto 199.9°C: 0.1°C

Above 200°C: 1°C

Accuracy : $\pm 0.02\%$ of mv ± 1 dgt (-200 to +600°C)

Ambient Temp.: 0-50°C

The instrument is Battery operated. The probes for surface and immersion temp. measurement shall be supplied with the instruments.

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74. Acidity test set for transformer oil - 1No.

The main unit of this apparatus incorporates the Microprocessor based circuitry. A light feather touch key board is fitted on the side of an informative alpha numeric display. The display indicates the emf in millivolts generated during the titration process and also the millivolts generated with each addition of volume of titrant to the reaction breaker and the total volume of the titrant added. The time interval between two consecutive additions of the titrant shall also be shown on the display.

The set shall be suitable for determination of acidity in transformer oil.

75. Buchholz Relay Gas analyser- 1No.

The equipment is suitable to test and analyse various gasses by Analytical Test Method.

No. of Pipettes : 5

Glass : Borosil Glass

76. Buchholz Relay testing kit- 1No.

The kit must include a test pump and hose to generate sufficient pressure so as to operate buchholz relay and check its operation. Carrying case to be provided.

77. Oil resistivity test kit - 1No.

Transformer Oil resistivity Kit should have certified oil test cell with heater arrangement for measuring oil parameters at various upto 90°C.

The Oil cell heater should have a cover interlock switch for safety.

The cell constant must be programmable in the oil resistivity meter before test.

Measurement Range: 10^9 to 10^{15} Ohm CM

78. Non contact radiation pyrometer - 1No.

Temperature range: -30 to 900°C (-25 to 1600°F)
 Display Resolution: 0.1°C of reading up to 900°C
 Distance to spot size: 60:1 Standard focus
 Min. measurement diameter: 19mm (0.76 in) Standard focus
 Laser sighting: Three point coaxial laser
 Emissivity: Digitally adjustable from 0.10 to 1.0 by 0.01

79. Voltmeters (Digital)- 2Nos.

Range: 0-1000V
 Accuracy class: $\pm 1\%$
 Frequency ranges: 45-55 Hz

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80. Digital frequency meter - 1 No.

Type : Digital

Cycles : 40/50/60

Accuracy : 0.1% Class

81. Tong testers (digital clamp on ammeter and voltmeter)- 5 Nos. of each range

For measurement of pilot currents without endangering the opening of CT circuit.

Measuring range: a) 10 μ A- 5A
b) 1A- 10A

Display: 3 ½ digit LCD

Voltage AC: 0.1-400V

Input resistance: 10M Ω

Resistance measuring range: 0.1- 400 Ω

Frequency range for AC voltage/current: 1kHz-40kHz

Clamp opening: minimum 50mm.

82. Cathode Ray Oscilloscope (portable) – 2Nos.

Dual beam, 25MHz.

83. Kelvin's Double Bridge - 1 No.

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

Maximum test current: 25 A

Power supply for DC Source: 1 Phase, 240 V AC.

84. Multichannel high speed Ultraviolet Oscillograph for testing of AVR's, ACB's.- 1Set

Input Type/ Number of Channels: Plug-in Input Modules

Maximum 2 Analog's Channels +8 Logic Channels

Measurement Functions: MEM (High speed recording)

REC (Real Time Recording)

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RMS (50/60 Hz, or DC only)

Maximum Sampling Rate: 1MS / Second
Memory Capacity: 4M words Total

Data Storage Media:

- PC Card Type III slot x 1 : up to 1GB (Flash ATA)
- 3.5" Floppy disk drivex1 : 1.44MB, 1.2MB, 720KB, MS-DOS format

File format: Binary, text, BMP

85. Circuit Breaker Contacts Resistance Measurement kit – 1No.

Measurement Range: 0.01 $\mu\Omega$ to 200 Ω
Scales: 20 μ to 200 μ
Resolution: 0.01 μ
Current Range: 10A
Memory: Inbuilt memory for storage of readings.
Running Temperature: -20°C to +50°C
Storage Temperature: -40°C to +50°C
Humidity: 0 to 95% non-condensed

Features:

1. Automatic indication of wrong and open Connections.
2. Automatic Comparison of resistance of different items with memory functions of first reading and difference of readings in successive measurement in ohms and percentage. (Delta R)
3. The Micro Ohm meter should be auto ranging type and should have automatic current adjustment.

86. Non-magnetic surveyor's umbrella – 1No.

The Survey Umbrella must not have any magnetic part which may cause interference in survey instruments like compass etc. The dia of umbrella must be 4 feet min.

87. Mercury in glass thermometer - 1 No.

Range: 0 to 150°C, 12 inch long
Purpose: To measure temperature

88. Rheostats- 4Nos. of each range

Ratings: a) 2A /1000 Ω
b) 8A /200 Ω
c) 5A /100 Ω
d) 12A/18 Ω

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89. Shunts- 1 No. each

Shunts(75A, 50Hz, four or two terminals)
Shunts(150A, 50Hz, four or two terminals)
Shunts(300A, 50Hz, four or two terminals)

90. Loading transformer-- 1 No.

Input: 240V, 1Ph, 50Hz, AC
Output: 5V, 1Ph, 50 Hz, AC

Capacity: 100A Continuous rated
Accessories: Test Leads

91. Phase shifting transformer -- 1 No.

A Phase-Shifting Transformer is a device for controlling the power flow through specific lines in a complex power transmission network.

The basic function of a Phase-Shifting Transformer is to change the effective phase displacement between the input voltage and the output voltage of a transmission line, thus controlling the amount of active power that can flow in the line.

92. Portable computerized combustible gas analyser- 1 No

Portable hand held combustible gas analyser.
The set should be suitable for combustible gases with data logging facility. The data can be transferred to PC.
Gases: Combustible gases (% LEL/ %Vol), O₂, CO, SO₂ etc.

93. Motor checker - 2 Nos.

Motor checker is a portable instrument used for fast and easy detection of electrical faults in electric motors.

Shall be capable of checking:

- Rotor and stator resistance/ inductance
- Insulation resistance 0-20 Mohms at 500V, maximum current 0.25mA
- Resistance range 0-60 ohms in 6 ranges.
- Inductance 0-300 mH in 6 ranges.
- Battery Operated (1.5Vx6AA size)

Accessories: Carrying case, Test leads and 6 Nos. 1.5V batteries

94. DC variable power supply source- 1 set

The instrument will provide a ripple free variable DC voltage.
Continuously variable output.
Voltage: 15 to 300V
Current: 0 to 1A

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95. Vacuum tester- 1 No.

Input Voltage : 230V, 50Hz
Output Voltage : 10, 14, 25, 40, 60kV DC switchable

96. High voltage Detector --- 1 No.

Power Supply : Dry Cell

Voltage Range : Suitable up to 400KV (Including 33,66, 132KV & 220KV system voltage also)

Insulation Class : F Class Insulation

Indication : Visual—LED
Audio – Buzzer

97. Tool kit for instrument mechanic - 6 Nos.

The tool kit shall comprise of the following tools:

- Screwdrivers : Head Size 3,6,8,10
- Stripping Knife
- Hacksaw : 300 mm
- Universal Plier
- Round nose plier
- Bend snipes nose plier
- Water pump plier
- Open End spanner 6 mm to 22 mm all sizes
- Adjustable spanner 29mm max. capacity
- Socket ½" wrench set- 8mm to 23 mm
- Low voltage line tester
- Rubber Gloves

Carrying case shall be supplied along with the tools.

98. Computerized relay test bench - 1 No.

Computerised Universal Relay testing set must be suitable to test various types of relays like Overcurrent, Distance, Differential, Over Voltage, Under Voltage, Rate of change of frequency df/dt and other relays in power plant.

Current Amplifiers:

3 phase Current: 0-30A

1Phase Current: 0-60A

DC Current: 0-80A

Accuracy: 0.2% or better

Voltage Amplifier:

4 phase Voltage: 0-300V

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1Phase Voltage: 0-600V
Accuracy: 0.1% or better

Frequency Sine Signals: 10-1000Hz
Harmonics: 10-1000Hz

Binary Input: 10 Nos.
Binary Output Relays: 4 Nos.

Counter Inputs 100KHz: 2Nos.

PC interface : Ethernet port

99. Decade resistance box (for testing & calibration of rotor E/F relay) - 1 No.

Ohms: 100K+10K+1K+100+10+1+0.1+0.01

Amps: 0.001, 0.005, 0.02, 0.07, 0.2, 0.7, 2.5

100. Single phase transformer for checking of knee point voltage for CT- 1 No.

I/P: 0-240V AC, 50Hz
O/P: 0-5000V AC
VA: 500VA

101. Milli ohm meter (Suitable for measuring the winding resistance of generator, motor, Transformers) – 1 No.

Low resistance digital ohmmeter (Micro Ohm Meter)
Measurement Range: 0.01 $\mu\Omega$ to 200 Ω
Scales: 20 $\mu\Omega$ to 200 Ω
Resolution: 0.01 $\mu\Omega$ in lowest range of 2m Ω
Accuracy: $\pm 0.1\%$ Of reading ± 2 Digits
Current Range: up to 10A
Complete with test leads, carrying case and battery charger

102. Harmonic analyser (Suitable for measuring the harmonics in the power system. Also shall be able to compare two system simultaneously) - 1No.

Voltage Range: 150/300/600/1000V
Allowable Input: 10-110% of each range
Display Range: 5 to 120% of each range
Accuracy: $\pm 0.3\%$ of reading $\pm 0.2\%$ fs (For Sine wave 45-65Hz)

Current Range: 50/100/200/500A
Allowable Input: 10-110% of each range
Display Range: 1 to 120% of each range
Accuracy: $\pm 0.3\%$ of reading $\pm 0.2\%$ fs +Accuracy of clamp sensor (For Sine wave 45-65Hz)

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Harmonic Measurement: Measurement Method: PLL Synchro System

Measuring Range: 45-65Hz

Analysis Order: 1st to 63rd

Window Depth: 2 cycles

Window Type: Rectangular

Analysis Data: 512 Points

Analysis Rate: Once every 2 seconds

Display Item:

- Voltage per CH/Current, THD, Freq.
- Voltage/Rate of Content/Phase Angle at each order

Measuring Carried Out: Voltage, Current, Active power, Reactive power, Apparent power, power factor, frequency, current flowing on the neutral line(only on 3 phase 4 wire measurement), Active power energy, reactive power energy, apparent power energy, demand measurement (with digital output alarm function available)

103. HV DC test set (0-100kV DC)- 1No.

Input: 230V±10%, 50Hz, 1PHASE

Output voltage: 0-100KV DC @ 10mA

Display: Digital LED Display for KV and mA

Accuracy of Meters: 1.5%

Accessories:

- Input Power Cable
- Interconnecting Cables
- Earth Cable
- Discharge Rod with Grounding Cable

104. HV measuring probe (0-66Kv)- 1No.

HV DC measuring probe.

Voltage rating: 0-70KV DC

Accuracy Class: 1.0%

Total Resistance: 100 MOhms

Complete with probe, Coaxial Cable and Digital KV meter

105. Telescopic earthing rod (Suitable for earthing the HV & EHV system)- 1No.

(PORTABLE EARTHING EQUIPMENT 'F' CLASS INSULATED, SUITABLE UPTO 400KV SYSTEM)

- Common operating pole with operating socket- 1 no.(1.2m long)
- Extension handles- 4Nos.(Each 1.4m long)
- Line end clamps- 3 Nos. Suitable from 19MM to 65MM Conductors(This covers ACSR Moose conductor)
- Earth end clamps- 3Nos.
- Flexible Braided & Transparent Sheathed copper conductor 32 Sqmm, 10mtr long- 3 Nos.
- Nylon Carrying case (For Rods)- 1No.

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- Nylon Carrying Case (For Accessories)-1 No.

106. Portable CT analyser test set for measurement of Ratio, knee point, IR value and polarity - 1 No.

(Current transformer & Potential transformer Analyzer)

The CTT will test the current transformer ratio, phase shift, polarity, Excitation, Saturation, winding resistance and winding insulation resistance.

Applications

CT Saturation/Excitation
CT Ratio, Polarity & Phase angle
CT Winding Resistance
CT Insulation resistance
CT Burden

Measurement Range:

- Voltage Output: 0-50V/ 0-200V/ 0-600V @ 2A
0-1200V @1.5A, 0-2000V @1.2A
- Current reading: 0-1.9999A RMS $\pm 0.5\%$
- Insulation Resistance: 2-500 Mohms
- Phase Angle: 0-360 degree
- Data Storage: up to 200 test files with up to 10 excitation curves per file

Interface with PC to be provided.

Note:-

- 1) All equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.
- 2) All equipment shall be supplied with associated trolley/table/bench etc.

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S. NO	BOQ	ITEM DESCRIPTION	QUANTITY	UNIT PRICE EX-WORKS	TOTAL PRICE EX-WORKS
	ITEM CODE				
1	556-11010-A	Insulation tester (Megger) 5 KV	1		
2	556-11003-A	Insulation tester (Megger) 2.5KV	1		
3	556-11002-A	Mega ohmmeter 10 kV	1		
4	556-11036-A	Clip on ammeter AC	2		
5	556-11037-A	Clip on ammeter DC	2		
6	556-11239-A	DC Clamp on ammeter	1		
7	556-11053-A	Digital ductor ohmmeter	1		
8	556-11240-A	Analog Multimeters (AVO meters)	5		
9	556-11096-A	Interfacial Tension Meter	1		
10	556-11011-A	AC Milli-ammeter	2		
11	556-11175-A	Substandard Frequency Meter	1		
12	556-11059-A	Digital Time Counter	2		
13	556-11214-A	HV discharge rods up to 39.5 kV	3		
14	556-11215-A	HV discharge rods From 132 kV to 420 kV	3		
15	556-11127-A	Portable Cable Core Identification Kit	2		
16	556-11160-A	SF6 & Halogen Gas Detector	2		
17	556-11093-A	Hydrogen Gas Detector	2		
18	556-11056-A	Phase Sequence Indicator	3		
19	556-11143-A	Portable Recording Meters	2		
20	556-11216-A	Moving Iron Ammeters (0-5A range)	2		
21	556-11217-A	Moving Iron Ammeters (0-100A range)	6		

22	556-11148-A	Portable Selective Level Meter with Tracking level Generator and Impedance Return Loss Measurement	1		
23	556-11241-A	Selective Level Oscillator	1		
24	556-11242-A	Precision Portable Digital Frequency meter	1		
25	556-11152-A	Power Factor Meter	2		
26	556-11139-A	Portable Capacitance Meter	2		
27	556-11203-A	Vibration/ Sound Level Meter			
27.1		Vibration Level Meter	1		
27.2		Sound Level Meter	1		
28	556-11058-A	Digital tachometer (Non-Contact type) Photo electric Optical	2		
29	556-11201-A	Universal Bridge (LCR-Q-Bridge)	1		
30	556-11157-A	Relay Repair Tool Kit	3		
31	556-11218-A	Standard Current Transformer (50-1500A)	2		
32	556-11219-A	Standard Current Transformer (10-100A)	2		
33	556-11171-A	Standard Potential Transformer	2		
34	556-11147-A	Primary Injection Set	1		
35	556-11220-A	Automatic relay test set (portable type) [Relay Secondary Injection Testing Set(0-100A)]	2		
36	556-11221-A	Automatic relay test set (portable type) [Relay Secondary Injection Testing Set (0-30A)]	1		
37	556-11033-A	Circuit Breaker Analyser	1		
38	556-11025-A	AutoTransformer (VARIAC) THREE PHASE			
38.1		4 Amps	3		
38.2		8 Amps	3		
38.3		28 Amps	3		
39	556-11063-A	Dual Trace Portable Storage Oscilloscope with camera (and associated PC & software) (0-100kHz)	1		
40	556-11136-A	Portable Moisture Meter	1		

41	556-11009-A	Insulation Tester (Megger) 500V	5		
42	556-11001-A	Insulation Tester (Megger) 1000V	2		
43	556-11226-A	Earth Resistance Testers (Four terminals)	2		
44	556-11229-A	High Voltage Testing Kit 10KVA (AC)	2		
45	556-11230-A	High Voltage Testing Kit 25KVA (AC)	2		
46	556-11035-A	Clamp on Wattmeter	1		
47	556-11243-A	DC Earth Fault Locator	2		
48	556-11244-A	Vibration Meter Cum Analyser	1		
49	556-11116-A	Portable digital Multimeters (True RMS type)	6		
50	556-11118-A	Analogue Multimeter (Portable)	3		
51	556-11126-A	Three Phase Sub Standard Wattmeter (Portable)	6		
52	556-11245-A	DC Milli-ammeter	2		
53	556-11232-A	DC Milli-Voltmeter	2		
54	556-11233-A	DC Moving Coil Micro ammeter (0-300 Microamps)	1		
55	556-11234-A	DC Moving Coil Milli ammeter (6-60 Milliamps)	1		
56	556-11055-A	Digital Phase Angle (Power Factor) meter	2		
57	556-11125-A	Platinum RTD Digital Temperature Indicator	1		
58	556-11135-A	Portable Light Intensity Meter (Lux Meter)	1		
59	556-11212-A	Battery Operated Insulation tester (Megger)	2		
60	556-11153-A	Precision Manual Scanning Radio meter	1		
61	556-11013-A	AC Voltage/ Current Standard	1		

62	556-11024-A	AutoTransformer (VARIAC) SINGLE PHASE			
62.1		4 Amps	3		
62.2		8 Amps	3		
62.3		28 Amps	3		
63	556-11031-A	Cable Fault location set	1		
64	556-11123-A	Partial Discharge Test set (contact loss) Portable type	1		
65	556-11184-A	Thermal Image camera (portable)	1		
66	556-11060-A	Variable Frequency Source	1		
67	556-11186-A	Three Phase Shifter	1		
68	556-11167-A	Special Equipment for lighting Arrestors (Both gapped & gap less)	1		
69	556-11048-A	Dew Point Meter	1		
70	556-11202-A	Vacuum Measurement Meter	1		
71	556-11213-A	AC Milli-Voltmeter	2		
72	556-11097-A	Kelvin Double Bridge	2		
73	556-11246-A	Microprocessor based Automatic Pensky Martin Flash point apparatus	1		
74	556-11247-A	Microprocessor based Gas Chromatograph and Data Station	1		
75	556-11248-A	Microprocessor Based dielectric Strength Analyser	1		
76	556-11134-A	Microprocessor based Coulometric Kurl Fischer Monitor Meter	1		
77	556-11181-A	Microprocessor based Dielectric Constant & Tan Delta Meter	1		
78	556-11249-A	Infrared Distance Temperature Indicator	2		
79	556-11015-A	Acidity Test Set for Transformer Oil	1		
80	556-11194-A	Buchholz relay Gas Analyser	1		
81	556-11250-A	Buchholz relay Testing Kit	1		
82	556-11251-A	Oil resistivity test kit	1		

83	556-11252-A	Non Contact radiation pyrometer	1		
84	556-11253-A	Digital Voltmeter	2		
85	556-11051-A	Digital Frequency Meter	1		
86	556-11188-A	Tong Tester (Digital Clamp on ammeter and Voltmeter)			
86.1		10 μ A- 5A	5		
86.2		1A- 10A	5		
87	556-11254-A	Cathode Ray Oscilloscope(Portable)	2		
88	556-11255-A	Multichannel high speed Ultraviolet Oscillograph for testing of AVRs, ACB's	1		
89	556-11030-A	Circuit breaker Contacts Resistance Measurement	1		
90	556-11256-A	Non Magnetic Surveyors Umbrella	1		
91	556-11107-A	Mercury in glass thermometer	1		
92	556-11158-A	Rheostats			
92.1		2A/1000 ohm	4		
92.2		8A/200 ohm	4		
92.3		5A/100 ohm	4		
92.4		12A/18 ohm	4		
93	556-11042-A	Shunts			
93.1		75A , 50mV	1		
93.2		150A , 50mV	1		
93.3		300A , 50mV	1		
94	556-11104-A	Loading Transformers	1		
95	556-11257-A	Phase Shifting Transformers	1		
96	556-11258-A	Portable Computerized combustible gas analyser	1		
97	556-11114-A	Motor Checker	2		
98	556-11259-A	DC variable power supply source	1		

99	556-11260-A	Vacuum tester	1		
100	556-11133-A	High Voltage Detector	1		
101	556-11261-A	Tool Kit for instrument mechanic	6		
102	556-11040-A	Computerized relay test bench	1		
103	556-11045-A	Decade resistance box (for testing & calibration of rotor E/F relay)	1		
104	556-11262-A	Single phase transformer for checking of knee point voltage for CT	1		
105	556-11263-A	Milli ohm meter (Suitable for measuring the winding resistance of generator, motor, Transformers)	1		
106	556-11082-A	Harmonic Analyser	1		
107	556-11085-A	HV DC test set (0-100kV DC)	1		
108	556-11264-A	HV measuring probe (0-66kV)	1		
109	556-11265-A	Telescopic earthing rod (Suitable for earthing the HV & EHV system)	1		
110	556-11266-A	CT analyser test set (Portable) for measurement of Ratio, knee point, IR value and polarity	1		

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 ARRANGEMENT

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ANNEXURE – B

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

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

Note:

1. TOTAL CHARGES = (Charges as per S.No.1) + [No. of Days(*) x Unit Charges as per Sl. No. 2]
- *: To be certified by BHEL site
2. Charges for site visits shall be payable as indicated in the NIT.



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1	Insulation tester (Megger) 5 kV	1						
2	Insulation tester (Megger) 2.5 kV	1						
3	Mega ohmmeter 10 kV	1						
4	Clip on Ammeter AC	2						
5	Clip on Ammeter DC	2						
6	DC clamp on meter	1						
7	Digital Ductor Ohmmeter	1						
8	Analog multi-meters (AVO meters)	5						
9	Interfacial Tension Meter	1						
10	AC milli ammeter	2						
11	Sub-standard Frequency meter	1						
12	Digital Time Counter	2						
13	HV discharge rods Upto 39.5kV	3						
14	HV discharge rod From 132kV to 420 kV	3						
15	Portable Cable Core Identification Kit	2						
16	SF6 & Halogen Gas detectors	2						
17	Hydrogen Gas detectors	2						
18	Phase Sequence Indicator	3						
19	Portable recording meters	2						
20	Moving Iron Ammeters (0-5A)	2						



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21	Moving Iron Ammeters (0-100A)	6						
22	Portable Selective Level Meter with Tracking level Generator and Impedance Return Loss Measurement	1						
23	Selective level Oscillator	1						
24	Precision Portable Digital Frequency Meter	1						
25	Power Factor Meter	2						
26	Portable Capacitance Meter	2						
27	Vibration/Sound Level meter							
27.1	Vibration Level meter	1						
27.2	Sound Level meter	1						
28	Digital Tachometer (Non-contact type) (Photo electrical optical)	2						
29	Universal bridge (LCR-Q-Bridge)	1						
30	Relay repair tool kit	3						
31	Standard Current Transformer (50-1500A)	2						
32	Standard current transformer (10-100A)	2						
33	Standard potential transformer	2						
34	Primary Injection Set	1						
35	Automatic relay test set (portable type) [Relay Secondary Injection Testing Set(0-100A)]	1						
36	Automatic relay test set (portable type) [Relay Secondary Injection Testing Set (0-30A)]	1						
37	Circuit Breaker analyser	1						



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38	Three Phase Auto transformer (VARIAC)							
38.1	4A	3						
38.2	8A	3						
38.3	28A	3						
39	Dual Trace Portable Storage Oscilloscope with camera (and associated PC& software) (0-100kHz)	1						
40	Portable Moisture Meter	1						
41	Insulation Tester (Megger) 500V	5						
42	Insulation Tester (Megger) 1000V	2						
43	Earth Resistance Testers (Four terminals)	2						
44	High Voltage Testing kit 10KVA (AC)	2						
45	High Voltage Testing kit 25KVA (AC)	2						
46	Clamp-on Wattmeter	1						
47	DC Earth Fault locator	2						
48	Vibration Meter-cum-Analyser	1						
49	Portable digital multimeters (true RMS type)	6						
50	Analogue multimeter (Portable)	3						
51	Three Phase Sub Standard Wattmeter (Portable)	6						
52	DC milliammeter	2						



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53	DC Millivoltmeter	2						
54	DC Moving Coil Micro Ammeter (0-300 Microamps)	1						
55	DC Moving Coil Milli Ammeter (6-60 Milliamps)	1						
56	Digital Phase Angle (Power Factor) meter	2						
57	Platinum RTD Digital Temperature Indicator	1						
58	Portable Light Intensity Meter (Lux Meter)	1						
59	Battery Operated Insulation Tester (Megger)	2						
60	Precision Manual Scanning Radio meter	1						
61	AC voltage / current standard	1						
62	Auto transformer (VARIAC) SINGLE PHASE							
62.1	4Amp	3						
62.2	8Amp	3						
62.3	28Amp	3						
63	Cable Fault location set	1						
64	Partial Discharge Test set (contact loss) Portable type	1						
65	Thermal Image Camera(portable)	1						
66	Variable frequency source	1						
67	Three Phase Shifter	1						
68	Special equipment for testing lightning Arrestors (Both gapped and gap less)	1						
69	Dew Point Meter	1						



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70	Vacuum Measurement Meter	1						
71	A.C. Milli Volt Meter	2						
72	Kelvin Double Bridge	2						
73	Microprocessor based automatic Pensky Martin flash point apparatus	1						
74	Microprocessor based gas chromatograph and data station	1						
75	Microprocessor based dielectric strength analyser	1						
76	Microprocessor based Coulometric Kurl Fischer monitor meter	1						
77	Microprocessor based dielectric constant & Tan delta meter	1						
78	Infrared Distance Temperature indicator	2						
79	Acidity test set for Transformer Oil	1						
80	Buchholz Relay Gas analyser	1						
81	Buchholz Relay testing kit	1						
82	Oil resistivity test kit	1						
83	Non contact radiation pyrometer	1						
84	Digital Voltmeter	2						
85	Digital Frequency Meter	1						
86	Tong testers (Digital clamp on ammeter and voltmeter)							
86.1	10 μ A- 5A	5						
86.2	1A- 10A	5						
87	Cathode Ray Oscilloscope(portable)	2						



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88	Multichannel high speed Ultraviolet Oscilloscope for testing of AVR's, ACB's.	1						
89	Circuit Breaker Contacts Resistance Measurement kit	1						
90	Non-magnetic surveyor's umbrella	1						
91	Mercury in glass thermometer	1						
92	Rheostats							
92.1	2A /1000Ω	4						
92.2	8A /200Ω	4						
92.3	5A /100Ω,	4						
92.4	12A/18Ω	4						
93	Shunts							
93.1	75A,50mV	1						
93.2	150A,50mV	1						
93.3	300A,50mV	1						
94	Loading transformer	1						
95	Phase shifting transformer	1						
96	Computerized combustible gas analyser (Portable)	1						
97	Motor checker	2						
98	DC variable power supply source	1						
99	Vacuum tester	1						
100	High voltage Detector	1						



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101	Tool kit for instrument mechanic	6						
102	Computerized relay test bench	1						
103	Decade resistance box (for testing & calibration of rotor E/F relay)	1						
104	Single phase transformer for checking of knee point voltage of CT.	1						
105	Milli ohm meter (Suitable for measuring the winding resistance of generator, motor, Transformers)	1						
106	Harmonic analyser	1						
107	HV DC test set (0-100kV DC)	1						
108	HV measuring probe (0-66kv)	1						
109	Telescopic earthing rod (Suitable for earthing the HV & EHV system)	1						
110	CT analyser test set (Portable) for measurement of Ratio, knee point, IR value and polarity	1						

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.
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DOCUMENT TITLE

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SCHEDULE OF DEVIATIONS



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Sl. No	Specification Clause Ref.	Technical Deviation	Reason for Deviation
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We the undersigned hereby certify that the above mentioned are the only Technical deviations w.r.t the Technical Specification.

Particulars of bidder/Authorised representative				COMPANY SEAL
NAME	Designation	Signature	Date	