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–E002, REV. 0

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

CONTENTS

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

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

S.No.	Reference Clause No. of Section-II (if any)	Specific Requirement/Change

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-VX-392-556-E0YY
2	Catalogue	PE-VX-392-556-E1YY

Complete Document numbers shall be provided after order placement.

4.2 The requirement of copies of Drawings/Documents for projects to be submitted by successful bidder shall be as per enclosed ANNEXURE-A

ANNEXURE- A

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.

ANNEXURE-I OF SECTION-I

DETAILED TECHNICAL PARAMETERS

1. 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 be hand driven insulation tester for checking insulation and conductor during simulated operating conditions in high tension electrical and electronic fields.
The instrument shall have an in-built continuity range and shall have an AC voltage measuring 0-500 volts.

2. 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: ±3% of rated output

Scale length upto 98 mm

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

Accuracy: ±2% of full scale or better

3. AC milli ammeter - 2 Nos.

Laboratory precision type, moving iron milli ammeter

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

Accuracy: ±0.5% of full scale

The instrument shall be suitable for voltages upto 750 volts.

4. 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.

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

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

Measurement Range: 0.01μΩ to 200Ω
Scales: 20μ to 200μ
Resolution: 0.01μ
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.

6. 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.

Cable fault locator shall detect faults of 415V, 1.1kV, 6.6kV and 11kV voltage grade cables.

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

7. 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
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 100 KHz: 2Nos.

PC interface: Ethernet port

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

8. 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

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

9. 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.

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

10. 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: ±0.25% of the reading
± LSD

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

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

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)

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

12. 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

13. Kelvin Double Bridge – 2 Nos.

Resistance range: 0.02 micro ohm – 1.1 ohm

Resolution: 0.02 micro ohm

Accuracy: ±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.

14. Mercury in glass thermometer - 1 No.

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

15. 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

16. 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: ± 0.2% or the reading

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: ± 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: 0-200µA / 2000 µA / 20mA /200mA /200A

Accuracy: ± 0.75% of the reading

Response time: Less than 1 sec.

d) AC current: 0-200µA / 2000 µA / 20mA /200mA /200A, 40-60 Hz

Accuracy: ± 1.5% of the reading

Response time: 5 sec or better.

e) Resistance: 0-200 ohms / 2ohms / 20kohms / 200kohms / 2Mogohms / 20Mogohms/200Mohms

Accuracy: ± 0.2% upto Kilohm ranges and ±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

17. 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- 2Ω /200 Ω /200k Ω/20M Ω/200M Ω

18. 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: +/- 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 filler.

Indication: Analog / Digital
The instrument shall be provided with a suitable leather carrying case.

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

19. 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 caulometric karl ischer 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

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

20. Portable Capacitance Meter - 2 Nos.

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

Accuracy: ±0.5% upto 20 microfarads
±2% above 20 microfarads

21. Reference Meter with Compatible Phantom Load Test - 1 Nos.

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°C 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.

22. 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.

23. Rheostats - 4Nos. of each range

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

24. 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

25. 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

26. 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.

Capacitance Range: 0-1.1µF to facilitate Generator Testing (Range extension inductors to be supplied)
Bridge Capacitance Range: 0-5µF
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: ±0.2% Readings & ±10pf
Tan delta: ±1.0% Rdg ±0.02% F.S
Frequency: ±0.02Hz

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

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

27. 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

28. 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: ±0.3% of the reading or better

b) Inductance: 1 micro henry to 1000 henries
Resolution: 1 micro henry
Accuracy: ±0.3% of the reading or better

c) Resistance: 0.001 ohms to 1.0 mega ohms
Resolution: 0.1 milli ohms
Accuracy: ±0.3% of the reading or better

d) Q-factor: 0-10 at 1 kHz

Frequency range for all the measurements
Internal/ External Oscillator: 40 Hz to 20 kHz

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

29. 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

Ammeter : Range: 0-9.99mA
Resolution: 0.01mA
Accuracy: ±1.5% of Full Scale

Ripple Max. : 7%

Accessories : Cables, Clamps & Clips etc.

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

30. A.C. Milli Volt Meter – 2 Nos.

Purpose: For Calibration of Meters and Transducers.

Type: RMS Measurement, Digital type, Desktop model, 3½ Precision Display.

Range: 0-250 V in multi range.

Accuracy: ±0.5 %.

Power Supply: Battery/AC

Accessories: Rugged carrying case, Mains leads, Probes, etc.

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

31. 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: ±0.2%

VA burden: 10VA

Suitable for primary conductor threading/terminal connections.

32. 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: ±0.2%

VA burden: 10VA

Suitable for primary conductor threading/terminal connections

33. Automatic relay test set (portable type)

The test set shall be able to test the latest numerical relays, eg from Dobley, 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.

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

34. 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: ± 0.5% of full scale

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

35. 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: ± 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.

36. 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.

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

37. 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.

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

38. Oil resistivity test kit – 1 No.

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

*** Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.**

39. Non contact radiation pyrometer – 1 No.

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

40. Voltmeters (Digital) - 2 Nos.

Range:	0-1000V
Accuracy class:	±1%
Frequency ranges:	45-55 Hz

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

Low resistance digital ohmmeter (Micro Ohm Meter)

Measurement Range:	0.01µΩ to 200Ω
Scales:	20µΩ to 200Ω
Resolution:	0.01µΩ in lowest range of 2mΩ
Accuracy:	±0.1% Of reading ±2 Digits
Current Range:	up to 10A

Complete with test leads, carrying case and battery charger

Note: -

1) All equipment shall be supplied with associated trolley/carrying case etc. as applicable.

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 55°C.

1.5 The Analog instruments shall be provided with knife-edge pointer and anti – parallax mirror.

1.6 The Bidder to quote only 'one' make/model against each equipment best to suit specification requirement.

1.7 The instrument shall be suitable for hand held operation, rugged in construction and suitable for field use.

1.8 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.

1.9 Bidder to note that "In case any offered make / model becomes obsolete or is stopped manufacturing by manufacturer, next higher model of the same make may be considered for ordering / supply at contract stage, without any price implication. In such cases, bidder is required to furnish valid confirmation letter from OEM as proof of change of model (citing reason: obsolete technology or stopping of manufacturing with date of effect) and that the offered model is "technically equivalent or better".

2.0 CODES AND STANDARDS

Some of the standards, which shall generally be followed, are listed below. Other applicable relevant 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-II with technical specification.

3.0 DESIGN CRITERIA:

3.1 Electrical Laboratory Equipment shall be used for metering, testing, calibration, diagnostics etc. of 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.

3.3.1 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 TEST REQUIREMENTS:

4.1 All equipment to be tested as per latest edition of relevant standards. Further, testing shall include verification of physical, functional & technical parameters of equipment & accessories, in line with approved datasheet.

4.2 The tests shall be carried out by the vendor at in-house lab/ OEM lab/ Third party govt. accredited lab. Charges for all these tests shall be deemed to be included in the bid price.

4.3 Vendor to furnish test report to BHEL for review/ acceptance. BHEL/BHEL's customer may witness the testing of equipment.

5.0 PACKING:

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.

6.0 DEMONSTRATION TO BHEL / BHEL'S CUSTOMER

6.1 The vendor shall be responsible for demonstration of the supplied equipment at site, conforming the satisfactory operation.

6.2 The equipment for which demonstration is required at site shall be intimated by BHEL.

6.3 The charges for visit to site for demonstration at site shall be in-line with 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:

a) Compliance to Technical parameters of various equipment as specified in Annexure-I of Section-I in Data Sheet – B (as enclosed).

b) Technical leaflets/ Catalogues/Product Manual of the Equipment

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 Following documents/drawings shall be submitted after placement of order for BHEL & customer's approval:

a) Technical Datasheet for each equipment
b) Technical leaflets/ Catalogues/Product Manual of the Equipment
c) Tests Reports and calibration certificate
d) General arrangement drawing showing constructional features, accessories, connections, range and rating, mounting arrangement, space requirement etc.
e) Detail instructions for application, assembly & testing of equipment.
f) Wiring and schematic diagrams (if applicable).
g) 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 equipment test as per relevant standard.

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	**6000/-**

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. Bidder to note that provision of maximum 4 visits amounting to total 12 man days is envisaged for respective bidders.

DATA SHEET-B (ANNEXURE-II OF SECTION-II)

ITEM No.	ITEM DESCRIPTION	QTY.	UNIT	Description (Detailed Specification)	Whether Quoted or not (Yes/No)	MAKE	MODEL No	COUNTRY OF MANUFACTURE	EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO)	ADDITIONAL ACCESSORIES RECOMMENDED	REMARKS
1	Insulation Tester (Megger) 1000V	2	No.	Test Voltage: 100/250/500/1000V DC							
				Megaohm Range: 20/50/100/200 megaohms							
				The instrument shall be hand driven insulation tester for checking insulation and conductor during simulated operating conditions in high tension electrical and electronic fields.							
				The instrument shall have an in-built continuity range and shall have an AC voltage measuring 0-500 volts.							
2	Insulation tester (Megger) 2.5 kV	1	No.	Test voltages: 2.5kV DC either continuously variable or variable in steps of 500/1000 Volts							
				Voltage stability: ±3% of rated output							
				Scale length upto 98 mm							
				Mega ohm Range: 0.1 to 50,000 Mohms either on multiple scales or provided with suitable range multiplier.							
				Accuracy: ±2% of full scale or better							
3	Insulation Tester (Megger) 500V	5	No.	Test Voltage: 100/250/500V DC							
				Megaohm Range: 20/50/100/200 megaohms							
				The instrument shall be hand driven insulation tester for checking insulation and conductor during simulated operating conditions in high tension electrical and electronic fields.							
				The instrument shall have an in-built continuity range and shall have an AC voltage measuring 0-500 volts.							
4	AC milli ammeter	2	No.	Laboratory precision type, moving iron milli ammeter							
				Range: 0-12 amps in multi ranges with a lowest range of 0-150 milliamps							
				Accuracy: ±0.5% of full scale							
				The instrument shall be suitable for voltages upto 750 volts.							
5	Acidity test set for Transformer Oil	1	No.	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.							

DATA SHEET-B (ANNEXURE-II OF SECTION-II)

ITEM No.	ITEM DESCRIPTION	QTY.	UNIT	Description (Detailed Specification)	Whether Quoted or not (Yes/No)	MAKE	MODEL No	COUNTRY OF MANUFACTURE	EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO)	ADDITIONAL ACCESSORIES RECOMMENDED	REMARKS
				The set shall be suitable for determination of acidity in transformer oil.							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							
6	Circuit Breaker Contacts Resistance Measurement kit	1	No.	Measurement Range: 0.01μΩ to 200Ω							
				Scales: 20μ to 200μ							
				Resolution: 0.01μ							
				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.							

DATA SHEET-B (ANNEXURE-II OF SECTION-II)

ITEM No.	ITEM DESCRIPTION	QTY.	UNIT	Description (Detailed Specification)	Whether Quoted or not (Yes/No)	MAKE	MODEL No	COUNTRY OF MANUFACTURE	EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO)	ADDITIONAL ACCESSORIES RECOMMENDED	REMARKS
7	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							
				(e) Voltage Decay.							
				Cable fault locator shall detect faults of 415V, 1.1kV, 6.6kV and 11kV voltage grade cables.							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							
8	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 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 100 KHz: 2Nos.							
				PC interface: Ethernet port							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							

DATA SHEET-B (ANNEXURE-II OF SECTION-II)

ITEM No.	ITEM DESCRIPTION	QTY.	UNIT	Description (Detailed Specification)	Whether Quoted or not (Yes/No)	MAKE	MODEL No	COUNTRY OF MANUFACTURE	EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO)	ADDITIONAL ACCESSORIES RECOMMENDED	REMARKS
9	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							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							
10	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.							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							
11	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: ±0.25% of the reading ±LSD							

DATA SHEET-B (ANNEXURE-II OF SECTION-II)

ITEM No.	ITEM DESCRIPTION	QTY.	UNIT	Description (Detailed Specification)	Whether Quoted or not (Yes/No)	MAKE	MODEL No	COUNTRY OF MANUFACTURE	EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO)	ADDITIONAL ACCESSORIES RECOMMENDED	REMARKS
12	Harmonic analyser	1	No.	Voltage Range : 150/300/600/1000V Allowable Input: 10-110% of each range Display Range: 5 to 120% of each range Accuracy: ±0.3% of reading ±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: ±0.3% of reading ±0.2% fs +Accuracy of clamp sensor (For Sine wave 45-65Hz)							
				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)							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							
13	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							
14	Kelvin Double Bridge	2	No.	Resistance range : 0.02 micro ohm – 1.1 ohm							
				Resolution : 0.02 micro ohm							
				Accuracy: ±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.							
15	Mercury in glass thermometer	1	No.	Range: 0 to 150°C, 12 inch long							
				Purpose: To measure temperature							

DATA SHEET-B (ANNEXURE-II OF SECTION-II)

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16	Motor checker	2	No.	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							
17	Portable digital multimeters (true RMS type)	6	No.	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 : ± 0.2% or the reading 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 : ±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: 0-200µA / 2000 µA / 20mA /200mA /200A Accuracy: ±0.75% of the reading Response time: Less than 1 sec.							
				d) AC current: 0-200µA / 2000 µA / 20mA /200mA /200A, 40-60 Hz Accuracy : ±1.5% of the reading Response time : 5 sec or better.							
				e) Resistance: 0-200 ohms / 2ohms / 20kohms / 200kohms / 2Mogohms / 20Mogohms/200Mohms Accuracy: ±0.2% upto Kilohm ranges and ±2% for Megaohm ranges							
				Display : 3 ½ digit LCD							
				Overload and surge-voltage protection shall be provided in the instrument.							

DATA SHEET-B (ANNEXURE-II OF SECTION-II)

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				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							
18	Analogue multimeter (Portable)	3	No.	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: 0-2Ω /200 Ω /200k Ω/20M Ω/200M Ω							
19	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 : +/- 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 filler.							
				Indication : Analog / Digital							
				The instrument shall be provided with a suitable leather carrying case							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							
20	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 caulometric karl ischer 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							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							
21	Portable Capacitance Meter	2	No.	Range : 0-200 picofarads 0-200 nano farads 0-2000 micro farads in multi-ranges							
				Accuracy : ±0.5% upto 20 microfarads ± 2% above 20 microfarads							

DATA SHEET-B (ANNEXURE-II OF SECTION-II)

ITEM No.	ITEM DESCRIPTION	QTY.	UNIT	Description (Detailed Specification)	Whether Quoted or not (Yes/No)	MAKE	MODEL No	COUNTRY OF MANUFACTURE	EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO)	ADDITIONAL ACCESSORIES RECOMMENDED	REMARKS
22	Reference meter with compatible Phantom Load Test	1	No.	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°C 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.							
23	Primary Injection Set	1	No.	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.							
24	Rheostats										
24.1	2A /1000Ω	4	No.	2A /1000Ω							
24.2	8A /200Ω	4	No.	8A /200Ω							
24.3	5A /100Ω,	4	No.	5A /100Ω,							
24.4	12A/18Ω	4	No.	12A/18Ω							
25	Standard potential transformer	2	No.	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							
26	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							

DATA SHEET-B (ANNEXURE-II OF SECTION-II)

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27	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.							
				Capacitance Range: 0-1.1µF to facilitate Generator Testing (Range extension inductors to be supplied)							
				Bridge Capacitance Range: 0-5µF							
				Tan-Delta Range: 0 to ± 10							
				Power Loss: 0 to 2kwatts							
				Power Loss: 0 to 2kwatts							
				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: ±0.2% Readings & ±10pf Tan delta: ±1.0% Rdg ±0.02% F.S Frequency: ±0.02Hz							
				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							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							
28	Buchholz Relay Gas analyser	1	No.	The equipment is suitable to test and analyse various gasses by Analytical Test Method.							
				No. of Pipettes : 5							
				Glass : Borosil Glass							

DATA SHEET-B (ANNEXURE-II OF SECTION-II)

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29	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 : ±0.3% of the reading or better							
				b) Inductance : 1 micro henry to 1000 henries Resolution : 1 micro henry Accuracy: ±0.3% of the reading or better							
				c) Resistance : 0.001 ohms to 1.0 mega ohms Resolution : 0.1 milli ohms Accuracy : ±0.3% of the reading or better							
				d) Q-factor: 0-10 at 1 kHz							
				Frequency range for all the measurements Internal/ External Oscillator: 40 Hz to 20 kHz							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							
30	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							
				Ammeter : Range: 0-9.99mA Resolution: 0.01mA Accuracy: ±1.5% of Full Scale							
				Ripple Max. : 7%							
				Accessories : Cables, Clamps & Clips etc.							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC							
31	A.C. Milli Volt Meter	2	No.	Purpose: For Calibration of Meters and Transducers.							
				Type: RMS Measurement, Digital type, Desktop model, 3½ Precision Display.							
				Range: 0-250 V in multi range.							
				Accuracy : ±0.5 %.							
				Power Supply : Battery/AC							
				Accessories: Rugged carrying case, Mains leads, Probes, etc.							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							
32	Standard Current Transformer (50-1500A)	2	No.	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 : ±0.2%							
				VA burden : 10VA							
				Suitable for primary conductor threading/terminal connections.							

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33	Standard current transformer (10-100A)	2	No.	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 : ±0.2%							
				VA burden : 10VA							
				Suitable for primary conductor threading/terminal connections							
34	Automatic relay test set (portable type) [Relay Secondary Injection Testing Set(0-100A)	2	No.	The test set shall be able to test the latest numerical relays, eg from Dobley, Omicron, Freza etc.							
				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.							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							
				The test set shall be able to test the latest numerical relays, eg from Dobley, Omicron, Freza etc.							
				Suitable for testing current, voltage, time and power relays							
				Input : 240V AC, 50 Hz single phase AC							
				Output current : 0-30A continuously variable in multiple ranges							
				AC voltage output : 0-250 V continuously variable							

DATA SHEET-B (ANNEXURE-II OF SECTION-II)

ITEM No.	ITEM DESCRIPTION	QTY.	UNIT	Description (Detailed Specification)	Whether Quoted or not (Yes/No)	MAKE	MODEL No	COUNTRY OF MANUFACTURE	EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO)	ADDITIONAL ACCESSORIES RECOMMENDED	REMARKS
35	Automatic relay test set (portable type) [Relay Secondary Injection Testing Set (0-30A)]	1	No.	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.							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							
36	DC Millivoltmeter	2	No.	Laboratory, precisions type moving coil milli voltmeter							
				Voltage : 0-500 Volts in multi ranges with a lowest range of 0-75 millivolts							
				Accuracy : ±0.5% of full scale							
				The instrument shall be provided with knife edge pointer with anti parallax mirror, and leather carrying case							
37	DC milliammeter	2	No.	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 : ±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.							
38	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.							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							

DATA SHEET-B (ANNEXURE-II OF SECTION-II)

ITEM No.	ITEM DESCRIPTION	QTY.	UNIT	Description (Detailed Specification)	Whether Quoted or not (Yes/No)	MAKE	MODEL No	COUNTRY OF MANUFACTURE	EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO)	ADDITIONAL ACCESSORIES RECOMMENDED	REMARKS
39	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.							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							
40	Oil resistivity test kit	1	No.	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							
				Equipment shall be able to run through PC or having the RS-232/ USB ports for interfacing with PC.							
41	Non contact radiation pyrometer	1	No.	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							
42	Digital Voltmeter	2	No.	Range : 0-1000V							
				Accuracy class : ±1%							
				Frequency ranges : 45-55 Hz							

DATA SHEET-B (ANNEXURE-II OF SECTION-II)

ITEM No.	ITEM DESCRIPTION	QTY.	UNIT	Description (Detailed Specification)	Whether Quoted or not (Yes/No)	MAKE	MODEL No	COUNTRY OF MANUFACTURE	EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO)	ADDITIONAL ACCESSORIES RECOMMENDED	REMARKS
43	Milli ohm meter (Suitable for measuring the winding resistance of generator, motor, Transformers)	1	No.	Low resistance digital ohmmeter (Micro Ohm Meter)							
				Measurement Range: 0.01μΩ to 200Ω							
				Scales : 20μΩ to 200Ω							
				Resolution : 0.01μΩ in lowest range of 2mΩ							
				Accuracy : ±0.1% Of reading ±2 Digits							
				Current Range : up to 10A							
				Complete with test leads, carrying case and battery charger							

NOTE :-

1) EQUIPMENT TO BE SUPPLIED ALONG WITH ESSSNTIAL 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 APLLICABLE.