1 X 660 MW PANKI TPS

VOLUME II B

TECHNICAL SPECIFICATION
FOR
ELECTRICAL LAB EQUIPMENT (METERING & TESTING)

SPECIFICATION NO.: PE–TS–426–556–E003, REV. 00

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 is 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.

1.5 The requirement of section-1 shall prevail and govern in case of conflict between the corresponding requirements of Section-I and section-II.

2.0 BILL OF QUANTITIES

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

2.2 Supplier to also give the following undertaking in the BOM: "The BoM provided herewith completes the scope (in content and intent) of material supply under PO No. ----------, dated ------. Any additional material which may become necessary for the intended application of the supplied item(s)/package will be supplied free of cost in most reasonable time."

3.0 SPECIFIC TECHNICAL REQUIREMENT

S.No.	Reference Clause No. of Section-II (if any)	Specific Requirement/Change
1	Cl. No. 1.9	In addition to the clause 1.9 of section-II, Bidder to note that "During contract stage , if it is found that the offered model is not meeting the specification requirement , bidder shall offer higher model of same make meeting specification requirement without any techno commercial implication to BHEL"
2	Cl. no 4.1	Shall be read as "BHEL/BHEL's customer shall witness the testing of equipment. Vendor to furnish test report/calibration certificate to BHEL for review/ acceptance. "

1X660 MW PANKI TPS

TECHNICAL SPECIFICATION FOR ELECTRICAL LABORATORY EQUIPMENT

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Annexure-I of SECTION-I DETAILED TECHNICAL PARAMETERS

Item no.	Description	Purpose
1	**Portable 5KV Digital Automatic Insulation Tester(2 Nos)** Complete with test leads, mains lead, carrying case, PC down load software, instruction manual, test/calibration certificate etc Measuring Ranges **:** Resistance **:** 100 Kohm to 10 Terra Ohm (minimum range) Current : > 5 mA Test Voltages : 500, 1000, 2500 and 5000V Accuracy : Maximum ±5% of reading. Test Time : Adjustable <15 Sec. -> 10 min. Display : LCD 3½ digit with analog bar graph for Resistance, test voltage, current, PI Data Storage : 100 values (Minimum) Capacity Power Supply : 240V, 50 Hz and rechargeable dc battery MMI : Via RS232 Printer/PC interface : Via RS232C and/ or USB Safety Standard : IEC 1010-1 EMC Standard : EN50081-1 & EN 50082-1 Accessories : Shielded plugs with 1 metre cable, carrying case with handle /strap.	For checking the insulation level & polarizing index of insulation material of electrical equipments such as transformers, motors, generators, cables and switchgears.
2.	**Portable Digital DC Resistance Meter (1 No)** Dual channel, direct-reading ohm meter; having a safe discharge circuitry and in-built printer with date & time stamping, software for remote PC control heavy duty connecting cables, clamps, operating manual, test/calibration certificate and transportable case. Having following features : *Resistance ranges 25 micro ohm to 6 kilo ohm Resolution* **Nom. Range 0.1 micro ohm** **Power Supply :** 240V, 50 Hz, 1 phase AC **Accuracy :** ·0.1% of reading + 5 digit **Exctn. Current :** 0.1 – 25A with compliance open circuit voltage of 100V **Display :** 4½ digit backlit LCD (256 x 128) **Data Storage :** Upto 1000 measurements Reading rate : 2 sec Interface for remote Control : RS232 Test Voltage : 50 V pure DC (Noise < 10mVpp) Test Current : 10 mA to 60 A (selectable) pure DC Measuring inputs : 2- current, 4- Potential (2Channels)	For simultaneous measurement of HV & LV winding resistance and check on OLTC operation
3	**Portable High Current Digital Micro Ohm Meter (1 No) Features:** **Type :** 4-terminal, Kelvin type **Dc test current** : 0—300/400/600 A, adjustable in 3 ranges. **Resolution**: 0.1 micro ohm **Display**: mV,A and micro ohm displayed simultaneously, direct ohms reading at any current, large back lit liquid crystal display -Thermal & over current protection -Compact and portable -Isolated RS232 interface for printer or PC connection Ranges: Should be fully auto ranging, selecting from two current ranges and three voltage ranges. The resistance range for different current and voltage settings to be approximately as specified below: 60.00A 600.0A 40.00 mV 0-600 micro ohm 0-60micro ohm 400.0 mV 0-6 milli ohm 0-600micro ohm 4000.0 mV 0-60 milli ohm 0-6 milli ohm Current and voltage accuracy: ±0.5% of reading +5digits. Resistance accuracy of ± 1.0% of reading+10 digits over the range 10-600 A.	For measuring contact resistance of circuit breakers, isolators, busbars etc.
	Protection and safety The unit should be protected by electronic over current and duty cycle trips on the output, thermal trips on the power components, and fuses on the input and regulator. An earth terminal to be provided for connection to a local earth. The unit should comply with BSEN61010, and must be CE marked. Power supply 100-250 V AC one phase,50 Hz. Measurement ranges : 0.01 – 100 micro ohm 0.1 – 600 micro ohm 1.0 – 6000 micro ohm 10.0 micro – 60 milli ohm 0.1 milli– 600 mili ohm 1.0 milli – 6 ohm Resolution : 0.01 micro ohm to 1.0 milli Ohm Accuracy : ±0.2%± 2 dgt to ±0.5% ± 10 dgt Display : with 4 digit LED or LCD (backlit) Data Storage : > 300 readings Interface : RS232 Test Current : Upto 200A Accessories : Set of 2 nos. 6m Kelvin leads with C-clamp, 3m ground lead with clamp, 2m USB cable, power cord, fuse, software.	
4	**<u>Portable Automatic Earth Tester (1 No)</u>** Microprocessor-controlled, user-friendly, with self- diagnostic features and alpha-numeric display, re-chargeable battery. Mounted in a robust case and provided with hammer & 4 GI spikes and 50M long cable on a cable winder. Having following features : **Earth resistance :** 0 Ohm-20K Ohms (Auto ranging) **Range** with 1 mΩ resolution And ±0.5% ±2 digit accuracy **Test frequency :** 100-160 Hz in 0.5 Hz steps **Test current :** 50 mA **Maxm output voltage:** <50V (RMS) **Maxm. Interference :** 40V peak to peak (50 Hz) **Display :** 3½ digit Alpha numeric LCD **Standards :** IEC 1010-1, EN 50081-1, EN 50082-1	For measuring earth electrode resistance and soil resistivity using Warner 4- terminal method

5.	**Precision Digital Multimeter (2 Nos)** 7½digit precision multimeter Having a large 24- digit vacuum fluorescent display, a bar graph function allowing user programming of high and low pass/fail limits, audible & visual indication of component specification and Auto Dynamic Filter (ADF) to enable automatic selection of suitable filter. 7½digit DMM suitable for calibration of voltage/current sources, decade boxes, frequency sources & also should have the option of facility for low thermal 10 channel scanner for multiple inputs to be displayed or compared. Basic Accuracy: 18PPM/Year **DC Volts: 14 ranges :** 3 mV to 10 KV with resolution Min. resolution:10nV **DC Current:15 Range :** 3 µA to 30A Resolution. : 100pA Resistance: 22 Ranges : 30 milli ohm to 1 G ohms Min. Resolution. :10 n Ohm Frequency Range : 0 Hz to 100 K Hz Resolution. : 1Hz Accu.: ±10 ppm ± 1 digit AC Voltage: 6 Ranges : 3mV to 3 kV Min. Resolution. :1 micro V AC Current: 8 ranges : 0 to 30A Resolution. : 1 nA Capacitance: 5 Ranges : 0-300 microfarad Resolution. : 1pF Accuracy: ±0.2%+ 20 digits/± 0.25 %+20 digits PT 100 : Range: -200C° to + 600°C Resolution: 0.001° Accuracy: ±0.05°C/±0.06°C Special Features: Self test mode, diode/Zener test, Max./Min functions, Continuity testing, AC/Dc coupled facility, countdown and sample beep on long filter periods, oxygen free copper input terminals.To be supplied with calibration certificate having national traceability.	
6.	**Portable Digital Frequency Meter (2 Nos)** Rugged, high accuracy portable frequency meter/calibrator in a dust-tight, water resistant case. Having LCD display complete with test leads, carrying case, 9V battery and instruction manual. Ranges : **0-100 KHZ / 0-1000 Hz** **Resol. :** 1 KHZ / 0.1 Hz **Accuracy :** ±0.1% FS ±1 LSD **Step Size :** 10% of range **Scroll Size :** 0.1% of range **Input :** 1V to 100V p-p **Output :** 5V p-p Square Wave **Maxm. load :** 5 mA	
7	**Digital Sound Level Meter (2 Nos)** Having condenser type microphone, frequency and time weighting functions, AC & DC outputs supplied with 9V battery and calibration screw driver. **Dual Range :** Low : 35 to 100dB High : 65 to 130 dB **Resolution :** 0.1 dB **Features :** • Record max/min values over time ☐ Auto power off and max Hold functions ☐ Tripod mountable ☐ Fast/slow response time ☐ LCD display ☐ Complete with re-chargeable batteries	
8	**Digital Tachometer (2 Nos)** Non-contact photo electric optical type. Having features such as reading hold, memory recall & low battery indication. **Range :** 0-10,000 RPM **Resol. :** 0.1 RPM to 1 RPM **Accuracy :** ±0.1 rpm for range 0-1000 rpm; ±1 rpm for range 1,001-10,000 rpm **Display :** 5 digit LCD **Optical Range :** Upto minimum 300 mm **Battery :** Re-chargeable	
9.	**Portable Vacuum Tester (2 Nos)** For testing the condition of vacuum in medium voltage (6.6KV) switchgear with automatic discharging facility and high voltage screened cable and over load/over voltage protection One (1) **Display :** Digital display of applied Voltage in KV and leakage Current in mA. Red & green Indications for defective & acceptable chambers **Resolution :** 0.1 KV and 0.01 mA **Input :** 240V AC ± 10% , 50 Hz + 5% **Output :** 0-60 KV 0-9.99 mA **Accuracy :** ± 1.5% of Full Scale **Duty Cycle :** 2 min ON, 2 min OFF **Other Feature** :a) Unit protection : Overload trip b) Protective earth terminal c) High voltage cable outlet with suitable connectors	
10.	**Portable Light Intensity Meter (3 Nos)** With selenium photocell, 2 metres lead and filters. **Ranges :** 0-200/0-2000/0-20000 Lux **Accuracy**: ±4% of full scale **Response time :** 2.5 times per sec **Other feature :** a) Single-hand-held unit b) Display resolution : 0.01, 0.1, 1 lux c) Backlit LCD display d) Power source : 9V alkaline (re-chargeable)	
11	**Tong testers (5 nos of each range, total 15 Nos)** (digital clamp on ammeter and voltmeter)- for measurement of pilot currents without endangering the opening of CT circuit. Measuring range: i) 0-5/25A, 0-60/300/600V ii) 0-1/5A, 0-60/300/600V iii) 0-10/30/300/1000A, 0-60/300/600V Display: 3 ½ digit LCD Voltage AC: 0.1-400V Input resistance: 10MΩ Resistance measuring range:0.1- 400Ω Frequency range for AC voltage/current: 1kHz-40kHz Clamp opening: minimum 50mm	
12	**Portable Phase Sequence/Continuity Indicators (3 Nos)** To indicate phase continuity and phase rotation sequence of 3-phase power circuits. Complete with colour-coded & insulated 1 Metre long fused leads with boot-protected alligator clips and carrying case. Having an impact resistant plastic body with encapsulated circuitry incorporating neon indicators for phase continuity and phase sequence. **Rated 100-600V, 40-60 Hz**	

13	**Standard tool kit (3 Nos)** **Comprising following minimum tools :** • Cutting Plier 6" • Nose Plier 6" • Wire cutter 6" • Cable cutter small • Cable cutter big • D/E Spanner set 6- 32 mm • Adjustable spanner 13 mm • Adjustable spanner 26mm • Pipe wrench 12" • Allen key set (1/16"-3.8") • Allen key set (1.5-10 mm) • Magnetic Screw driver • Rough file 6" • Smooth file 6" • Slide wrench (6,8,10") • Ratchet Screw driver • Spring setting tool • Inspection mirror & Torch • Ring spanners • Box spanners • Burnishing tool • Contact pressure gauge • Factor gauge • Test plugs with link plugs • Screw drivers • Nose pliers Scissors	
14.	**Portable Hydrogen Purity Meter (1 Nos)**	
15.	**Portable High Voltage / Live Line Detector (2 Nos)** Electronic type, giving audio-visual indication for presence of voltage/charge. Having in-built self-diagnostic check feature. Insulating stick shall be class'F' insulated. Range : Upto 300 kV	
16.	**Vibration Meter – cum – Analyser (1 Nos)**	
	i) Measurement range	Displacement 0 to 2 mm Velocity 0 to 1000 mm/s acceleration 0 to 100 mm/sq.s
	ii) Frequency range	10 to 1000 Hz
	iii) Power supply battery operated	200-240V, 50Hz, single phase AC supply
	iv) Environmental Temp. range Relative humidity	0 to 40oC Upto 95%
17.	**Platinum RTD Digital Temperature Indicator (1 Nos)**	
	i) Display	LED/LCD
	ii) Temperature measurement range	-100^0 550^0C
	iii) Resolution up to 200^0C above 200^0C	0.1^0C
	iv) Above 200^0C	1.0^0C
	v) Accuracy	$+/-1^0$C
	vi) Ambient Temperature	$0-40^0$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.	

SECTION-II

STANDARD TECHNICAL SPECIFICATION

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 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 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 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)	3 VISIT	**20000/-**
2	LUMP SUM ALL INCLUSIVE CHARGES FOR EXPERIENCED / CAPABLE ENGINEER PER DAY	9 DAY	**5000/-**

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 3 visit amounting to total 9 man days is envisaged for respective bidders.

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TECHNICAL SPECIFICATION FOR ELECTRICAL LABORATORY EQUIPMENT

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DATA SHEET-B (Annexure-II of Section-II)

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.

3) All equipment shall be properly packed in Galvanized sheet steel trunk/ box with proper lock & key arrangement except for equipment which are trolley mounted or are already available in rugged steel/wooden box packing. Further, any damage (reading error/calibration error/broken parts/missing parts etc) found on receipt at site, leading to replacement of parts/whole item, shall be to bidder's account

Item no.	Description	Purpose	Whether Quoted or not (Yes/No)	Make	Model no	Country of Manufacture	EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO)	Catalogue (attached or not)	Remarks
1	**Portable 5KV Digital Automatic Insulation Tester(2 Nos)** Complete with test leads, mains lead, carrying case, PC down load software, instruction manual, test/calibration certificate etc Measuring Ranges **:** Resistance **:** 100 Kohm to 10 Terra Ohm (minimum range) Current : > 5 mA Test Voltages : 500, 1000, 2500 and 5000V Accuracy : Maximum ±5% of reading. Test Time : Adjustable <15 Sec. -> 10 min. Display : LCD 3½ digit with analog bar graph for Resistance, test voltage, current, PI Data Storage : 100 values (Minimum) Capacity Power Supply : 240V, 50 Hz and rechargeable dc battery MMI : Via RS232 Printer/PC interface : Via RS232C and/ or USB Safety Standard : IEC 1010-1 EMC Standard : EN50081-1 & EN 50082-1 Accessories : Shielded plugs with 1 metre cable, carrying case with handle /strap.	For checking the insulation level & polarizing index of insulation material of electrical equipments such as transformers, motors, generators, cables and switchgears.							
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3	**Portable High Current Digital Micro Ohm Meter (1 No) Features:** **Type :** 4-terminal, Kelvin type **Dc test current** : 0—300/400/600 A, adjustable in 3 ranges. **Resolution**: 0.1 micro ohm **Display**: mV,A and micro ohm displayed simultaneously, direct ohms reading at any current, large back lit liquid crystal display -Thermal & over current protection -Compact and portable -Isolated RS232 interface for printer or PC connection Ranges: Should be fully auto ranging, selecting from two current ranges and three voltage ranges. The resistance range for different current and voltage settings to be approximately as specified below: 60.00A 600.0A 40.00 mV 0-600 micro ohm 0-60micro ohm 400.0 mV 0-6 milli ohm 0-600micro ohm 4000.0 mV 0-60 milli ohm 0-6 milli ohm Current and voltage accuracy: ±0.5% of reading +5digits. Resistance accuracy of ± 1.0% of reading+10 digits over the range 10-600 A.	For measuring contact resistance of circuit breakers, isolators, busbars etc.							
	Protection and safety The unit should be protected by electronic over current and duty cycle trips on the output, thermal trips on the power components, and fuses on the input and regulator. An earth terminal to be provided for connection to a local earth. The unit should comply with BSEN61010, and must be CE marked. Power supply 100-250 V AC one phase,50 Hz. Measurement ranges : 0.01 – 100 micro ohm 0.1 – 600 micro ohm 1.0 – 6000 micro ohm 10.0 micro – 60 milli ohm 0.1 milli– 600 mili ohm 1.0 milli – 6 ohm Resolution : 0.01 micro ohm to 1.0 milli Ohm Accuracy : ±0.2%± 2 dgt to ±0.5% ± 10 dgt Display : with 4 digit LED or LCD (backlit) Data Storage : > 300 readings Interface : RS232 Test Current : Upto 200A Accessories : Set of 2 nos. 6m Kelvin leads with C-clamp, 3m ground lead with clamp, 2m USB cable, power cord, fuse, software.								

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7	**Digital Sound Level Meter (2 Nos)** Having condenser type microphone, frequency and time weighting functions, AC & DC outputs supplied with 9V battery and calibration screw driver. **Dual Range : Low** : 35 to 100dB High : 65 to 130 dB **Resolution :** 0.1 dB **Features :** • Record max/min values over time ☐ Auto power off and max Hold functions ☐ Tripod mountable ☐ Fast/slow response time ☐ LCD display ☐ Complete with re-chargeable batteries								
8	**Digital Tachometer (2 Nos)** Non-contact photo electric optical type. Having features such as reading hold, memory recall & low battery indication. **Range :** 0-10,000 RPM **Resol. :** 0.1 RPM to 1 RPM **Accuracy :** ±0.1 rpm for range 0-1000 rpm; ±1 rpm for range 1,001-10,000 rpm **Display :** 5 digit LCD **Optical Range :** Upto minimum 300 mm **Battery :** Re-chargeable								
9.	**Portable Vacuum Tester (2 Nos)** For testing the condition of vacuum in medium voltage (6.6KV) switchgear with automatic discharging facility and high voltage screened cable and over load/over voltage protection One (1) **Display :** Digital display of applied Voltage in KV and leakage Current in mA. Red & green Indications for defective & acceptable chambers **Resolution :** 0.1 KV and 0.01 mA **Input :** 240V AC ± 10% , 50 Hz + 5% **Output :** 0-60 KV 0-9.99 mA **Accuracy :** ± 1.5% of Full Scale **Duty Cycle :** 2 min ON, 2 min OFF **Other Feature** :a) Unit protection : Overload trip b) Protective earth terminal c) High voltage cable outlet with suitable connectors								
10.	**Portable Light Intensity Meter (3 Nos)** With selenium photocell, 2 metres lead and filters. **Ranges :** 0-200/0-2000/0-20000 Lux **Accuracy**: ±4% of full scale **Response time :** 2.5 times per sec **Other feature :** a) Single-hand-held unit b) Display resolution : 0.01, 0.1, 1 lux c) Backlit LCD display d) Power source : 9V alkaline (re-chargeable)								

11	**Tong testers (5 nos of each range, total 15 Nos)** (digital clamp on ammeter and voltmeter)- for measurement of pilot currents without endangering the opening of CT circuit. Measuring range: i) 0-5/25A, 0-60/300/600V ii) 0-1/5A, 0-60/300/600V iii) 0-10/30/300/1000A, 0-60/300/600V Display: 3 ½ digit LCD Voltage AC: 0.1-400V Input resistance: 10MΩ Resistance measuring range:0.1- 400Ω Frequency range for AC voltage/current: 1kHz-40kHz Clamp opening: minimum 50mm								
12	**Portable Phase Sequence/Continuity Indicators (3 Nos)** To indicate phase continuity and phase rotation sequence of 3-phase power circuits. Complete with colour-coded & insulated 1 Metre long fused leads with boot-protected alligator clips and carrying case. Having an impact resistant plastic body with encapsulated circuitry incorporating neon indicators for phase continuity and phase sequence. **Rated 100-600V, 40-60 Hz**								
13	**Standard tool kit (3 Nos)** **Comprising following minimum tools :** • Cutting Plier 6" • Nose Plier 6" • Wire cutter 6" • Cable cutter small • Cable cutter big • D/E Spanner set 6- 32 mm • Adjustable spanner 13 mm • Adjustable spanner 26mm • Pipe wrench 12" • Allen key set (1/16"-3.8") • Allen key set (1.5-10 mm) • Magnetic Screw driver • Rough file 6" • Smooth file 6" • Slide wrench (6,8,10") • Ratchet Screw driver • Spring setting tool • Inspection mirror & Torch • Ring spanners • Box spanners • Burnishing tool • Contact pressure gauge • Factor gauge • Test plugs with link plugs • Screw drivers • Nose pliers Scissors								
14.	**Portable Hydrogen Purity Meter (1 Nos)**								
15.	**Portable High Voltage / Live Line Detector (2 Nos)** Electronic type, giving audio-visual indication for presence of voltage/charge. Having in-built self- diagnostic check feature. Insulating stick shall be class'F' insulated. Range : Upto 300 kV								
16.	**Vibration Meter – cum – Analyser (1 Nos)**								
	i) Measurement range	Displacement 0 to 2 mm Velocity 0 to 1000 mm/s acceleration 0 to 100							
	ii) Frequency range	10 to 1000 Hz							
	iii) Power supply battery operated	200-240V, 50Hz, single phase AC supply							
	iv) Environmental Temp. range Relative humidity	0 to 40oC Upto 95%							
17.	**Platinum RTD Digital Temperature Indicator (1 Nos)**								
	i) Display	LED/LCD							
	ii) Temperature measurement range	-100^0 550^0C							
	iii) Resolution up to 200^0C above 200^0C	0.1^0C							
	iv) Above 200^0C	1.0^0C							
	v) Accuracy	$+/-1^0$C							
	vi) Ambient Temperature	$0-40^0$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.								