BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

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TYPE OF DOC.	TECHNICAL SPECIFICATION			SIGN			
TITLE	OPERATION & MAINTENANCE TEST EQUIPMENT & TOOLS			NAME	AJ	SS	AG
				DATE	18/11/13	18/11/13	18/11/13
				GROUP	TBEM	W.O.No	80014

CUSTOMER	**Power Grid Corporation of India Ltd**
PROJECT	**±800KV, 6000MW, HVDC MULTI-TERMINAL NER/ER – NR/WR INTERCONNECTOR-I PROJECT**
CA NO.	**C-61901R-S056-8/CA-II/3660 dated 22.12.2011 for on shore Supplies & C-61901R-S056-8/CA-IV/3662 dated 22.12.2011 for Services**
STATION	**Biswanath Chariali , Agra & Alipurduar**

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution	To	TBEM	TBMM	TBQM	Vendor
	Copies	1	1	1	1

SECTION - I

Scope, Quantities and Specific Technical Requirements

1.1 Scope

This specification is intended to specify the requirements for Supply of operation & maintenance test equipment & tools required at the sites as mentioned in subsequent clause. The scope of work shall encompass at least the following:

i) Detailed design of all the equipment
ii) Inspection and testing before supply
iii) Packing, Loading & Transportation to site
iv) Providing engineering data, drawings, Brochures and O & M manuals for BHEL/Powergrid review, approval and records.
v) Testing, Demonstration at site & Commissioning of the testing equipments.

1.2 Terminology

The following terminology shall be applicable for the purpose of interpreting the relevant clauses of the specification.

Project title:	±800KV, 6000MW, HVDC MULTI-TERMINAL NER/ER - NR/WR INTERCONNECTOR-I PROJECT
Owner/ Employer:	Power Grid Corporation of India Limited (POWERGRID)
Contractor:	Bharat Heavy Electricals Limited (BHEL)

1.3 Bill of quantities

Sr. No.	Instrument Name	Quantity			Make	Model
	OPERATION & MAINTENANCE TEST EQUIPMENT & TOOLS	Agra LOA REF NO – BB.II.A.29.3 & BB.II.F.24	Biswanath Chariali LOA REF NO – AA.A.29.3 & BB.I.F.24	Alipurduar LOA REF NO – CC.I.A.29.3 & CC.I.F.24		
		1 lot comprises of the following	1 lot comprises of the following	1 lot comprises of the following		

1	Digital Micro Ohm Meter for Contact Resistance Measurement	1	1	1	Megger	MOM 690
2	Battery Operated 5 kV Insulation Tester	1	1	1	Megger	S1-554/2
3	Phase Sequence Meter	1	1	1	Megger	PSI 700
					Extech	480400 / PRT 200
					Sew	855
4	Transformer Winding Resistance & Tap Changer Testing Kit	1	1	1	Megger	MTO330
5	DC Current Source	1	1	1	Megger	CSU 600AT
					Vanguard	PCI 600
6	Automatic Relay Testing Unit	1	1	1	Megger	Freja 300
					Ponovo	PW636i
7	Harmonic Analyzer	1	1	1	Megger	PA 9 plus
					ZES Zimmer Electonics systems	LMG 95
					Algodue Electronika	UPM 6100
					Hioki	3390
8	Digital Multimeter	6+1*	6	6	Megger	AVO 410
					Extech	EX 530
					Hioki	DT4252
9	Primary Injection Kit	1	1	1	Megger	ODEN AT/2S
10	CT Secondary Winding Magnetization Kit	1	1	1	Megger	Magnus

					Vanguard	EZCT 2000B
11	Phase Angle Meter	1	1	1	Megger	PAM 360
12	Earth Fault Locator for Floating DC System	2	2	2	Megger	BGFT/BGL
13	Paper Moisture Analyzer	1	1	1	Megger	IDAX 200 with VAX 230
14	Frequency Response Analyzer	1	1	1	Megger	FRAX 101
15	PPM/ moisture content measurement kit for oil	1	1	1	Megger	KF -Lab MkII
					Metrohm	831 KF Coulometer with Diaphragm
					Photovolt Instruments Inc.	Aquatest 1010
16	Transformer oil dielectric strength measuring instrument [0-100kV range as per IS-6792]	1	1	1	Megger	OTS100AF
					Deltatronic	Portatest 100A-2
17	Clip on Meter	2	2	2	Fluke	345
18	Thermovision Camera	1	1	1	Flir (sweden)	P660
19	Digital Camera	1	1	1	Sony/Canon	DSC-H5 or better
20	Precision Multi-meter	1	1	1	Time Electronics	5075
21	Digital Oscilloscope along with color printer	2+1*	2	2	Tektronix	TDS 2014 B
22	Capacitance, Inductance Resistance Meter	1	1	1	Agilent	4263 B

23	Function Generator	2 +1*	2	2	Agilent	33220A
24	Frequency Counter	2	2	2	TTI	PFM 3000
25	Impedance Analyzer	1	1	1	TTI	LCR 400
26	Variable Stabilized Power Supply	1	1	1	Power Stablo	
27	Variac (single phase & three phase) Power Supply	1	1	1	Power Stablo	
28	Three Phase Automatic Transformer Turns Ratio & Vector Group Meter	1	1	1	Tettex, UK	2795
29	Vibration Cum Noise Level Meter	1	1	1	B&K and Pulsar	VT 60 Module 1.1 and M33
30	PCB Repairing Work Station	1	1	1	HAKKO	FM 203 ESD
31	Portable Earthing Kit	3	3	3	Catu (France)	
32	Imaging Camera for SF_6 Leak Detection	1	1	1	UViRCO	COROCAM IV
33	Tan Delta kit with built in function of voltage Booster & current booster	2*	0	0	Omicron	CPC 100, CP TD1
34	Relay Test Kit	2*	0	0	Omicron	CMC 356
35	Sludge content measuring instrument; to cover the complete range as required	1	1	1	Culture Instruments	
36	Acidity measuring instrument; to cover the complete range as required	1	1	1	Culture Instruments	

37	Interfacial Tension measuring instrument; to cover the complete range as required	1	1	1	Culture Instruments	
38	Flash point measuring fully automatic instrument based on Pensky's Marten's closed cup (ASTM D-93) method with automatic sample changer and complete accessories (Measurement in ^{0}C)	1	1	1	HAMCO	

NOTE :- * Marked quantities to be supplied at POWERGRID GURGAON office. (LOA Ref No. BB.II.F.24.51, BB.II.F.24.52 & BB.II.F.24.53)

All the above listed equipments shall be supplied with standard accessories & any other accessory required to meet the technical specification.

1.4 Specific Technical Requirements

1. The Test equipment shall be delivered to the Employer in new/ fresh condition.
2. Supplier shall provide valid calibration certificate, test certificate & warranty certificate for the quoted test equipments (As applicable), in the event of order.
3. Supplier is required to give an undertaking "to address issue of warranty / after sales services from the respective manufacturer of the equipment".
4. A single order for all the instruments will be placed on a single supplier.
5. Vendor must quote for specified make & model of the instrument. Better model of specified make may also be acceptable subject to POWERGRID approval with no commercial implication.
6. The instrument is intended for use in high-voltage substation (up to 800kV) and industrial environment. The testing equipments are generally meant for carrying out testing at site and movement from one place to another is unavoidable. Therefore equipment shall be robust in design so that it gives desired performance even in adverse site conditions. Necessary transport packing arrangement shall be provided along with the equipment.

SECTION – 2

EQUIPMENT SPECIFICATION

2.1 Digital Micro Ohm Meter for contact resistance measurement

This test kit shall be portable, light weight, robust and tropicalized to suit outdoor applications such as circuit breaker, isolator contact resistance measurement etc. and shall include all accessories like probes/ test leads, lamps for use of conductor's size up to 35mm dia. The test instrument shall provide contact resistance in digital display.
Technical requirements:
Range: 0 to 200 mohm
Accuracy: ± 1 %
Resolution: 1 micro-ohm
Test Current: 0-600A (DC) with 15 Sec load Time and 0-660 A (AC) with 2 sec load time

General Requirements:

The instrument shall contain all standard accessories including test leads with suitable Clamps / connectors and carrying case. It should offer repeatability of test results in charged switch yard conditions. The test kit should be complying with EMC Directive 89/336/EEC AM by 91/263/EEC, 92/31/EEC and 93/68/EEC. As per requirement of ISO-9001, calibration Certificate for each testing instrument covering entire range shall be supplied with the test kit at the time of supply. The testing equipment is generally meant for carrying out testing at site and movement from one place to another is unavoidable. Therefore equipment shall be robust in design so that it gives desired performance even in adverse site conditions. Environmental conditions such as temperature, humidity, vibration, bump etc. shall be as per IEC or equivalent standards.
Necessary transport packing arrangement shall be supplied along with the equipment. The equipment shall generally comply with the requirement of relevant Indian standard or equivalent International standards such as IEC, BS, ASTM, ISO, etc.

2.2 Battery Operated 5 KV Insulation Tester:

Heavy Duty Battery Operated Insulation Resistance tester (5 KV Megger). For Automatic P.I., DAR, Step Voltage and Dielectric Discharge Test.
Technical Requirement:
Voltage selection: 50V to 1KV in 10V steps, 1KV to 5KV in 25 V steps
Instrument should have provision to operate in both modes i.e.

(i) In AC 230 V ± 20% mains
(ii) Internal rechargeable Battery mode.

Instrument should display direct reading of voltage across the test piece when the test is in progress. Instrument should display leakage measurement. Short Circuit current of 3mA. Instrument should have Breakdown or 'Burn' mode Interference Rejection 2mA r.m.s. per KV test voltage. Insulation Resistance Measurement should be in Digital and analogue with backlit display.
Measurement Range:
Insulation resistance range Digital display: 10 KΩ to 15 TΩ.
Analogue display: 100KΩ to 15TΩ.
Current Measurement: 0.01 nA to ±5 mA
Capacitance Measurement: 1 nF to 50 µF
Test time should be selectable from 1 second to 99 minutes.
Voltage Measurement range: 50 to 1000V DC or AC, 0 to 5000V DC
Testing Instrument should have high voltage warning display when input voltage across the terminal is above 50V.
Mains Input voltage: 85-260V, 50Hz.
The instrument should perform automatic test and measure Insulation Resistance, current, capacitance, Polarisation Index, Step voltage tests, DAR & Dielectric Discharge.
Suitable port and software if any for download of digital data to a computer and directly to the printer should be possible. Real Time down load to computer should be possible.
Operating Temperature: 10 °C to 55 °C
Storage Temperature: -20°C to 70 °C
Data storage of 800 reading with Real time RS232 & USB download capability to store test results for trending analysis.
Safety Should Conform to IEC 1010-1 (1995)
Environmental Protection- Instrument should be rated to IP65 EMC Meets IEC61326 including amendment No.1.
Instrument should have compliance to following Safety standards IEC1010-1(1995), EN61010 (1995) to installation category III, 300V phase to earth, 500 V phase to phase.
A suitable calibrator should be provided with the Megger.

General Requirements:

Necessary transport packing arrangement shall be supplied along with the equipment. The instrument shall be supplied with two meter long mains lead and 20 meters long test leads with carrying case. As per requirement for ISO-9001, calibration certificate for each testing instrument covering entire range shall be supplied with the test kit at the time of supply.

2.3 Phase sequence meter

Phase Sequence Meter should determine phase rotation sequence of energised three phase power circuits and indicate phase continuity. Meter should indicate faulty phase if continuity is not proven. Heavily insulated fused leads with boot protected alligator clips should be provided

for extra safety. Identify true phase sequence of energised 3 phase ac power lines up to 600 volts.

2.4 Transformer Winding Resistance & Tap Changer Testing Kit

The equipment shall be line-operated, field-portable designed specifically to measure the dc resistance of all types of magnetic windings safely and accurately.
The equipment shall have high contrast bright 8.4" full VGA color display which can be seen even in direct sunlight environments.
The equipment shall have software On Board that allows for automated control and the option of saving data (information processing, data trending, report generation) in an XML file with all historical data.
The equipment shall read direct digital reading to save time without manual balancing.
The equipment shall have eight Independent measuring channels which allow simultaneous testing of all 3-phase primary and secondary windings. The equipment should have high impedance inputs, each with separate range control and protection provided for flashover caused by inductive kickback. The equipment should have electronically generated and regulated current supply which overcomes high inductance transformers quickly, allowing fast measurements to be taken.
The equipment should have wide resistance range which allows heat-run testing of many transformer types. The equipment should be Lightweight and portable, and ideal for use in shop or substation environments.

SPECIFICATIONS:

Input Voltage: 240V, 50Hz, 1-Phase AC supply
Output Current Ranges: Variable, 5 mA - 10A (dc)
Open-Circuit Test Voltage: 50 Vdc
Rating Continuous use on all ranges
Accuracy: ±0.5% reading, ±0.5% full scale (when current has stabilized)

Other required features:

Should be able to test the operation of on-load tapchangers. Should have Built-in discharge circuit to safely discharge the specimen when test is completed, if lead accidentally disconnects or if power is lost. Should have Built in Safety indicator which gives a visual indication of a charged or discharged specimen, even if power to the instrument is lost.
The equipment should monitor the contact operation of on-load tap changers for the proper make-before-break sequence. If an open circuit condition exists, the instrument shuts down immediately. Should have Built in auto lead compensation circuit to be provided in the instrument.
Current leads, potential leads, shorting lead, User guide should be provided along with the Instrument. Should have over temperature protection which automatically shutdown current to prevent instrument damage.

General Requirements:

It should offer repeatability of test results in charged switchyard. The test kit shall be compatible for EMI/EMC environment as per IEC 1000. As per requirement of ISO- 9001, calibration certificate for each testing instrument covering entire range shall be supplied with the test kit at the time of supply.
Required certificates confirming to above standards shall be furnished along with the kit. The equipment shall generally comply with the requirement of relevant Indian standard or equivalent International standards such as IEC, BS, ASTM, ISO, etc.

2.5 DC current source

General Requirements:

600 A for 1 minute continuous, 200 A Continuously.

2.6 Automatic Relay testing unit

General Requirements:

The test unit should have Delayed On & OFF features with variable time settings, variable AC & DC voltage and current stabilized supply with over load MCB protection and different ranges of built in resistors and capacitors values. The relay shall be capable of testing the entire protective relay installed in HVDC terminal.

2.7 Harmonic analyzer

Self powers from unregulated A-phase voltage input 90-600VAC/110-600VDC or auxiliary IEC input (90-250VAC). Internal, rechargeable backup battery with automatic, built-in charger Unlimited from VA or auxiliary input, 15 minutes recording from backup battery before autostop. Measure up to 600V RMS with applicable voltage, input cables to category 3 certification, 0-600V AC/DC. Accuracy depending upon input voltage range (Supplier to provide datasheet).
Input Impedence 1MOhm
All trending taken are true RMS. Stores maximum, minimum, and average per each user-selected storage interval.

General Requirements:

Capable of measuring the harmonics upto 60th order. The units should also be capable to measure flickers and be used as power analyser with high accuracy being a single channel unit. The equipment should be capable of directly displaying individual and total harmonic distortions.

2.8 Digital multi-meter

General Requirements :

Capable of measuring DC and AC voltages (range 200mV to 600 V), currents (range 2 mA to 10A), frequency and resistance. It shall also have provision of measuring Current range in mA and voltage range in mV. Shall have accuracy of ± 0.2 %.

2.9 Primary Injection Kit

Unit shall be suitable for secondary injection and primary injection as well with built-in timer of 1msec resolution.

Unit shall be rated to 20kVA and through a loading unit be able to out put range 0 to 3000 Amps in series connection and 0-6000A in parallel connection.

For continuous ratings, it should be rated to 10kVA, and output 0 to 1500A in series and 0-3000 A in parallel connection mode.

Input power supply of the test unit should be single phase 50 Hz AC.

2.10 CT Secondary Winding Magnitization Kit

Output 1.0 Amps at 2 kilovolt with overload trip feature.

2.11 Phase Angle Meter

It should be able to measure the phase difference between all possible combinations of input voltages and currents. It shall have measurement range of 0-359.9deg, input current range 0-10A and can be increased by means of a clamp on meter CT, Input voltage 0-500 V, shall be able to measure phase angle between current-current, voltage –voltage and current –voltage of Sine wave with resolution 0.1 degree.

2.12 Earth Fault Locator for Floating DC System

Scope: Supply of Battery Ground Fault Tracer which shall be able to find ground faults on Line in ungrounded Battery/ intricate D.C. System upto 220V, in substations up to 400 KV, Generating Stations, UPS systems and any other ungrounded DC System. The instrument should be manually balanced instrument and capable to identify, track and locate ground fault in ungrounded D.C. Battery System – on line upto maximum voltage to ground 220 V dc. The

instrument should be provided with digital display of voltage and current Signal amplitudes. The instrument should be operable in high electrical noise environment with the provision to adjust the strength of test current. Bridge measurement of fault resistance and System Capacitance should be possible with the instrument. Charging System should be soft start to prevent sensitive relay tripping. The instrument should be immune to distributed noise. The instrument's fault resistance range should be from 1W to 399 KW. The instrument should comprise of Transmitter that operates on mains and a portable, convenient, hand held receiver that operates on battery. The transmitter should be capable of determining fault magnitude and severity before tracking the fault. The measured reading should not be affected by any presence of a.c. ripple or d.c. current upto 15 Amps. Receiver should have gain Control for optional resolution.The transmitter should be caster – mounted for easy portability and should incorporate a resistance and capacitance bridge. It should be possible to null out the System Capacitance from the measurement to prevent erroneous readings on the receiver. Separate 3 digit LCD meters for Volt/Curent on transmitter should be provided with an accuracy of + 5%.
Digital Meter display upto 1.999 with three gain selections should be available on receiver.

SPECIFICATIONS:

Transmitter: Maximum voltage to ground: 220 V dc, Mains: 100 to 240 V ac, 50/60 Hz, 200 VA max.
Source voltage :0 to 50 Vrms (Should be variable)
Source current : 0 to 2.0 Arms (Load dependant)
Source frequency: 20 Hz ±2%
Display (volts) : three-digit LCD +5%
Display (current) : threedigit LCD +5 %
Fuses: dc output, 2A, 600Vdc FET Driver, time-delay,2A,250 V (internal) ac line, 5x20mm, 1 AT, 240V ac, time delay
Operational:
Fault resistance:1 to 399 kΩ @ 50V, Bridge accuracy ± 10%
Line capacitance: 0.01 to 11.1 mF, bridge accuracy ± 20%
Receiver
Electrical: 9V alkaline battery
Power (max.):11 mA at 9 Vdc
Battery life: 40 hours continuous use at 35°C (estimated)
Environmental
Operating temperature range: 32 to 105°F (0 to 40°C)
Storage temperature range:-5 to 130°F (-20 to 55°C)
Humidity: 20 to 95% RH noncondensing
Standards: The equipment shall be conforming to relevant per IEC/IEEE and able to carry out the testing as per IEC/IS recommended practice.
Compatibility: Electromagnetic and Electrostatic inference Compatibility.

Accessories: Source leads, 20ft (6 m) two each single conductor, 14 AWG, or equivalent SWG, 600 V insulation, each conductor fused at 2 A, 600 V dc Current probe, leads, 4ft (1.2 m) ac line cord, 6 ft (1.8 m) Feedback cable, 40ft (12 m) single conductor, 18 AWG, or equivalent SWG, 600 V insulation Instruction Manual Accessories bag & Transit Case.

2.13 Paper moisture analyser

Frequency range: 0.1mHz 7Khz Measurement voltage set 0-30 KV, Measurement Current 0-40mAmps. With real time signal waveform capture.

2.14 Frequency Response Analyzer

The unit shall have best basic Frequency accuracy of >0.01%, controlled By computer through Blutooth, graphical analysis and sweep, Operable via inbuilt battery, Sweep direction from low to high or High to low selectable data collection up to 30000 points user selectable, Sweep settings for individual setting for customer defined frequency bands, Dynamic range (0.1 Hz – 10 MHz) >125 DB, for (10 M Hz – 20 Mhz).

Each substation with transformers to be equipped with a frequency response analyser for analysis of the frequency response of the transformers after delivery also for periodic testing if required.

2.15 Clip On Meter

General Requirements:

2000 A AC, 1000 A DC with a feature of measuring different order harmonics; Accuracy of the instrument shall be 1% of the range. Resolution 100 mA upto 200 A and 1A for higher.

2.16 Thermovision Camera :

Requirement :

The instrument shall be thermal imaging system based on principle of infrared radiation detection to identify hot spots and loose connections in substations and transmission lines up to 800kV AC and 500kV DC. The instrument shall be portable and battery operated.

Functional Requirements :

The thermo vision camera shall have the facility to measure the following temperatures:

- Absolute value of Hot spot temperature.
- Color thermal image of focused object.
- Isotherm temperature.
- Measured temperatures shall be corrected for effects of solar emittance, atmospheric temperature.

Range and Accuracy :

Temperature measurement :- The camera shall be able to measure the hot spot temperatures ranging from 0 to 2000°C with an accuracy of + 1 %.
Focal range shall be from 0.3m to infinity.
The instrument shall be light weight so that Operator can easily scan the Switchyard equipment for hot spots. The instrument shall have storage capacity up to 1200 (2 GB) thermal images.
The instrument should have been proven for repeatability of test results in charged switchyard conditions.
Software for retrieval of data to maintain database and preparation of reports shall be supplied along with the kit.
The hot spot focusing shall be motorized.
Accessories shall also include FOV wide angle lens of 32° or better, 8°FOV telephoto lens for detailed scanning.
Battery and Battery charger: - Battery shall be rechargeable Ni-cad battery. Battery charger should be suitable for single phase 230V AC, 50 Hz, with variations of + 15 % and +5 % in Voltage and Frequency respectively.
Infrared detectors shall be based on Focal plane array technique 640 x 480 FPA.
Instrument shall be capable of measuring hot spot temperature from 1m to 1000 meter distance.
The specification for laptop PC if required shall be latest as per requirement of employer (POWERGRID).
The required software for analysis of data measured shall be supplied along with the equipment.

General Requirements:

The instruments shall contain all standard accessories including testing lead of 20 meters with suitable clamps/connectors and carrying case. The instrument should have been proven for repeatability of test results in charged switchyard conditions. Documentary furnished along with the bid. Environmental conditions such as temperature, humidity, vibration, blimp etc. shall be as per IS-9000 and IS-9001 or equivalent standards. Required certificates confirming to above standards shall be furnished along with the offer. Necessary transport packing arrangement shall be supplied along with the equipment.
The kit shall be compatible for EMI/EMC environment as per IEC. As per requirement of 1SO-9001, calibration certificate for each testing instrument covering entire range shall be supplied

with the test kit at the time of supply. The equipment shall generally comply with the requirement of relevant Indian standard or' equivalent International standards such as IEC, BS, ASTM, ISO, etc.

2.17 Digital Camera

General Requirements:

Suitable for taking pictures of equipments along with accessories during O & M stage. It shall have necessary zoom features and shall be capable of operating in 400 kVAC/ 800 kV DC switchyard. It shall have minimum resolution of 10 Mega pixel, 6x zoom. Storage capacity shall be minimum 1GB. Suitable accessories and necessary interface for downloading feature to HVDC terminal station PC shall also supplied along with camera.

2.18 Precision Multi-meter

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.

7½ Digit DMM suitable for calibration of voltage source, current source, Decade boxes and 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

D.C. Volts : 14 Ranges: 3mV to 10kV
Min Resolution: 10nV

D.C. Current : 15 Ranges: 3uA to 30A
Maximum Resolution: 100pA

Resistance : 22 Ranges: 30mohm to 1Gohm
Min Resolution: 10nOhm

Frequency : Range: 0 to 100kHz
Resolution: 1Hz

A.C. Voltage : 6 Ranges: 3mV to 3kV
Min Resolution: 1 micro V

A.C. Current : 8 Ranges: 0 to 30 Amps
Min Resolution: 1 nA

Capacitance : 5 Ranges: 0- 300uF
Min Resolution: 1pF
Accuracy: ± 0.2% + 20/ ± 0.25% + 20 digits

PT 100 : Range: -200ºC to +600ºC

Resolution: 0.001ºC
Accuracy: ± 0.05ºC/ ± 0.06ºC

SPECIAL FEATURES
Self test Mode, Diode/Zener Test, Max/Min functions, Continuity Testing ,A.C./D.C. Coupled facility, Countdown and sample beep on long filter periods Oxygen free copper input terminals.

General Requirements :
Capable of measuring DC and AC voltages and currents, frequency, resistance. It shall also have provision of measuring Current range in mA and voltage range in mV shall be available. Shall have accuracy ± 0.2 %. IEEE INTERFACE should be fitted as standard & confirming to IEEE-488.

OPERATING TEMPERATURE: 0 to 50 degree C
Calibration Certificate to be supplied with calibration certificate having national/ international traceability

2.19 Digital Oscilloscope along with colour printer

General Requirements:

The device should have four digital/analogue channels, analogue and digital triggering features, data storing facility along with the necessary hardware and software needed for down loading the stored data from the oscilloscope buffer memory to the PC hard disc for storage, printing and analysis.

2.20 Capacitance, Inductance Resistance Meter

General Requirements:
Basic accuracy: ± 0.1%
Frequency: 100 Hz to 100 kHz
The equipment should be table top and should be able to carry out measurement of R, L & C of valve components.

2.21 Function Generator

General Requirements :
Capable of generating sine, square, triangular waves for varying magnitude (0 to 20 volt) and varying frequency 0 to 100 kHz shall have high power output and suitable protection. It shall be capable of generating sine, triangle, square, positive and negative pulses, broadband amplifier, DC Input supply 230 V AC.

2.22 Frequency Counter

General Requirements:

Range : 5 Hz to 100 MHz with 8 digits. It shall have high sensitivity, high resolution with 8 digits or better.

2.23 Impedance Analyser

The unit should have feature :-

1) Precise high frequency impedance measurements from 100 Hz to 10KHz.
2) Resistance measurement from 0.1 m Ohm to 990 M Ohms
3) Very fast measurement speed
4) 0.1% to 2% + 1 Dgt basic measurement accuracy
5) Clear display

Test conditions

Frequency range : 100Hz to 10 KHz

Measurement Parameters

1) Capacitance (C)
2) Inductance (L)
3) Resistance (R)
4) Dissipation Factor (D)
5) Quality Factor (Q)

Power Supply Input voltage 230 V AC Mains frequency 50 Hz.

2.24 Variable Stabilized Power Supply

General Requirements:

0 to +/- 50 Volt adjustable stabilized 200 Watt output power supply.

2.25 Variac (single phase & three phase) Power Supply

General Requirements :

250 volt single phase, 415 volt three phase four wire variable supply. Max output current at three phase is 25 Amps per phase. There should be a suitable out put over load prevention.

2.26 Three Phase Automatic Transformer Turns Ratio & Vector Group Meter

The kit should be strictly in compliance with the specifications as stated below:

Ratio measurement range

Range : 0.9 to 20,000: 1

Accuracy: ±0.1%±1digit (to 2500)

±0.2% ±1digit (2500 to 5000)

±0.3% ±1digit (5000 to 10000)
Measuring voltages : 1, 10,40, 100V selectable
Range selection : Full automatic
Phase angle measurement: ±180 degree
Accuracy : ±0.05°
Printer : Built – in

Transformer turns Ratio meter should have built-in three phase lead switching network for testing the no load turns ratio of all types of single and three phase power transformers on all vector groups without changing the connections to the transformer The kit should be supplied along with 10 meters of 3 phase High voltage and Low Voltage cable set, power supply lead, clamps, operating manual and a traceable calibration certificate.

2.27 Vibration Cum Noise Level Meter

The equipment shall be compact, portable and battery operated. It shall conform to IEC, ISO or other international standards. The equipment shall be suitable for measurement of sound, as well as vibration level of EHV class transformers and reactors. The equipment shall have provision for fixing probes for vibration & noise measurements. The equipment shall have suitable arrangement with magnets/studs etc. for mounting. The vibration pick up shall be self-generation type. The sensitive axis shall be the longitudinal axis and shall be perpendicular to the mounting surface. It should be possible to orient the instrument in any mounting position without adjustment and correction.

Technical Parameters:
Vibration Measurement:
I. Frequency range: 10 to 1000 Hz
II. Amplitude range: 0 to 3000 microns in suitable overlapping range (Displacement)
III. Velocity: 0 to 200 mm/s true RMS
IV. Max. Acceleration: 0 to 300m/sec^2 true RMS
V. Sensitivity: 0.3 micron

Vibration pick up:
i. Amplitude linearity: 15 % over the range of measurement.
ii. Amplitude Sensitivity: 0.15 mm/s peak velocity.

Natural resonant Frequency: < 20 Hz

Noise level measurement:
i. Range: 23db to 140db
ii. Accuracy: +0.7db

The equipment offered shall be complete with following:

Standard Accessories:

1. Vibration pickup: 1 no.
2. Straight probe: 1 no.
3. Pick up cable (1.2 mtr): 1 no.
4. Retractile pick up cable (2 mtrs): 1 No.
5. Carrying strap: 1 no.
6. Plug recorder output: 1 no.
7. Carrying case: 1no.

General Requirements:

It should offer repeatability of test results in charged switch yard conditions. The test kit shall be compatible for EMI/EMC environment as per IEC 1000. As per requirement of ISO- 9001, calibration certificate for each, testing instrument covering entire range shall be supplied with the test kit at the time of supply. The testing equipment is generally meant for carrying out testing at site and movement from one place to another is unavoidable. Therefore equipment shall be robust in design so that it gives desired performance even in adverse site conditions. Environmental conditions such as temperature, humidity, vibration, bump etc. shall be as per IS-9000 and IS-9001 or equivalent standards. Required certificates confirming to above standards shall be furnished along with the offer. Necessary transport packing arrangement shall be supplied along with the equipment.

The equipment shall generally comply with the requirement of relevant Indian standard or equivalent international standards 'such as IEC, BS, ASTM, ISO, etc. The Supplier should have adequate "After Sales Service" facility in India. Special facility and software for the Instrument shall be available for downloading the data to station PC /laptop for analysis.

2.28 PCB Repairing Work Station

The equipment should have soldering, de-soldering tools. The soldering machine should have variable temperature settings and controlled through microprocessor based system.

2.29 Portable Earthing Kit

The kit shall have insulated glass fiber telescopic stick suitable for working in 400KV AC/800KV DC. Self bonding spring loaded jaw type clamps of anticorrosive material suitable for various bus bar conductors/ tubes and earthing cables are to be specially designed to combine low electrical resistance with high mechanical strength suitable for system earth fault current so as to enable the user to achieve an effective connection in order to safely dissipate static electricity (including filter capacitor banks).

Conductor sizes:

Rigid conductor, Aluminium tube: Max. 8" tube, Outer Diameter – 202 mm
Flexible conductor, Dia: Max. – 38.22 mm

2.30 Imaging Camera for SF6 Leak Detection

- Camera should be FPA based QWIP detectors with 320 x 240 pixels.
- Field of View (FOV) of lens should be 11° x 8° with manual focus facility.
- Spectral band of Camera should be 10 – 11 microns.
- Thermal sensitivity of camera : 0.03°C.
- Image refresh rate of camera should be at least 50Hz.
- Camera should have inbuilt view leakages on line.
- Integration time of Camera should be adjustable to be used for wide dynamic range, high sensitivity or high temperature scenes.
- RS232 port should be available for interface with PC.
- Video output port should be available in the form of RS170 or CCIR/ S-Video.
- Internal re-chargeable NIMH batteries should be available with camera for at 3 hrs. continuous operation.
- Battery charger should be available as standard accessory with wide input range from 100 to 250 VAC 50/60 Hz. Charger should charge the fully discharged battery within one & a half hours time.
- Time constant of detectors should be 16ms/ 12ms (user selectable).
- Weight of Camera including Battery & lens should not exceed 2.5 kg.
- Power consumption of camera should be < 8W.
- Operating temperature range of Camera should be -15°C to +55°C.
- Storage temperature range of Camera should be -15°C to +70°C
- Camera has protection grade EN 55011:1998 (Emission), EN 61000-4-2:1995 (Electrostatic Discharge), EN 61000-4-3:1996 (Electromagnetic Field Immunity), EN 61000-4-3:1993 (Magnetic Fields) 40g,MIL-STD-810F (bump), 7.15g,MIL-STD-810F (vibration), EN 50081-2 (Generic mission) & EN50082-2 (Generic Immunity).
- Wide angle lens & Telelens should be available as option to detect distant leakages.
- Tripod mounting arrangement for UNC ¼" should be available.
- Images & videos of leakages should be stored in personal Video Recorder, which should be supplied along with camera.

Accessories:
Following accessories shall be provided with each unit:
Battery, Battery Charger, Protective carrying case, Hand Strap, Lens Cap, Tripod, USB Cables, Video cable, Personal Image/ Video Recorder (PVR), Interface cable to connect PVR with Camera