MATERIAL SPECIFICATIONS CELL

TECHNICAL SPECIFICATION

DISTRIBUTION TRANSFORMER TEST SET UP FULLY AUTOMATIC.

TECHNICAL SPECIFICATION NO.

CE/QC-T/MSC-II/DTS
Date:10.01.2017 (Revised on 05.09.2019)

Table of Contents

1.00 SCOPE

This specification covers the general and standard requirement, technical data design, engineering, manufacturing, assembly, inspection & testing at manufacturer's works, supply, delivery, commissioning at stores/laboratory of Transformer Testing Set Up.

The transformer testing set up for testing of 25 KVA to 1500 KVA (Primary –11/22/33 KV. Secondary –433V) Distribution Transformer.

The transformer testing set up shall be fully integrated & automatic. "All the equipment shall be control from panel by screen touch system & manually also" one system can be operated at one time & second will interlock.

The Hardware & Software connectivity for test instruments with PC & printer for further processing to generate inputs & reports.

The transformer testing set up shall be capable for testing of all routine test and other tests as stated in this specification.

The transformer testing set up shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation, in a manner acceptable to purchaser, who will interpret the meaning of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in these specifications and / or the commercial order or not.

2.00 QUALIFYING REQUIREMENTS

2.01 The bidder shall be an original manufacturer / sole authorized dealer / accredited representative of manufacturer of the tendered item. In case of dealers / authorized representative, an authorization letter for quoting in this tender with mentioned tender no. shall be obtained from original manufacturer & shall be submitted along with this bid.

2.02 In case the bidder is not an original manufacturer, the operating experience of the bidder shall be more than 5 years for supplying and providing after sales support of similar or better equipment to NABL Accredited Laboratories / Transformer Manufacturing Companies/ Govt. Depts. /Power Utilities in India or Aboard.

2.03 The bidder's average annual turnover for last 3 years should not be less than INR 40 Cr.

2.04 The Bidder should submit solvency certificate from nationalized bank for min. INR 15Cr.

2.05 The bidder should have a valid ISO 9001 & ISO 14001 certification.

2.06 The bidder should submit minimum 5 Job Completion Certificates for Transformer manufacturer or Utility Projects.

2.07 The manufacturer must have experience of minimum five years in Micro Controller Based automation in the field of Transformer Testing & Integration for supply of similar or better equipments to National / International Accredited Laboratories/Govt. Depts. /Transformer Manufacturers or Power Utilities. The manufacturer shall enclose necessary purchase order copies along with their bid to prove the same.

2.08 The bidder shall submit satisfactorily performance report copies of supplying automatic transformer testing and report generating software from recognized NABL Accredited Laboratories/Govt. Depts./ Transformer manufacturers that the same has given trouble free service. Bid submitted without the performance letters from NABL accredited laboratories shall be treated non responsive.

2.09 The Bidder shall have successfully executed as a prime contractor at least three (3) contracts involving supply, installation, testing and commissioning of fully automatic transformer test bench, within the last five (5) years as of the last date of Bid Submission. Out of the above 3 contracts, two (2) contracts must have been executed outside bidders home country.

2.10 The bidder shall declare that the bidder or their principals have not ever been black listed / defaulter by any utility / ESCOMs / Distribution Company / Laboratories / Any department of State Government or Central Government on record of poor performance such as not properly completing the contract, inordinate delays in supply completion, not supplying the items as per commitment of contract etc.

2.11 Bidder or their principals shall have fully equipped technical support office / laboratory for facilities of testing, calibration, adjustment, diagnosis and repair of equipments in India itself. Bidder or their principals shall have technical support staff posted in India for technical support after sale.

2.12 The Bidder or their principals shall have their own service centers and trained engineers dedicated for trouble shooting and technical support

permanently posted in India. The bidder shall enclose necessary proof that the firm / the manufacturer / the principal the bidder is participating for, has necessary facility to adjust and calibrate the offered measuring units within the country. The list of Plant and Machinery, tools and tackles to carry out services shall be submitted along with the offer.

2.13 The offers of Indian subsidiary company, whose parent company is located abroad fulfilling the qualifying requirements as above, shall be considered provided the Indian participant subsidiary company fulfils the minimum experience of one year of supply or manufacturing of similar or better equipments to National / International accredited laboratories or power utilities. However, the conditions of turnover and supply of minimum quantity of similar or better equipments to National / International accredited laboratories or power utilities as brought out elsewhere in tender documents can be fulfilled by the parent company located abroad on behalf of their Indian subsidiary company. The parent company shall furnish undertaking for accepting responsibility for supplying quality equipments as per specifications and execution of the contract on behalf of its India based subsidiary unit who has participated in the tender in Annexure U-I.

3.00 APPLICATION

The transformer testing set up shall be suitable for the testing of Distribution transformer. The transformer testing set up shall be capable to conduct the following test.

1. Measurement Of Voltage Ratio And Check Of Phase Displacement (Vector Group).
2. Measurement Of Winding Resistance.
3. Measurement Of Insulation Resistance.
4. Measurement Of No Load Loss And No Load Current.
5. Measurement Of Load Loss.
6. Measurement Of Impedance Voltage.
7. Calculation Of Efficiency And Regulation.
8. Applied Voltage Test (High Voltage/Separate Source Test).
9. Induced Over Voltage (DVDF) Test.
10. Measurement Of No Load Loss & No Load Current At Low Voltage.
11. Measurement Of Load Loss And Impedance Voltage At Low Voltage.
12. Measurement Of Single Phase / Three Phase Short Circuit Impedance.
13. Temperature Rise Test.
14. Magnetic Balance Test.

4.00 SERVICE CONDITIONS

The transformer testing set up to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions:

Environmental Conditions

a)	Maximum ambient temperature	55^0 C
b)	Minimum ambient temperature	-10^0 C
c)	Maximum ambient temperature of air in shade	50^0 C
d)	Minimum temperature of air in shade	35^0 C
e)	Maximum daily average temperature	40^0 C
f)	Maximum yearly weighted average temperature	32^0 C
g)	Relative Humidity	100 %
h)	Maximum Annual rainfall	1450 mm
i)	Maximum wind pressure	150 Kg/m^2
j)	Maximum altitude above mean sea level	1000 meters
k)	Isoceraunic level	50 days/year
l)	Seismic level (Horizontal acceleration)	0.3 g

m) Climate: Moderately hot and humid tropical climate conducive to rust and fungus growth.

5.00 APPLICABLE STANDARDS.

The transformer testing set up shall conform in all respects including performance and testing thereof to the latest relevant and applicable Indian / International Standards to be read with up to date and latest amendments / revisions thereoff. E.g. IS 2026, IS 11171, ANSI C57.12.70-1978 CEI/IEC 76-1:1993 and Publication 616:1978, AS-2374 Part 4-1982 (Australian Standard).

Insulation resistance tester - IS: 10656.

Turns ratio meter - IEC61076

The equipment meeting with the requirements of other authoritative standards, which ensures equal or better quality than the standard mentioned above, also shall be considered.

In case the bidder wishes to offer material conforming to the other authoritative standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought

out in relevant schedule. Copy of such standards with authentic English Translations, shall be furnished along with the offer.

In case of any difference between provisions of these standards, the provisions of this specification shall prevail.

6.00 CONSTRUCTIONAL & GENERAL TECHNICAL REQUIREMENT.

The transformer testing set up shall comply with the following requirement.

6.01 The transformer testing set up shall be capable for testing the Transformers ranging of 25 KVA to 1500 KVA, maximum high voltage up to 33 KV to minimum Low voltage of 0.415 KV. 3 Ph & 0.23 KV 1 Ph.

6.02 The transformer testing set up shall include Test Bench & HMI to control & monitor transformer test equipment which includes MG set, HV Tester, CTS PTS, Booster Transformer, Power Analyzer, Ratio Meter, Resistance Meter , Insulation Tester, voltage regulator and automatic change over system with the help of motorized isolators. The HMI shall be LCD touch screen based.

6.03 The Controller, HMI and Software based control, monitoring and reporting system should be used for Transformer Testing and allied functions. Transformer testing equipment's operation can be done through HMI. In addition, optionally operations can be done manually from the test bench. The system should also acquire various parameters from the test instruments on real time basis and analyses the data for preparation of test report. This system shall be used to reduce the testing time, acquire the testing data online and log to the database to solve error-free complex calculation and to generate instant error free report.

6.04 HMI shall be Touch Panel LCD display.

6.05 "All instruments should be integrated in the test panel and low voltage test setup and the online data transfer from these instruments should be done through the PC based software for the test system operation. There will be only one software for all the instruments to acquire the data, store into the database and generate the reports.

6.06 There should be Data logging software with features like instrument selection, data acquisition, and test report development and generation with data/report archiving.

6.07 The software provided should also be capable of data analysis based on user set points.

6.08 The bidder should Supply the necessary interface hardware and appropriate for the system.

6.09 The equipments viz. Insulation resistance tester, Transformer turn ratio meter, Power Analyzer Computer & HMI shall be panel mounted & fixed on the front side of the test bench.

6.10 All the instruments fully automatic integrated with the computer & HMI.

6.11 The supplier shall provide all the software / drivers for all the instrument free of cost.

6.12 The format for all the test reports shall be as per attached sheet with this specification as annexure - I

6.13 Test bench should have following controls & indications from 15" LCD based touch screen in Auto mode and manual mode.

Sr	Equipment Name	Auto mode	Manual mode
1	**Power Control**	Yes	
	a)Main Circuit Breaker Close/Trip	Yes	On / Off switch
	b)Emergency Stop	Yes	Push button
	c)Alert	Yes	
	d)Danger light on/off	Yes	required
	e)Main incomer voltage/current/frequency	Yes	Yes Required
	f)Main incoming Over voltage & over current protection	Yes	
	g)Auto/manual button	Yes	Auto/ Manual Switch
	h) H V Tester ON/OFF	Yes	Yes
	i)H.V tester Raise/ lower	Yes	Yes
	j)H.V Regulator out put voltage & leakage current	Yes	Yes

2	**Dimmer (NLL & LL)**		
	a)Dimmer CB Close/Trip	Yes	With PB & indicator
	b)Dimmer Auto Raise/Lower	Yes	Dimmer raiser PB & Max position indicator
	c)Dimmer Max & Zero position indication	Yes	Dimmer Lower PB & zero position indicator
	d)Dimmer output voltage / current	Yes	Yes
3	**MG Set for DVDF**		
	a)Motor Generator On/Off	Yes	Motor Generator On/Off PB cum indicator
	Excitation On/Off	Yes	Excitation On/Off PB cum indicator
	b)Excitation raise/Lower	Yes	Yes, with PB cum indicators
	c)Generator Output voltage/current/frequency	Yes	yes
	d)Excitation voltage/current	Yes	
	e) Timer with auto start /stop	Yes	Yes
4	**HV Tester**		
	a)HV tester ON/Off	Yes	Yes with PB cum indicator
	b)HV tester Raise/Lower	Yes	Yes with PB cum indicator
	c)HV Regulator output voltage and leakage current	Yes	Yes with PB cum indicator

	d) Timer with auto start /stop	Yes	Yes

6.14 **Temperature**

The specified operation range shall be -10^0 C to $+55^0$ C

6.15 **Frequency**

The rated frequency shall be 50 Hz with a tolerance of ± 5%.

6.16 The Test Bench should be is designed to accommodate all required instruments, test equipment, control & protection system, alarm and indications etc. All Meters should be integrated in the Test Bench and the online data transfer from these meters should be done through the PC based software.

6.17 The testing instruments & equipments included in the offer should be of reputed make.

6.18 All the equipment used shall be of very high quality and most dependable and designed with proper safety margin to carry the necessary electrical parameters like current, voltage and power for continuous use throughout year and proper protection to trip under any abnormality. The test system is likely to be used round the clock.

6.19 All the measuring & testing instruments should be latest calibrated and the calibration certificates from accredited NABL should be provided along with the supplies. All the major equipment will also carry test reports as per the standards

6.20 In Software, data acquisition from various test instruments should be happen without any human intervention. The soft ware validation should be done by the supplier.

6.21 The Software should have user interface that acquires on-line data from test instruments to generate test reports with auto indexing and page numbering. It should consist of an option of manual data entry too. The software can be used in the automatic mode for acquiring data from test instruments with the click of a mouse or data from a test instrument can be read and entered in the software manually.

6.22 The Software should have facility to provide for multiple, user defined permutations and combinations based on the type of a transformer, type of phase, type of winding, type of cooling, various rated capacities, various vector connections, and tap changers.

6.23 The Software should generate auto indexing and page numbering of test reports according to the selected test sequence. It must have the facility of printing test reports on A4 size blank sheets.

6.24 The Software should have easy storage, data retrieval; data analysis capability ensures error-free complex calculations facility.

6.25 In addition to the detailed report format, the software should have the short report facility which gives the report of the routine test to avoid the unnecessary paper wastage. The Software should have the database backup facility to take the backup of database in the hard drive.

6.26 Software should have facility to export data in other formats such as MS excel/MS word /PDF for further analysis.

6.27 The Software should have the facility of printing formula sheet on demand.

6.28 The Software should have the facility to generate MIS reports by selecting a specific period, customer, KVA Rating, and the inspection type.

6.29 The website integration and connectivity with ERP should be possible in software as an option.

6.30 Safety/EMC/Vibration Meets the requirements of IEC-1010-1, CE and ASTM D999.75

6.31 The transformer testing set up shall be designed and constructed in such a way as to avoid introducing any danger in normal use and under normal conditions, so as to ensure especially:

(a) personal safety against electric shock:

(b) personal safety against effects of excessive temperature;

(c) protection against spread of fire;

(d) Protection against penetration of solid objects, dust & water in meter.

6.32 All parts that are likely to develop corrosion under normal working condition shall be effectively protected against corrosion by suitable method to achieve durable results. Any protective coating shall not be liable to damage by ordinary handling nor damage due to exposure to air, under normal working conditions.

6.33 The transformer testing set up shall be manufactured using SMT (Surface Mount Technology)

6.34 All the cords / connectors / accessories supplied along with the instrument must conform to the international standards of safety. Adequate built in features to protect the instrument itself from over-voltage shall be provided.

6.35 The transformer testing set up shall also have interface to an external printer through PC software.

6.36 **CIRCUIT PROTECTION**

Adequate protection fuses shall be provided for current circuits in test bench & for all the equipment independently.

6.37 **SHOCK AND VIBRATION PROTECTION**

The equipment must be immune to Vibration and dumping due to transport.

Suitable transportation case shall be provided along with the equipment.

6.38 The necessary precaution in packing should be taken to avoid any damages to Test Bench during the transportation due to shocks/vibration etc.

6.39 **Automatic LV test setup:-**

Following test shall be conducted automatically on single click and test results transfer to the common database.

- Measurement of Voltage Ratio And Check Of Phase Displacement (Vector Group).
- Measurement of Winding Resistance.
- Measurement of Insulation Resistance.
- Magnetic Balance Test.

6.40 **The test system software should have following features/ facilities:**

- The facility should be provided to select Cooling type such as ONAN/OFAF/OFWF/ODAF/ONAF/ONAF-1/ONAF-II/DWF/AN/ANAF/ ANAN etc
- The software should provide facility to test transformers of at least following vector groups by choosing appropriate option: Dd0,Dd10,Dyn11,Dyn1,Dyn7,Dyn5,Ynd11,Ynd1,Ynd7,Ynd5,YNyn0,Dz 10 etc
- The software should provide facility to test single phase or three phase & two winding or three winding transformers
- The software should generate combine reports on single click for Winding resistance test, Ratio test, Insulation resistance test, Vector group test, No load loss test, Load loss test, Induced over voltage test, Magnetic balance test, separate source voltage test

- The software should provide the selection of transformers with tap changer or without tap changer
- While testing winding resistance there should be facility to present results in units such as ohms or mili-ohms. Calculation in load loss test should take account of unit selected during winding resistance test .
- For voltage ratio test report error in % should be provided.
- Software should provide user editable acceptance criterion for voltage ratio test
- For no load loss test watt meter constant entry should be available
- Software should provide Analysis feature including search option with periodic report, vendor wise report, KVA/MVA based report, test wise report.
- Software should provide option to Print Values in Report (Page Footer, Test By Engg. , Test Date Etc.)
- The software should provide error free calculations
- Software should have instrument selection facility
- The software should maintain log for delete option
- The software should have data backup facility
- Software should provide facility to export data in other formats such as MS excel for further analysis
- Software should have user friendly graphical interface.
- Software should acquire data form temperature scanner and generate cooling curve graph and do all the calculation automatically
- Software should have facility to lock the data so no intervention after completion of tes

7.00 SPECIFICATION:

A) Measuring Instruments -

1. Winding Resistance Meter –

1.0 SCOPE

This specification covers the Transformer Winding Resistance Meter suitable for measuring winding resistance for single phase and three phase transformers. The kit should be supplied with software to

conduct Temperature Rise Test on transformers and plot relevant graphs to interpretthe test results.

2.0 CLIMATIC CONDITION

The Measuring Instrument should work in following climate.

i) Maximum Ambient Air Temperature 55°C
ii) Minimum Ambient Air Temperature 05°C.
iii) Maximum Relative Humidity Upto 95% (non-condensing)
iv) Storage Temperature -20°C to 60°C
v) Storage Humidity Upto 95 %(non condensing)
vi) Max. Altitude 1000 meter

3.0 GENERAL & CONSTRUCTIONAL REQUIREMENTS

Transformer Winding measurement meter shall be designed and constructed in such a way so as to easy to operate, compact, rugged design, user safety. However, the following General features should be ensured.

Feature Description

1. Instrument should be suitable for measuring cold and hot winding resistance measurement of the Transformer winding.
2. Instrument should be lightweight and portable unit designed to deliver up to 10 Amps D.0 max.continuous Injection (50V dc for 30 sec.), 50V open circuit voltage for heavily inductive loads.
3. This product should be designed with safety feature and ease of use.
4. Instrument should be used at any transformer for measuring the winding resistance value with high accuracy.
5. Instruments should be rugged and light weight, Portable type and very suitable for field use.
6. Instrument should be capable of storing 100 test values on First In First Out (FIFO) basis and also the instrument should have USB port for communication and transfer of stored data to PC via communication cable. The communication software with media for installation on PC should be provided along with every instrument.
7. Instrument should have 4*1/2 digit reading for resistance measurement. Display should be 6characters, 7 segments, LCD.
8. Instrument should have simultaneous display for dual channel resistance and injected current without the need for time consuming bridge balancing.
9. It should be have current smoothing test technology for fast and convenient testing.
10. It should have in built demagnetization circuitry which allows the operator to de-magnetize the transformer core, either before or upon completion of resistance testing or as a standalone feature.

11. It should have Bi-directional current capability feature to sense pre test core polarization or direct the test current in the direction that reduce the test time.
12. It should have in built Discharge circuitry which safely discharges the specimen when test is completed, if lead accidentally disconnects or if power is lost.
13. The equipment should monitor the contact operation of on-load tap-changers .for the proper make before break sequence. The equipment should indicate immediately in case open circuit exists. The max.timing for the operation should less than 20ms.The timing should be settable. Instrument should have Automatic fault detection in OLTC of the transformer.
14. Unit should provide with remote trigger switch for testing transformer with on load tap changer
15. Instrument should have facility of internal memory allows for storage of minimum 100 dataset for later recall, printing and analysis.
16. Thermal Printer should be provided for printing the stored data on thermal paper.
17. The Instrument should have Input Power Supply: 240V AC±20%, 50Hz ±10 %, 750VA.
18. Instrument should have following output range :-
    Current range: - up to 10A DC continuous and 50V for 30sec.
    Voltage range: - up to 50 V DC
19. Instrument should have **at least four** resistance measurement range : 1 μ Ω to 2000Ω
    (0 μ Ω - 2 mΩ, 2 m Ω - 200 m Ω, 200m Ω - 2 Ω, 2 Ω - 2000Ω **) ,**
20. Instrument should have Minimum resolution of 0.1 IA2 with accuracy ±0.2% of rdg +5 Counts
21. Instrument should have the facility to measure direct cold and hot resistance during temperature rise test.
22. Instrument should have Protection for high voltage flashover caused by inductive kickback
23. Instrument should have facility for Auto discharge for operator safety/ safety interlock circuit
24. Instrument should be supplied with the Software to analyze the Temperature rise test Readings.
25. The test kit shall be supplied with accessories viz, sufficient test leads i.e current leads, potential leads, shorting lead, grounding lead, mains power cord, instruction manual, computer interface cable and software CD etc
26. Standard Accessories:
    Test leads with heavy duty Crocodile clamps (8 No): -10 Meter Each
    Earthing Cable : 2 No

Mains power cord : 1 No.
User Manual : 1 No.
Calibration Sheet : 1 No.
Rugged Carrying case : 1 No.
Software media : 1 No.
USB cord : 1 No.

27. Calibration certificate from NABL accredited lab shall be provided with every instrument.
28. Safety
    a. CE & EN61010 CAT-IV EN61326 for enhanced safety or IC 61010-1 & IEC61326-1
    b. Compatible with IP54 standards.
    c. Compatible with EMC-1EC61326-1
29. Warranty:- 5 Years from date of delivery.

2. Turns Ratio Meter

i. Features:

- Portable, light weight, automatic, 3 phase Turns Ratio Meter
- Automatic measurement of Ratio and phase angle deviation
- Suitable for operation in energized switchyard condition.
- Should be able to measure and display actual turn's ratio of Three phase transformer having different vector groups.
- It should also measure and display, magnetizing current alongwith phase angle deviation.

ii. Technical Specification

- Mains Power: 240V+/-20%, 50Hz+/-5%, single phase A.C.
- Excitation voltage(Auto Manual Selection) :-8 to 10V/ 35 to 40V/80 to 100V
- Turns Ratio Measurement Range and Accuracy

Turns Ratio Range	8 to 10 V AC	35 to 40 V AC	80 to 100V AC
0.8 to 1000	0.1%	0.1%	0.1%
1000 to 2000	0.15%	0.1%	0.1%

- Excitation current Range and Accuracy

  0 to 1000 mA with resolution of 0.1mA, 4½ digit Resolution with less than1% Accuracy

- Phase Deviation Range and Accuracy
- +/-90 degrees (one decimal point for minute display and two decimal point for degree display.
- RS 232 USB port for communication.

iii. Display

Touch screen colored display viewable in direct sunlight.

iv. Computer/Printer/ Interface:

RS 232 /Preferably USB port, with communication software for online control software and report generation software.

v. Test results storage:

Internal nonvolatile memory for storing, 1000 Tests Results shall be stored including graphs with Ratio, Ratio Error, Ex. Current, Phase Angle, Deviation from Std. Value and pass & fail.

vi. Accessories

a) Power supply cord 3 RMT
b) 3 phase cable set length 5 RMT with clip ends
c) 3 phase extension cable set length 10 meter
d) Carrying case for test leads
e) Grounding lead:- 5 RMT
f) Communication Software
g) RS 232/USB cable for connection to PC

3. Power Analyzer

a) Power Analyzer should have following features/functions:

Sr. No.	Particulars	Requirement.
1.	Input Voltage range	15/30/60/100/150/300/600/1000V
2.	Input Current range	500mA, 1/2/5/10/20/30 A
3.	Large current measurements capability by using external sensor input range	50/100/250/50mV, 1, 2 / 5 / 10V.
4.	Frequency range	DC, 0.1Hz to 1 MHz
5.	Basic Voltage/ Current measurement accuracy	± (0.01% of rdg+ 0.03% of range)
6.	Power measurement accuracy	± (0.02% of rdg + 0.04% of range)
7.	Wiring combinations	1 Phase 2 wire, 1 Phase 3 wire, 3 Phase 3 wire, 3 Phase 3 wire-Two loads, 3 Phase 4 wire
8.	Line filter	500Hz, 5.5kHz, 50kHz
9.	A/D converter resolution	16 bits
10.	Data update rate	Selectable from 50ms, 100ms, 250ms
11.	Display	8.4 inch color TFT LED/LCD preference shall be given to LED. Capable to show Numeric display, Harmonic measurement; Waveforms, Bargraph, Vector & Trend display, with various

		combinations for all above.
12.	Display type a. Numeric Display items	:0 – 1.000 :4/8/16/All/ single list/dual list
	b. Waveforms Display	:Waveforms in single/Dual/Triad/ Quad format
	c. Time axis	:0.5ms – 2s/div
	d. Trigger	:Voltage, current or external.
	e. Vector Display	: Phase difference in fundamental waves of voltage & current.
	f. Bar Graph Display	Bar Graph up to upper limit of analyzed order in harmonic measurement.
	g. Trend Display	:Up to 16 parameters of measurement channels
13.	Scaling	User programmable CT/PT ratio Scaling Function for obtaining direct display of voltage & current of primary side

b) In addition to above Power Analyzer should have following functions:

a. Auto ranging function - Auto ranging when feeding unknown input quantities.

b. Compensation Functions - Wiring compensation for the loss caused by wiring of element, Efficiency compensation function for the power measurement on the secondary side of a power transformer, compensation for two watt meter method.

c. User defined Math Function - This function should be used to define twenty user-defined formulas. These equations can be used to calculate various parameters.

d. Delta Calculation Function - This function should be used to calculate individual phase voltages from the line voltages.

e. Advanced Calculation Function - This function should perform IEC harmonic measurements, MATH calculations, FFT calculations and waveform data capturing function.

f. Integration Function - It should have Standard integration mode (timer mode), Continuous integration mode (repeat mode) & manual integration.

g. Harmonic Measurement Function –

Method :PLL synchronization or external sampling clock.
Measurement Freq. Range :Source fundamental frequency from 10 Hz to 440Hz.

Harmonic order analyzed :Up to 100
Analyzed Parameter :for each order V, I, Active Power,Reactive Power, Phase Angle, and Phase difference of Harmonic component relative to fundamental wave.

h. Inbuilt internal memory having capacity up to 30 MB to store measurement data in binary or ASCII format.

i. External Input/Output –
USB port for PC communication
Built-in PC Card interface, type II
GPIB : Confirming to IEEE 488.2

j. General –
Power supply : 90 to 264 V AC, 48 to 63 Hz.
Operating temperature : 5 to 40 deg. C
Battery back-up : Set-up information & internal clock are to be backed-up with lithium battery

k. Setting - Control of the instrument should be possible from PC including wiring method, range, filter, scaling etc

l. Data Acquisition & trend display Software –

Application software must be able to load data from normal measurement, harmonic measurement, waveform calculation, FFT calculation & cycle-by-cycle measurement and then display and/or save the data on the PC.

All measured data to be automatically displayed in a trend graph and saved to a CSV file.

Numerical data: Simultaneous display of V, I, W & other parameters for all elements and calculations. Numeric data to be displayed cycle-bycycle & checked by using the scroll bar.

Power Trends: The power value P & 3-phase power values from each phase to be displayed.

Vectorial Views: Should be able to view vectorial display of fundamental voltage, current & phase angle in harmonic mode.

4. Insulation Tester 5000V

Technical Requirement.

The inclusion of following feature is needed.

i. The test kit should display the value of Insulation Resistance, Current and Capacitance after each test.

ii. The test kit should have automatic test sequence for Automatic IR Test, Polarization Index Test, Dielectric Absorption Ratio Test, Dielectric Discharge Test, Step Voltage Test and Withstand Voltage Test.
iii. The test kit should have self calibration check up at every start up.
iv. Display should contain analogue and digital resistance results, battery charge indication, mains or battery operation indication should be displayed on LCD screen with backlight.
v. The test kit along with accessories should be supplied with a carrying case so as to be carried to testing site easily.
vi. The equipment should be enclosed with industrial grade casing so that in closed condition display, key pad and connection terminals should be fully protected and covered.
vii. The test kit shall be both AC Mains and Battery Operated.
viii. The test kit shall be equipped with High Voltage terminal, Measurement terminal and Guard terminal. These terminals shall be suitably marked for easy identification
ix. The test kit should display the direct reading of voltage across the test object when the test is in progress.
x. Instrument should provide warning as well as able to inhibit testing, if the voltage measured is above 50V at the terminals.
xi. The test kit should be equipped with audio and visual indication for the test ON condition.
xii. The test kit should discharge the test object after every test.
xiii. The kit should have three programmable timers for conducting diagnostic tests.
xiv. The Testing Equipment should be properly shield / screened so that performance under induced voltage conditions is not affected. There should be the provision of interference suppression unit which nullifies the effect of electrostatic interference.
xv. Instrument should have internal storage of minimum 1000 test results on First In First Out (FIFO) basis as well as Real time data output and on-board storage for subsequent download.
Xvi Selectable Test voltage from 500 to 5000V.
Xvii It should meet requirements of EN61010.

Power input range : 240V AC +/- 20%, 50Hz +/- 5% and Integrated Re-Chargeable Battery

Test voltages : 100VDC to 1KVDC variable in steps of 10V and 1 KV DC to 5 KVDC in step of 25 V

Resolution: 1Volt

Accuracy (23°C):

+/-5% up to 100 G Ω & +/- 10% up to 15 TΩ

Display range:

Digital display 10 kOhm to 15 TOhm

Analogue display 100 kOhm to 1 TOhm

Short circuit: 3 mA.

Capacitor charge time:

less than 3 second per µF at 3 mA

Capacitor discharge time:

less than 250mili- second per µF from 5000V to 50V.

Capacitance measurement :

1nF to 50 µF (measured with test voltage >500 V)

Capacitance measurement accuracy (23°C):

±5% ±5 nF

Voltage output accuracy (0°C to 30°C):

±2% ±1 V of nominal test voltage at 100 MOhm load

±25 V for test voltages less than 500 V

Current measurement range:

±0.01 nA to ±5 mA

Current measurement accuracy (23°C):

±5% ±0.2 nA at all voltages

Display: Analogue/Digital 3 digits

Interference rejection: 1mA rms per kV test voltage, 2 mA rms maximum

Timer range: Up to 99 minutes

Test regimes : Auto IR

Lead set : Three leads with compact clamp, flexible silicon insulated.

Ingress protection (lid closed) : IP54

Humidity: 90% RH non-condensing at 40°C

5. High voltage Tester 0-80 KV

High voltage test set shall be portable. It shall consists of two separate units: the control unit and the high voltage unit. The test set shall be equipped with a rectifier attachment for D.C. Voltage testing upto 80KV.

The High Voltage Test Set is to be used for:

- AC voltage testing of low capacity test objects upto 0-75 KV.
- DC voltage testing upto 0-80 KV

The offered system shall ensure following minimum features.

- Continuous testing with AC voltages upto 75kV at 1kVA & DC voltages upto 80 KV
- Set shall be composed of function blocks & shall have built in overload protection.
- DC voltage testing with rectifier attachment.

Minimum Guaranteed Technical Particulars

Output Voltage	: 0-75 KVrms / 0-80 KV DC
Time loading	: 1kVA; unlimited
	: 2kVA; 20 min.
	: 4kVA; 1 min
Short-circuit current	: Max. 50 mA (1 min.)
Nominal Current	: 13mA
Test load	: ca. 1000 pF max. 30 min.
Power Supply	: 240V ±10%; 50Hz

6. Power Panel And Equipments

LT Capacitor Panel: 250KVAr, 440V with automatic/ motorized control in step of 10KVAr.

Dimmer: Three phase,0-470V,50Hz with motorized control.

HV Tester: 80kV, 200mA with Suitable Voltage Regulator

Power Panel

MG Set, 50kVA, I/p Voltage- 400V, O/p Voltage- 0-1000V, Frequency- 100Hz**.**

Booster Transformer, 200kVA, I/p Voltage- 400V, O/p Voltage- (2.5-1.7-0.9-0.6-0.3-0.15)kV, Hz- 50

CT1, (40-80-150)/5A, Accuracy Class: 0.02, Burden 15VA, Insulation class-3.3kV

CT2, (5-10-20)/5A, Accuracy Class: 0.02, Burden 15VA, Insulation class-3.3kV

PT1- (0.55-1.1-2.2-3.3)kV/110V, Accuracy Class:0.02, Burden 50VA

UPS, 2.5KVA Single Phase, 230V, 50Hz for Test Bench input supply

7. **Motorized Isolator:-** For open circuit & Short circuit test of the transformer the motorized Isolator 2500 A with silver coated blades shall be provided.

8.00 NAME PLATE DATA AND MARKING

The equipment shall have a name plate clearly visible, effectively secured against removal and indelibly and distinctly marked with all essential particulars as per relevant standards.

Sr. No. of the equipment along with date of manufacturing as well as other technical details shall invariably be mentioned on the equipment as well as on the Hand bag. Serial number on sticker will not be allowed.

In addition, following shall be marked on the name plate.

- Purchase order No & date.
- Month and Year of manufacture.
- Name of purchaser, i.e. MSEDCL.
- Guarantee Five Years.

9.00 TESTS

9.01 "Calibration Reports/ Test Certificate"

The tenderer shall furnish detailed type test reports of the offered instrument for all the tests as per relevant standards. All the type tests shall be carried out at laboratories which are accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL) of Government of India to prove that the instruments offered meet the requirements of this specification. These tests should have been carried out within 5 years prior to the date of opening of the tender. The offer without type test report shall not be considered for further evaluation. The type test report shall be submitted along with the offer. Type Test Reports conducted in manufacturers own laboratory and certified by testing institute shall not be acceptable. However, the tenderer who have supplied the offered instrument to MSEDCL against order from Material Management Cell of MSEDCL shall be exempted from submission of type test reports against this tender provided that,

i) The offered instruments are already fully type tested at Laboratories accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL) within five years prior to the date of opening of the tender.

ii) There is no change in the design of type tested instruments and those offered against this tender.

iii) Such tenderer complying with (i) & (ii) above, shall furnish an undertaking in the format schedule 'F' enclosed herewith.

The Purchaser reserves the right to demand repetition of some or all the type tests in presence of purchaser's representative at purchaser's cost. For this purpose, the tenderer shall quote unit rates for carrying out each type test. However, such unit rates will not be considered for evaluation of the offer. In case the unit fails in type test, the complete supply shall be rejected & expenditure incurred shall be recovered from the tenderer from his deposit.

The successful tenderer shall take approval / waival of type test from the Chief Engineer, MSEDCL, Testing & Quality Control Section, Prakashgad, Bandra (E), Mumbai – 400051 prior to commencement of supply.

The successful tenderer shall take approval of calibration certificate of all the instrument & whole as Transformer Test Bench from the Chief Engineer, MSEDCL, Testing & Quality Control Section, Prakashgad, Bandra (E), Mumbai – 400051 prior to commencement of supply.

In other cases where Indian / International Standards for the equipment are not available / specified, following test condition shall be made applicable against the type test.

"The tenderer shall furnish detailed Calibration reports of the offered instrument carried out at Standard NABL approved Laboratories on all of the equipments as per relevant standards to prove that the instrument offered meets the requirements of this specification. Tenderer shall take approval / waival of Calibration reports from the Chief Engineer, MSEDCL, Testing & Quality Control Section, Prakashgad, Bandra (E), Mumbai – 400051 prior to commencement of supply."

All the instruments shall be tested for Electromagnetic Compatibility & Electromagnetic Interference as per IEC 61000.

All the instrument shall be tested for Shock & Vibration test as per procedure define in the IS 9000.

Transformer test Bench shall be tested for minimum IP 40 for degree of protection for dust & water.

10.00 GUARANTEED TECHNICAL PARTICULARS.

The tenderer shall furnish the particulars giving specific required details of measuring equipment/testing equipment in schedule `A' attached. The offers without the details in Schedule 'A' stand rejected. System schematic, Single Line Diagram and test procedure has to be submitted with the tender.

11.00 DEMONSTRATION.

Demonstration of the transformer testing set up and PC software shall be given by the manufacturer as and when required by purchaser.

12.00 SPARES:

The bidder should supply the essential spares for maintenance purpose.

13.00 TRAINING.

The successful bidder shall depute their representative for commissioning & training educate to Engineers of purchaser as and when they will be called for at no extra cost.

14.00 GUARANTEE

The Test Bench shall be guaranteed for a period of **5 years** from the date of commissioning or five one and half years from the date of dispatch whichever is earlier. The equipment found defective within above guarantee period shall be replaced / repaired / rectified by the supplier free of cost, within one month of receipt of intimation. After the replacement / repairs / rectification, the accuracy shall not be affected. Test report and calibration certificate shall invariably be submitted after rectification / repairs.

If defective equipment is not replaced / repaired / rectified within the specified period as above, the Company shall recover an equivalent amount plus 15% supervision charges from any of the bills of the supplier. Further, life time Guarantee required for software upgradable as and when required by MSEDCL.

15.00 AFTER SALES SERVICE

The bidder has to indicate clearly the after sales service to be provided by the supplier within guarantee period and outside guarantee period and Addresses of Sales Service Centre, details of Engineers, etc. shall be submitted along with the offer.

16.0 PRE-DESPATCH INSPECTIONS

The successful bidder shall offer inspection of equipments before dispatch at respective factories. For imported equipments, the supplier / tenderer shall offer the equipments at the authorized service center / works of the original manufacturer in India or at the supplier's works / testing center. The offered lot shall be tested for acceptance tests and any other test as per relevant IS / IEC as required by inspecting officers. During inspection, if the instrument does not meet the required specification & test results found not

satisfactory then it shall be liable for rejection. Calibration Certificates of all associated equipments shall be furnished at the time of factory inspection.

The manufacturer shall offer to the inspector representing the purchaser all the reasonable facilities, free of charge, for inspection and testing, to satisfy him that the material is being supplied in accordance with this specification. The MSEDCL's representative / Engineer attending the above testing shall carry out testing as per relevant IS / IEC & as per this technical specification and issue test certificate approval to the manufacturer and give clearance for dispatch.

The ERSS meters shall be inspected jointly by the Executive Engineer, Testing Division & the Executive Engineer, Inspection Wing.

17.0 QUALITY CONTROL.

The purchaser may send a team of experienced engineers for assessing the capability of the bidder or their principals for manufacturing of ERSS meters as per this specification. The team shall be given all assistance and co-operation for inspection and testing at the bidder's works.

One tender samples shall be kept ready for assessing and testing. The tenderer has to give all facilities for carrying out the testing of these samples.

18.0 MINIMUM TESTING FACILITIES

The bidder or their principals / manufacturer shall have the necessary minimum testing facilities for carrying out various acceptance and routine tests. A list of machinery / equipment and testing facility available at their Works shall also be furnished along with the offer.

19.0 PACKING

19.01 The Test Bench shall be suitably packed to avoid damage or disturbance during transit or handling. Each instrument may be suitably packed in the first instance to prevent ingress of moisture and dust and then placed in a cushioned carton of a suitable material to prevent damage due to shocks during transit. The lid of the cartoon may be suitably sealed. A suitable number of sealed cartons may be packed in a case of adequate strength with extra cushioning if considered necessary. The cases may then be properly sealed against accidental opening in transit. The packing cases may be marked to indicate the fragile nature of the contents.

19.02 The following information shall be furnished with the consignment :

- Name of consignee.
- Details of consignment.
- Destination
- Total Weight of consignment.
- Sign showing upper / lower side of the crate
- Sign showing fragility of the material.
- Handling and unpacking instructions.
- Bill of Materials indicating contents of each package and spare materials.

20.0 SCHEDULES.

The tenderer shall fill in the following schedules which are part and parcel of the tender specification and offer. If the schedules are not submitted duly filled in with the offer, the offer shall be liable for rejection. The order copies of the order executed mentioned in the list of order shall be invariably enclosed along with the offer. Only those orders mentioned in the list shall be considered whose order copies shall be enclosed with the offer.

Schedule A – Guaranteed and technical particulars.

Schedule C – Tenderer's experience.

Schedule F – Proforma undertaking.

The tenderer shall submit the list of orders for similar type of equipment, executed or under execution during the last three years, with full details in the schedule of tenderer's experience (Schedule - C) to enable the purchaser to evaluate the tender.

21.0 DOCUMENTATION

Two set of following documents shall be supplied along with each test system.

- Operating manual
- Service manual
- Calibration certificate as per relevant reference standard of whole as Transformer Test Bench.
- Calibration certificate as per relevant reference standard of all instruments.

SCHEDULE – "C"

TENDERER'S EXPERIENCE

Tenderer shall furnish here list of similar orders executed / under execution for supplying Fully Automatic Transformer Test Bench by him to whom a reference may be made by purchaser in case he considers such a reference necessary.

Sr. No.	Name of client	Order No. & date	Qty. ordered	Qty. supplied

NAME OF FIRM _____

NAME & SIGNATURE _____

DESIGNATION _____

DATE _____

SCHEDULE – "F"

PROFORMA OF UNDERTAKING

We hereby confirm that Portable **Transformer Test Bench** Meter offered by us against this tender are of the same design and type as have been supplied to MSEDCL against earlier order No. _____ dtd. _____ and all the type test reports thereof were approved by Chief Engineer, Testing & Quality Control vide letter No. _____, dtd. _____ (Copy enclosed).

We further confirm that the said type tests have been carried out at the laboratories accredited by NABL within five years prior to the date of opening of present tender.

NAME OF FIRM _____

NAME & SIGNATURE _____

DESIGNATION _____

DATE _____

ANNEXURE U-I

"INDEMNITY BOND"

UNDERTAKING TO BE SUBMITTED BY THE PARENT COMPANY SITUATED ABROAD IN CASE OF THE PARTICIPANT BIDDER WHO IS AN INDIAN BASED SUBSIDIARY ON GENERAL STAMP OF `200.00.

The Chief Engineer,
Maharashtra State Electricity Distribution Co. Ltd.,
Material Management Cell,
1st Floor, Prakashgad, Bandra (E),
Mumbai – 400 056.

Dear Sir:

Sub: Undertaking against Tender No. _____ for procurement of _____

We, M/s. _____ having registered office at _____ are the Parent Company of M/s. _____ who have participated against your tender no. _____ for procurement of _____.

We have carefully read and have thoroughly understood and agree to the terms and conditions of the subject tender.

We hereby undertake that in case of placement of order against the subject tender on our subsidiary company, M/s. _____, in the event of we accept all the responsibilities and liabilities for supply of quality equipments as per specification of the tender and execution of the contract. We further hereby undertake that we shall be responsible for any liability arising out of the contract placed on M/s. _____ and to pay MSEDCL on demand the sum of rupees as per agreement in the event of any breach of condition of the purchase order, loss and damage of the material till expiry of guarantee period as stipulated in the order.

Our liability here under shall not be impaired or discharged by extension of time or variation or alteration made with or without our knowledge or consent by or between the parties to the said contract. This undertaking shall be valid and binding on us upto and including the execution and guarantee period of the order and shall not be terminable by notice or change in the constitution of any of the companies. In case of any dispute arising out of or in connection with this tender or contract, if concluded, the same shall be subject to the exclusive jurisdiction of the **"Court in Mumbai (India)."**

Yours faithfully,
(Authorised Signatory)

For _____

SCHEDULE A

GAURANTEED TECHNICAL PARAMETER

SR. NO.	GTP PARAMETERS	GTP VALUES
1.	PLEASE CONFIRM THAT THE OFFERED VALUES AGAINST GTP ARE AS PER TECHNICAL SPECIFICATION.	BOOLEAN
2.	MANUFACTURER'S / SUPPLIER'S NAME AND ADDRESS WITH WORKS ADDRESS	TEXT
3.	MAKE AND TYPE OF TRANSFORMER TEST BENCH	TEXT
4.	APPLICABLE STANDARDS.	TEXT
5.	OVERALL ACCURACY CLASS.	TEXT
6.	RATED VOLTAGE.	TEXT
7.	TEST VOLTAGE RANGE.	TEXT
8.	RATED FREQUENCY.	TEXT
9.	AMBIENT TEMPERATURE.	TEXT
10.	TRANSFORMER TEST BENCH CAPABLE FOR TEST THE TRANSFORMER (IN KVA).	TEXT
11.	TEMPERATURE OPERATING RANGE.	TEXT
12.	CIRCUIT PROTECTION SHALL BE PROVIDED FOR CURTRENT CIRCUIT OF EACH EQUIPMENT.	BOOLEAN
13.	TRANSFORMER TEST BENCH TESTED FOR SHOCK & VIBRATION TESTS.	BOOLEAN
14.	TRANSFORMER TEST BENCH CAPABLE TO TEST THE DISTRIBUTION TRANSFORMER FOR THE FOLLOWING TESTS.	
A)	MEASUREMENT OF VOLTAGE RATIO AND CHECK OF PHASE DISPLACEMENT (VECTOR GROUP).	BOOLEAN
B)	MEASUREMENT OF WINDING RESISTANCE.	BOOLEAN
C)	MEASUREMENT OF INSULATION RESISTANCE.	BOOLEAN
D)	MEASUREMENT OF NO LOAD LOSS AND NO LOAD CURRENT.	BOOLEAN

E)	MEASUREMENT OF LOAD LOSS AND IMPEDANCE VOLTAGE.	BOOLEAN
F)	MEASUREMENT OF PERCENTAGE IMPEDANCE VOLTAGE.	BOOLEAN
G)	CALCULATION OF EFFICIENCY AND REGULATION.	BOOLEAN
H)	APPLIED VOLTAGE TEST (HIGH VOLTAGE/SEPARATE SOURCE TEST).	BOOLEAN
I)	INDUCED OVER VOLTAGE (DVDF) TEST.	BOOLEAN
J)	MEASUREMENT OF NO LOAD LOSS & NO LOAD CURRENT AT LOW VOLTAGE.	BOOLEAN
K)	MEASUREMENT OF LOAD LOSS AND IMPEDANCE VOLTAGE AT LOW VOLTAGE.	BOOLEAN
L)	MEASUREMENT OF SINGLE PHASE / THREE PHASE SHORT CIRCUIT IMPEDANCE.	BOOLEAN
M)	TEMPERATURE RISE TEST.	BOOLEAN
N)	MAGNETIC BALANCE TEST.	BOOLEAN
15.	ALL SOFTWARES/ DRIVERS FOR ALL THE EQUIPMENT PROVIDED FREE OF COST.	BOOLEAN
16.	INITIAL CALIBRATION DATE & DUE DATE SHALL BE DISPLAY ON THE LCD DISPLAY BEFORE STARTING THE INSTRUMENT.	BOOLEAN
17.	ALL INDICATIONS AS PER THE SPECIFICATION SHALL BE PROVIDED ON THE TTB.	BOOLEAN
18.	GTP FOR WINDING RESISTANCE METER	
19.	MANUFACTURE NAME & COUNTRY OF MANUFACTURE	TEXT
20.	TYPE /MODEL DETAILS OF THE EQUIPMENT.	TEXT
21.	WHETHER CAPABLE OF WORKING IN HOSTILE ELECTROSTATIC NOISY CONDITIONS PREVAILING IN CHARGED HV / EHV SUBSTATIONS?	BOOLEAN
22.	WHETHER CAPABLE OF SUSTAINING BACK EMF OFFER BY TRANSFORMER	BOOLEAN
23.	WHETHER HAS INBUILT POWER SOURCE	BOOLEAN
24.	RESISTANCE MEASUREMENT	TEXT
25.	WHETHER IT CAN MEASURE WINDING RESISTANCE OF DISTRIBUTION AND POWER TRANSFORMER IN A SHORT PERIOD, AT 10 A CURRENT RANGE.	BOOLEAN
26.	CURRENT RANGES	TEXT

27.	WHETHER 2 OHM RANGE IS AVAILABLE AT 10 A CURRENT RANGE AND 4 OHM RANGE IS AVAILABLE AT 5 A CURRENT RANGE ?	BOOLEAN
28.	OPEN CIRCUIT TEST VOLTAGE	TEXT
29.	POWER SUPPLY RATING .	TEXT
30.	WHETHER IT CAN OVERCOME HIGH INDUCTANCE OFFERED BY LARGE POWER TRANSFORMER INSTANTLY	BOOLEAN
31.	IS IT HOUSED IN SUITABLE ALUMINUM CARRYING CASE	BOOLEAN
32.	WHETHER IT HAS FORCED COOLING ARRANGEMENT FOR EFFECTIVE HEAT MANAGEMENT WHEN CURRENT IS INJECTED OVER LONGER DURATIONS?	BOOLEAN
33.	BACKLIT FOUR LINE LCD DISPLAY WITH INTERACTIVE MENU	BOOLEAN
34.	THE SELECTION OF CURRENT AND RESISTANCE RANGE SHOULD BE DONE THROUGH KEYPAD.	BOOLEAN
35.	WHETHER IT DISPLAYS THE ACTUAL VALUE OF THE CURRENT PASSING THROUGH THE TEST OBJECT ?	BOOLEAN
36.	WHETHER IT HAS PROTECTION AGAINST OVER TEMPERATURE?.	BOOLEAN
37.	WHETHER IT HAS AUDIO INDICATION DURING CURRENT INJECTION FOR OPERATOR SAFETY?.	BOOLEAN
38.	WHETHER IT IS PORTABLE AND LIGHT WEIGHT?	BOOLEAN
39.	INPUT POWER SUPPLY	TEXT
40.	ACCURACY ± 0.1% OF READING ± 0.05% OF RANGE OR ± 0.5% OF READING ± 3 DIGIT.	TEXT
41.	WORKING TEMPERATURE RANGE	TEXT
42.	GTP FOR TURNS RATION METER	
43.	MANUFACTURERS NAME & COUNTRY OF MANUFACTURE.	TEXT
44.	TYPE/MODEL DETAILS OF EQUIPMENT.	TEXT
45.	APPLICABLE INDIAN/INTERNATIONAL STANDARD TO WHICH THE EQUIPMENT CONFORMS	TEXT
46.	THE EQUIPMENT IS PORTABLE AND RUGGED AND FREE FROM INDUCTION EFFECTS AND SUITABLE FOR OPERATION IN ENERGIZED SWITCHYARD	TEXT

47.	OPERATION ON A SUPPLY OF SINGLE PHASE 240V+/-20%, 50Hz+/-5%, A.C.	TEXT
48.	OPERATING TEMPERATURE -5°C TO 50°C	TEXT
49.	EQUIPMENT IS INTERNALLY PROTECTED AGAINST OVER VOLTAGES AND OVER CURRENTS.	TEXT
50.	EXCITATION VOLTAGE I) 8-10V II) 35 – 40 V III) 80 – 100 V IV) AUTO/MANUAL SELECTION	TEXT
51.	TURNS RATIO RANGE I) 0.8 - 1000 II) 1000 - 2000	TEXT
52.	ACCURACY A) FOR TURNS RATIO RANGE 0.8 - 1000 I) 8 – 10 V AC 0.1 % II) 35 – 40 V AC 0.1 % III) 80 – 100 V AC 0.1 % B) FOR TURNS RATIO RANGE 1000 - 2000 I) 8 – 10 V AC 0.15 % II) 35 – 40 V AC 0.1 % III) 80 – 100 V AC 0.1 %	TEXT
53.	EXCITATION CURRENT RANGE A) 0 – 1000 MILLI A B) ACCURACY LESS THAN 1 % WITH MIN. 4½ DIGIT RESOLUTION	TEXT
54.	PHASE DEVIATION RANGE - ± 90 DEGREES ACCURACY - ACCURACY OF 1 DECIMAL POINT FOR MINUTE DISPLAY AND TWO DECIMAL POINT FOR DEGREE DISPLAY.	TEXT
55.	TYPE OF DISPLAY TOUCH SCREEN COLORED DISPLAY VIEWABLE IN DIRECT SUNLIGHT.	TEXT

56.	COMPUTER/PRINTER/INTERFACE RS 232/PREFARABLY USB PORT, WITH COMMUNICATION SOFTWARE FOR ONLINE CONTROL SOFTWARE AND REPORT GENERATION SOFTWARE.	TEXT
57.	MEMORY INTERNAL NONVOLATILE MEMORY FOR STORING, 1000 TESTS RESULTS SHALL BE STORED INCLUDING GRAPHS WITH RATIO, RATIO ERROR, EX. CURRENT, PHASE ANGLE, DEVIATION FROM STD. VALUE AND PASS & FAIL.	TEXT
58.	EQUIPMENT IS TESTED IN STQC LABORATORY FOR SAFETY TESTING COMPLYING IEC 61010.& FOR EMI/EMC TESTING COMPLYING IEC/EN 61326	TEXT
59.	ACCESSORIES 1. POWER SUPPLY CORD MIN. 3 RMT 2. 3 PHASE CABLE SET LENGTH MIN. 5 RMT WITH CLIP ENDS 3. 3 PHASE EXTENSION CABLE SET LENGTH MIN.10 METER 4. CARRYING CASE FOR TEST LEADS 5. GROUNDING LEAD:- MIN.5 RMT 6. COMMUNICATION SOFTWARE 7. RS 232/USB CABLE FOR CONNECTION TO PC	TEXT
60.	GTP FOR POWER ANALYSER	
61.	MANUFACTURERS NAME & COUNTRY OF MANUFACTURE.	TEXT
62.	TYPE/MODEL DETAILS OF EQUIPMENT.	TEXT
63.	APPLICABLE INDIAN/INTERNATIONAL STANDARD TO WHICH THE EQUIPMENT CONFORMS	TEXT
64.	EQUIPMENT IS AS PER THE REQUIREMENT OF OUR TECHNICAL SPECIFICATIONS (YES/NO)	TEXT

65.	INPUT VOLTAGE RANGE	TEXT
66.	OUTPUT VOLTAGE RANGE	TEXT
67.	FREQUENCY RANGE	TEXT
68.	POWER MEASUREMENT ACCURACY	TEXT
69.	INBUILT INTERNAL MEMORY	TEXT
70.	WIRING COMBINATIONS	TEXT
71.	LINE FILTER	TEXT
72.	A/D CONVERTER RESOLUTION	TEXT
73.	DATA UPDATE RATE	TEXT
74.	DISPLAY	TEXT
75.	DISPLAY TYPE LED/LCD preference shall be given to LED.	TEXT
76.	SCALING	TEXT
77.	ADVANCED CALCULATION FUNCTION	TEXT
78.	DATA ACQUISITION & TREND DISPLAY SOFTWARE	TEXT
79.	EXTERNAL INPUT/OUTPUT PORTS	BOOLEAN
80.	INBUILT INTERNAL MEMORY	TEXT
81.	INTEGRATION FUNCTION	BOOLEAN
82.	COMPENSATION FUNCTIONS	BOOLEAN
83.	USER- DEFINED MATH FUNCTION & DELTA CALCULATION FUNCTION	BOOLEAN
84.	ADVANCED CALCULATION FUNCTION	BOOLEAN
85.	BATTERY BACK-UP FACILITY	BOOLEAN
86.	WHETHER THE EQUIPMENT IS TYPE TESTED AT STANDARD LABORATORY AS PER THE RELEVANT INDIAN/INTERNATIONAL STANDARDS WITH IN 5 YEARS.	BOOLEAN
87.	GTP FOR INSULATION RESISTANCE TESTER.	

88.	MANUFACTURER NAME & COUNTRY OF MANUFACTURE	TEXT
89.	TYPE / MODEL DETAILS OF EQUIPMENT	TEXT
90.	APPLICABLE STANDARDS FOR THE EQUIPMENT	TEXT
91.	INSULATION TEST VOLTAGE	TEXT
92.	STEPS OF INSULATION VOLTAGE	TEXT
93.	A) SHORT CIRCUIT CURRENT	TEXT
	B) MEASURNMENT OF PI & DI	TEXT
94.	INSULATION RANGE	TEXT
95.	ACCURACY OF TEST VOLTAGE	TEXT
96.	CAPACITOR CHARGE TIME	TEXT
97.	CAPACITOR DISCHARGE TIME	TEXT
98.	CAPACITANCE MEASUREMENT	TEXT
99.	CAPACITANCE MEASUREMENT ACCURACY	TEXT
100.	CURRENT MEASUREMENT RANGE	TEXT
101.	INTERFERENCE REJECTION	TEXT
102.	TIMER	TEXT
103.	AUTOMATIC DISCHARGE	TEXT
104.	EMC SHOULD MEET EN61010	BOOLEAN
105.	TEST INHIBIT	BOOLEAN
106.	INGRESS PROTECTION (LID CLOSED)	BOOLEAN
107.	TYPE OF DISPLAY	TEXT
108.	VOLTAGE INPUT RANGE	TEXT
109.	OPERATING VOLTAGE	TEXT
110.	BATTERY LIFE	TEXT
111.	ACCESSORIES TO BE PROVIDED	BOOLEAN

112.	GTP FOR HV TESTER	
113.	MANUFACTURER NAME & COUNTRY OF MANUFACTURER.	TEXT
114.	TYPE/MODEL, DETAILS OF EQUIPMENT.	TEXT
115.	APPLICABLE STANDARDS FOR THE INSTRUMENT.	TEXT
116.	SUPPLY VOLTAGE (240V ±10%; 50HZ)	TEXT
117.	OUTPUT VOLTAGE IS 75 KV CONTINUOUSLY VARIABLE WITH NEGATIVE POLARITY TO GROUND (YES/NO)	TEXT
118.	VOLTMETER RESOLUTION IS 100V ON ENTIRE RANGE (YES/NO)	TEXT
119.	NOMINAL CURRENT (13 MA)	TEXT
120.	SHORT-CIRCUIT CURRENT(MAX. 50 MA)	TEXT
	TIMER WITH START/STOP SWITCH	TEXT
121.	AMMETER RANGE (0 – 20 MA)	TEXT
122.	AMMETER RESOLUTION (0.1 MA)	TEXT
123.	NEGATIVE POLARITY TO GROUND (YES/NO)	TEXT
124.	COMPLETE INTERNAL GUARDS CIRCUIT & GUARD CONNECTION ON HIGH VOLTAGE CABLE OUTPUT.	TEXT
125.	SAFETY FEATURES : 1) ZERO START INTERLOCK (YES/NO) 2) INPUT SUPPLY LINE CIRCUIT BREAKER (YES/NO) 3) FULL CIRCUIT BREAKER PROTECTION AGAINST INTERNAL DAMAGE BY OVERLOADS, SURGES OR TEST SAMPLE BEAK DOWN (YES/NO)	TEXT
126.	3 ½ DIGIT LCD DISPLAY (YES/NO)	TEXT
127.	POWER CONSUMPTION	TEXT
128.	TEST LOAD CAPACITY (1000 PF MAX.30MIN.)	TEXT
129.	WARRANTY 5 YEAR MINIMUM	TEXT
130.	GTP FOR M G SET	

131.	TYPE , MAKE & NAME OF MANUFACTURER	
132.	POWER RATING	
133.	INPUT VOLTAGE	
134.	OUTPUT VOLTAGE	
135.	FREQUENCY RANGE	
136.	GTP FOR BOOSTER TRANSFORMER	
137.	TYPE , MAKE & NAME OF MANUFACTURER	
138.	POWER RATING	
139.	INPUT VOLTAGE	
140.	OUTPUT VOLTAGE	
141.	FREQUENCY RANGE	
142.	GTP FOR DIMMER	
143.	TYPE , MAKE & NAME OF MANUFACTURER	
144.	CURRENT RATING	
145.	VOLTAGE RANGE	
146.	FREQUENCY RANGE	
147.	GTP FOR LT CAPACITOR BANK	
148.	TYPE , MAKE & NAME OF MANUFACTURER	
149.	RATING	
150.	VOLTAGE RANGE	
151.	FREQUENCY RANGE	
152.	GTP FOR CURRENT TRANSFORMER 1	
153.	TYPE & MAKE	
154.	NAME OF MANUFACTURER	

155.	CURRENT RATIO	
156.	PRIAMARY CURRENT	
157.	SECODARY CURRENT	
158.	ACCURACY CLASS	
159.	INSULATION CLASS	
160.	BURDEN	
161.	STC	
162.	GTP FOR CURRENT TRANSFORMER 2	
163.	TYPE & MAKE	
164.	NAME OF MANUFACTURER	
165.	CURRENT RATIO	
166.	PRIAMARY CURRENT	
167.	SECODARY CURRENT	
168.	ACCURACY CLASS	
169.	INSULATION CLASS	
170.	BURDEN	
171.	STC	
172.	GTP FOR POTENTIAL TRANSFORMER	
173.	TYPE & MAKE	
174.	NAME OF MANUFACTURER	
175.	VOLTAGE RATIO	
176.	PRIAMARY VOLTAGE	
177.	SECODARY VOLTAGE	
178.	ACCURACY CLASS	

179.	INSULATION CLASS	
180.	BURDEN	
181.	VOLTAGE FACTOR	
182.	UPS DETAILS	

****