

## 1 MVA Distribution Transformer Test Set up

**Technical Specifications:** The Transformer Test Bench System shall be able to perform tests in accordance with IEEE C57.12, IEC 60076, IS : 2026(Part I), IS 1180 (Part I) and its latest amendments. The Transformer test bench should be suitable to test complete losses, Temperature rise test etc.

### CONTROL DESK

S/N	Descriptions	Specifications
1	<b>ENCOLOURE</b>	
1	<b>Construction</b>	Material of Construction - cold rolled annealed material with powder coating with minimum sheet thickness of 3mm in the interface section and 2mm in the remaining portions. The transformer test Bench Should be Compact, rugged, robust, shock proof and suitable for use in harsh workshop indoor conditions.
2	<b>Components</b>	<ol style="list-style-type: none"> <li>1. Incomer Metering: Digital Voltmeter, Digital Ammeter, Frequency Meter.</li> <li>2. ELCB, RCCB and MCCB</li> <li>3. Control On/Off Push Buttons</li> <li>4. Emergency Off Push Button</li> <li>5. Three Phase Auto transformer</li> <li>6. Variac Controls Switches</li> <li>7. Test Start/Stop Push Buttons.</li> <li>8. Computer with loaded software</li> <li>9. Indicating Lamps.</li> <li>10. DVDF tester</li> <li>11. AC HV tester</li> <li>12. Data Logger &amp; Temperature Sensor.</li> <li>13. All other Related Cables &amp; accessories.</li> </ol>
3.	<b>Field Mounting Items</b>	<ol style="list-style-type: none"> <li>1. Emergency Push Button Stations- 2 Set</li> <li>2. Warning Light with Hotter- 1 Set</li> </ol>

#### Safety Facilities on Control Desk:

Warning lights  
 Emergency press button  
 Surge protection (for instruments and digital circuitry)  
 Bonding of all metal work and grounding through an earth-point.  
 Mechanical and Electrical interlocks wherever applicable.

#### Power Analyzer 3 Channel:

Three input elements for Voltage & Current
Accuracy: DC 0.1% of reading, 0.1% of range.
A/D Converter – 16 Bit resolution, Sampling rate Approximately 100 kS/s
Display: 5 Digit, Four independent 6 segment bright LED displays or Single Screen LCD Display
Display Update rate – Minimum 100ms
Input type: Isolated, floating, distorted, unbalanced.
Input Ranges: Currents – 0.5A to 20A AC/DC and
Voltages - 15 V to 600 V AC/DC
Auto ranging function when feeding unknown input quantities.

Large current measurements capability by using external sensor input.
User programmable CT/PT ratio Scaling Function for obtaining direct display of voltage & current of primary side
Measurement Modes: RMS, Mean value & DC
Frequency response: 0.5 Hz to 100 kHz
Wiring: 1 Phase 2 wire (1-CH), 1 Phase 3 wire, three phase three wire, three phase four wire, or 3V3A. Total – 3 CH (Element).
Line filter function to measure fundamental wave rms values of inverter output
Measurement Parameters: Voltage of each phase, Current of each phase, Watt of each phase, Power Factor of each phase, $\pm$ kWh, $\pm$ kVAh, kVA, kVAr, kVA, Current Frequency of each phase, Voltage frequency of each phase, Phase angle, Voltage peak, Current peak, Crest factor of Voltage & Current.
Harmonics Measurement function: Harmonic Analysis up to 50th order, System Frequency 40 Hz to 440Hz or better, Analysis Parameters – Voltage, Current, Active Power, Phase angle, Individual Harmonic Levels, RMS Voltage, RMS Current, Active Power, Fundamental Frequency PF, Harmonic Distortion rate, individual harmonic content
Max, hold function and Average Active Display function
Built-in memory locations to Store & Recall different setup information files
Built-in data memory to store /recall minimum 600 measured data items with selectable storing & recalling intervals.
Integration Mode with timer, repeat or manual starts & stops. Energy Measurement up to 10,000 hours in 1-second increments.
Power & Current values integrated separately for positive & negative polarities.
Averaging function: Exponential average & moving average up to 64 numbers.
User Calibration capability
Inbuilt USB, RS232 & Ethernet Interface with TCP/IP Modbus protocol for PC communication, acquiring, Modbus communication Protocol.
Automatic zero adjustment without disconnecting the wire in 100ms.
Software for communication, acquiring & managing measurement data on PC
Power Supply 230V, 50Hz AC
Accessories: Power cord- 01 No.; Instruction Manual-01No., along with other required accessories.
Portable, Compact in size

#### **Temperature Rise Test with Automation:**

1. 8 Channel measurement Paperless Recorder that displays real-time measured data on a colour LCD and saves data on a SD card.
2. Types of measurement: DC voltage, 1-5V, thermocouple (TC), resistance temperature detector (RTD), ON/OFF input (DI), and DC current (by adding an external shut resistor).
3. The scan interval to 2 or 5 seconds.
4. Display: 5.7-inch TFT colour LCD or better
5. Measurement Accuracy (Digital display)
  - a. DC voltage:  $\pm$  (0.05% of rdg + 3 digits)
  - b. Thermocouple:  $\pm$  (0.15% of rdg + 1°C)
  - c. RTD:  $\pm$  (0.15% of rdg + 0.3°C)
6. Up to 4 alarms (levels) per measurement channels
7. FX data types and file name extensions: DAD/. DAE/. DAM/.PNG/. PDL/. DAR
8. Ethernet Communication Interface
9. Rated supply voltage: 180 to 250 VAC.
10. Ambient temperature: 0 to 50°C
11. Ambient humidity: 20 to 80%RH
12. Vibration: 10 to 60 Hz, 0.2 m/s<sup>2</sup>

#### **Auto Transformer with Booster Transformer:**

##### **Auto Transformer:**

1. Current Rating : 100 Amp
2. Frequency : 50 Hz
3. Phase : 3 Phase
4. Type of Operation : Motor Operated

- 5. Insulation : 6 M Ohms
- 6. Efficiency : As per IS Standards
- 7. Duty Cycle : Continuous
- 8. Power Factor : Suitable for all Power Factors
- 9. Temperature Rise : 45° C above Ambient
- 10. Cooling Type : Oil Cooled
- 11. Distortion : Nil
- 12. Input : 415 Volts
- 13. Output : 0-470 Volts

**Booster Transformer:**

- 1. Capacity : 100 kVA
- 2. Input Voltage : 433 V
- 3. Output Voltage : 1100/3300V (Dual Output - use 1 winding at one time)
- 4. Number of Phase : 3 Phase
- 5. Applicable Standard : IS 2026
- 6. Number of Winding : 02 Nos
- 7. Installation Type : Outdoor
- 8. Cooling Type : ONAN
- 9. Terminal Arrangement : Bare Bushing for HV Side & Cable Box for LV Side
- 10. Vector Group : Dyn 11
- 11. Ambient Temperature : 50° C
- 12. Temperature Rise of Oil: 50° C
- 13. Temperature Rise of Winding: 55° C

**Current Transformer:**

Specification:

- 1. Primary Current: 50/100/200 A
- 2. Secondary Current : 5 A
- 3. Relative Error : 0.2%
- 4. Phase Angle : 10 min
- 5. Class : 0.2%
- 6. Circuit Voltage : 3450V
- 7. Withstand Voltage : 10000V (1 Min)
- 8. Rated Frequency : 50/60Hz.

**Voltage Transformer:**

Specification:

- 1. UNprim : 1100V/3300V
- 2. UNsec : 110V
- 3. Load range : 80 ... 120 % UN
- 4. Secondary burden : 15 VA, cos Ø = 1
- 5. Accuracy over the range: 80...120 % UN
- 6. Voltage error : ±0.2 %
- 7. Angle error δ : ± 10 Min
- 8. Frequency : 50 Hz

**Cabling and Accessories:**

**Technical Specifications:**

- 1. For the DTR test, Calibrated cables will be provided.
- 2. Voltage connection cables for phase (one side with crocodile clip and other side with 4 mm thimble)
- 3. Voltage connection cables for neutral (one side with straight pin and other side with 4 mm thimble).
- 4. Current connection cables for testing of 3 phase Distribution Transformers.

5. Looping coloured (only end terminal will be coloured) current cables (for R, Y & B phase) of appropriate size.
6. All test benches shall be provided with necessary cables, wires, clips, shorting wires with lugs, bolt & nuts.

S/N	Descriptions	Specifications
1	<b>Power Cables</b>	
1.1	Incomer Panel to Variac	1100 V/3300V, 100 Amp. Copper Cables (15mtr.)
1.2	Variac to Loading Transformer	1100 V/3300V, 100 Amp. Copper Cables (15mtr.)
1.3	Loading Transformer to Test Transformer	1100 V/3300V, 100 Amp. Copper Cables (15mtr.)
2	<b>Control Cables</b>	
2.1	Control Desk to Emergency Off Push Button Stations	1100 V/3300V, 6 A, copper Cables (15mtr.)
2.2	Control Desk to Warning Light	1100 V/3300V, 6 A, copper Cables (15mtr.)

### Technical Specification of integrated Winding Resistance for low resistance measurement in transformer test bench

#### 1.Product Description

Following all the ethical norms and values defined by the industry, a Micro ohm meter is required. This Micro ohm meter is to be used on DC resistance and other testing points of transformers ranging from 10 KVA to 1000 KVA which are repairing various damaged transformers under Different Transformer Repairing Workshop

Sr.No.	Description																											
1	<b>Application</b> <ul style="list-style-type: none"> <li>•Testing of Communication Cable</li> <li>•Testing of Instrumentation Cable</li> <li>•Testing of Transformer (10 kva to 1000 kva)</li> <li>•Testing of Motors, Coils.</li> <li>•Testing of Component.</li> </ul>																											
2	<b>Features &amp; Technical Specification</b>																											
2.1	Large seven segment LCD display.																											
2.2	Back-EMF Protection																											
2.3	Heat Run Test with time vs resistance graph																											
2.4	Six measurements range from 1 Micro-Ohm to 2000 Ohm <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Range</th> <th>Resolution</th> <th>Max Current</th> </tr> </thead> <tbody> <tr> <td>2 mΩ</td> <td>0.1 UΩ</td> <td>10 A</td> </tr> <tr> <td>20 mΩ</td> <td>1 uΩ</td> <td>1 A</td> </tr> <tr> <td>200 mΩ</td> <td>10 mΩ</td> <td>0.1 A</td> </tr> <tr> <td>2000 mΩ</td> <td>100 uΩ</td> <td>0.01 A</td> </tr> <tr> <td>20 mΩ</td> <td>1 mΩ</td> <td>0.1 A</td> </tr> <tr> <td>200 mΩ</td> <td>10 mΩ</td> <td>0.01 A</td> </tr> <tr> <td>2000 mΩ</td> <td>100 mΩ</td> <td>1m A</td> </tr> <tr> <td>20 MΩ</td> <td>1 Ω</td> <td>0.1m A</td> </tr> </tbody> </table>	Range	Resolution	Max Current	2 mΩ	0.1 UΩ	10 A	20 mΩ	1 uΩ	1 A	200 mΩ	10 mΩ	0.1 A	2000 mΩ	100 uΩ	0.01 A	20 mΩ	1 mΩ	0.1 A	200 mΩ	10 mΩ	0.01 A	2000 mΩ	100 mΩ	1m A	20 MΩ	1 Ω	0.1m A
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2.5	Dual Chanel Measurement Facility																											
2.6	4 Wire Measurement Method																											
2.7	Fully Protected from Back EMF of inductive load.																											
2.8	Pulse mode operation with 10 second pulse.																											

2.9	Stable and fast measurement
2.10	Data download port USB
2.11	Temperature Rise test software
2.12	Regulated and Highly stable 10 Amp Current Source
2.13	0.1uOhm resolution on 1mili-Ohm range
2.14	Accuracy: $\pm 0.05\%$ of reading $\pm 5$ Digit
2.15	Power Supply: 230V AC, 50Hz, 1 Phase
2.16	Temperature correction facility
3	<b>Other Specifications –</b>
3.1	Set of Test leads (3meters) with good quality Kelvin/ Crocodile clips (One set of Test leads is in spare).
3.2	Housed in Good quality briefcase Type Box wooden or High Quality PVC box
3.3	Operating TEMPERATURE : -10 to 50°C
3.4	Humidity : Ambient to 90% RH

### Double Voltage & Double Frequency Test Set 15 kVA:

Specification:

1. Input : 415, 3Phase, 50Hz
2. Output : 50-1000V AC, 3 Phase, 100Hz
3. Protection : O/C Trip in output
4. Output Capacity: 15 KVA

### AC High voltage test set 40kV at 50mA:

Specification:

1. HVT unit : 40kV, 50mA.
2. Meter : Digital Meters
3. Output : Continuously variable (motorized operated dimmer)
4. Type : OIL cooled.
5. Input : single phase 230 V.
6. Output current : 0-50 mA with ammeter WITH TIMMER
7. Protection : Interlock for zero start
8. Auto tripping : 4 selectable switch values

### Turn Ratio Test:

### Technical Specifications of Integrated ratio Measurement in transformer test bench.

SrNo.	Descriptions
1	3-Phase Automatic Transformer Turns Ratio Meter should have basic accuracy $\pm 0.1\%$ Reading $\pm 0.1\%$ of range (For HV-LV Voltages & Ratio).
2	It should be capable of performing accurate measurements of TRMS HV & LV Voltage, Excitation Current (HV Side), Turns Ratio of Transformer.
3	It should be capable to measure Turns Ratio of Transformer up to 2000 Ratio.
4	It should be capable to calculate %Deviation of Measured Turns Ratio with Calculative Turns Ratio entered by User.
5	Excitation Current measurement should be up to 200mA.
6	Test Voltage must be approx. 55 V @ 230V Aux. Supply Voltage of Instrument.
7	It should have Vector Group Selection Facility & User should be able to set Measurement
8	Hookup Error should be provided for YY Connections.
9	It should have user-friendly features like Blue Colour 20x 4 LCD Display, with suitable Key pad.
10	Mechanically, it should be designed in Carrying Case : ABS Plastic Bag for Easy Carrying
11	It should also have inbuilt memory storage facility to store at least 100 nos. of readings.
12	It should be provided with one USB Port at rear/front side of instrument to communicate with Computer.
13	Free Demo Software should be provided with Instrument to see Turns Ratio, %Deviations, Excitation Currents in Computer & to Print & save Test Report.

### **MEASUREMENT FUNCTIONS:-**

S.N	PARTICULARS	Specifications
1	Measuring & Calculative Parameters	Turns Ratio, % Deviation, Excitation Current, HV & LV side Voltages & Reverse Polarity
2	Resolution of Turns Ratio	5 Digits
3	Excitation Voltage	Approx 55 V, 50 Hz @ 230 V Input Supply
4	Excitation Current Range & Resolution	Range Up to 100 mA, Resolution 0.1 Ma
5	Accuracy : (within 1 year after Calibration)	$\pm 0.1\%$ reading $\pm 0.1\%$ range (For HV & LV Voltages & Ratio)
6	Ratio Range	1.0 – 200.0
7	Connections	Y-Y, D-Y, Y-D, D-D
8	Computer Interface	RS-232 or USB with Free Demo Software
9	Data Storage	Up to 100
10	Over Current protection	Fuse as well as Range Overload Tripping should be provided.
11	<b><u>ACCESSORIES</u></b>	
1	10 Meter Long HV-LV Testing lead with Alligator clip with R, Y, B Color Code	
2	RS-232 or USB Cable For Computer Interface	
3	Mains Power Cord	
4	Software CD	
5	Documents File with Operational Manual & Test Certificate	
6	Extra Fuse	

### **Technical Specification of Integrated Insulation Resistance Test:**

Sr. No	Description	Specification
1	Digital resistance range	0.01 M $\Omega$ - 5T $\Omega$
2	Analog display resistance range	1 K $\Omega$ - 1T $\Omega$
3	Test Voltage ranges (DC)	500, 1000, 2500, 5000V in steps by 50V or 25V
4	Leakage Current range	3mA (Max)
5	Short circuit Current	5mA
6	Voltage AC/DC range	0-600V
7	Accuracy	$\pm 5\%$ up to 1000 G $\Omega$ and $\pm 20\%$ from 1000 G $\Omega$ to 5 T $\Omega$ (Tera ohms)
8	Polarization index (pi) range	0-99.9
9	Dielectric discharge test (DD)	0-99.9
10	Dielectric absorption ratio (DAR)	0-99.9
11	Power supply	AC 230 V $\pm 20\%$
12	Display	LCD dot matrix with backlight
13	Protection classification	Double Insulation
14	Over Voltage category	CAT IV / 600V
15	Degree of protection	IP 65 or better
16	Working temperature range	-10°C - +50°C

17	Storage temperature range	-20°C - +70°C
18	Communication	Serial port RS 232 (along with adaptor) or USB
19	Memory	1000 measurement results
20	Maximum Humidity	95% RH (o-40°C) non-condensing
21	Visual & Sound warnings	Yes
22	Safety Standards	As per IEC 61326-1 & IEC 61010-1

**PC loaded with Testing Software:**

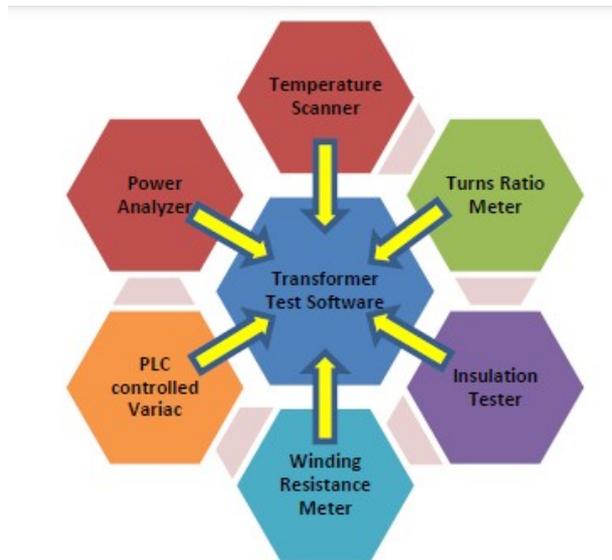
**Specifications:**

1. Data Acquisition Capability from measuring instruments
2. Customized display screens
3. Different screens for different tests with provision for easy navigation to different screens
4. Supervisory Controls for User creation and data protection.
5. Data Entry facility.
6. Preparation of Individual/ complete Test Reports
7. Data exporting facility.
8. Data Storage and Back up facility
9. Search options
10. Test Value Display facility
11. Customized Reports.
12. Test report.
13. English language

**TECHNICAL DATA FOR DESKTOP:**

Processor	I3/I5 Intel
RAM	8GB
HDD	256 SSD
Keyboard & Mouse	Will be provided
I/O ports	USB, LAN, HDMI
Operation System	Windows 10
Monitor	19.5 Inch

Tentative Image



## TECHNICAL SPECIFICATION FOR TRANSFORMER WINDING RESISTANCE METER

Sr. No.	Description	Specification
1	Function	The instrument shall be used for measuring DC winding resistance of all Transformers/Reactors where high inductance is present.
		The test kit shall be able to withstand inductive kicks from transformer winding and shall be capable of working in inductive atmosphere.
		It should employ four wire methods, and no lead compensation shall be required for the measurement. Shall have minimum two independent measuring channels and quick stabilization period.
2	Test current	30A DC continuous or better
3	Open Circuit Voltage	100V
4	Measurement Channels	Minimum two independent measuring Channels for simultaneous measurement of HV & LV winding
5	Display	Digital LCD display with backlight viewable in bright sunlight
6	Range	0 to 1000 ohms Auto reading
7	Resolution	Resolution: 1 $\mu\Omega$ upto 1m $\Omega$ range
8	Accuracy	+0.5% $\pm$ 5Count
9.	Demagnetization	The equipment shall have Built-in demagnetization circuitry which shall allow the operator to manually/automatically demagnetize the transformer core, either before or upon completion of resistance testing, or as a standalone feature.
10	Temperature correction	The kit should have the facility to have correction of resistance value to a reference temp. i.e. provide temp. compensate reading of resistance (for Cu and Al)
11	Key Board	Front Panel, interactive
12	Power supply	It shall work on single-phase 230 $\pm$ 10% V, 50 $\pm$ 5% Hz, supply with variations in voltage and frequency respectively on standard sockets.
13	Protection of Kit	Kit should have all necessary protections against transient voltages, induction, short circuits etc. Built-in-discharge circuit should be provided to discharge the specimen when test is completed or when current lead accidentally disconnects or when instrument power supply is lost.
14	Storage	Internal, nonvolatile memory for storing up to minimum 1000 sets of readings.
15	Repeatability	It should offer repeatability of test results in charged area.
16	Cooling arrangement	Necessary in built cooling arrangement should be provided to dissipate the heat generated during testing. No external coolant/accessory shall have to be required.
17	Computer connectivity	The kit should have facility to connect with Windows 11 based computer/laptop for exporting test data.
18	Software	A suitable software should be supplied for data downloading & report generation including OLTC graphs and temperature compensation.

19	Accessories	Complete set of test leads of min. 20meter length, combination plugs clamps and connectors, Built in thermal printer with 5 spare paper rolls/Provide Laptop, power-supply cables, original hard carrying case for main kit and cables (which should be robust/rugged enough for proper safety of the kit during transportation), manual (both in soft copy & hard copies) etc. required for carrying out all types of testing. All the accessories for desired operation & control of instrument shall have to be provided.
20	Design/Engg.	The complete equipment along with complete accessories must be designed/ engineered by Original Equipment Manufacturer.
21	Transit Case	The kit and accessories shall be robust and rugged enough, so that it can be transported safely at different locations. The transportation and packing cases of the kit shall be such that the transportation from one station to other will not affect the performance and accuracy of measurement of kit.

## Technical Specifications of oil BDV Testing Equipment

### Scope:

The scope is for Supply of oil BDV testing equipment and complying to the latest relevant standards. The scope includes supply of the equipment with necessary hardware, software, accessories, installation and providing training. The equipment shall use the latest state of art technology and may comprise of all necessary components and accessories, in order to ensure proper and hassle-free working of the supplied equipment.

### GENERAL REQUIREMENTS

1. The instrument should be suitable for Automatic Measurement of Electrical Breakdown Strength of transformer oil.
2. The instruments shall contain all standard accessories, software, and transport/carrying case. The equipment should be compact in size and light in weight
3. The instruments should have been proven for repeatability of test results in laboratory conditions.
4. The precise setting of electrode gap should be possible with the help of built-in micrometer.
5. The instrument should have built-in temperature sensor and same should be printed in report.
6. The Instrument should have Real Breakdown Monitoring (RBM) facility.
7. Environmental conditions such as temperature, humidity, vibration, bump etc., shall be as per IS- or equivalent standards. Required certificates confirming to above standards shall be furnished along with the offer.
8. The kit shall be compatible for EMI/EMC environment as per IEC.
9. The oil test set should have minimum 10Test result storage capacity. The test result can be recalled and printed.
10. 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.
11. Protection/Control: Against Short circuit, overload, transient surges etc. Also the instrument should have facility of stopping automatically on power failure. Also the kit should have facility of HV Chamber interlocking as well as zero start interlocking. A safety interlock has to be there, which prevents access to the high voltage terminals during testing. The design should ensure a high level of safety for the operator. The high voltage chamber is to be covered.
12. The equipment shall generally comply with the requirement of relevant Indian standard or equivalent International standards such as IEC, BS, ASTM, ISO etc.

### TECHNICAL SPECIFICATION FOR BDV TEST KIT

SN	Description	Specification Limit etc.
1.	Voltage Measurement Range Accuracy Resolution	0-100 kV ± 1kV 0.1 kV
2.	Test Output Voltage	0-100 kVrms Symmetrical
3.	Power consumption	Max. 70 VA
4.	Voltage Increase Rate	0.5 – 10 kv/s and preprogrammed as per standards
5.	Switch off Time on Flash over	< 10μ Sec
6.	Measurement Programmes	Fully Automatic Pre-programmed/User programmed Test Sequences including as per latest IEC & other national/international standards.
7.	Printer	Inbuilt Matrix printer
8.	Data Interface	USB 2.0 (type B plug)
9.	Operating Temp Range	-0°C to +50°C

10.	Storage Temp Range	-20°C to +60°C
11.	Display & Keypad	Backlite, Alphanumeric/LCD Display & Soft Keypads
12.	Power Source	90 – 264 V (50/60 Hz)
13.	Internal temperature recording of the oil sample & resolution	0 – 99°C, Temperature resolution 1°C
14.	Humidity	Non-condensing
15.	Stirrer	Magnetic Type stirrer to be provided
16.	Display/Control	
17.	Safety and EMC	CE-compliant in accordance with Low Voltage Directive (2014/35/EC), EMC Directive (2014/30/EC), EN 60068-2-ff Environmental testing
18.	Equipment Standards	ASTM D1816:2012 1 mm, ASTM D1816:2012 2 mm, ASTM D1816/97, ASTM D877/D877M:2013 PA, ASTM D877/D877M:2013 PB, BS EN 60156, CEI EN 60156, CSSR RVHP:1985, IEC 60156:2018, IEC 60156:2018 Annex A, IRAM 2341:1972, JIS C2101:1999, PN 77/E-04408, SEV EN 60156, UNE EN 60156, NF EN 60156, SABS EN 60156, VDE 0370-5:1996, AS 1767.2.1

## TECHNICAL SPECIFICATIONS OF DISSOLVED GAS ANALYZER (DGA) 7 GASES

### Scope:

The scope is for Supply of Dissolved Gas Analyzer (DGA) 7 Gases and complying to the latest relevant standards. The scope includes supply of the equipment with necessary accessories, installation and providing training. The equipment shall use the latest state of art technology and may comprise of all necessary components and accessories in order to ensure proper and hassle free working of the supplied equipment.

### **1.0 GENERAL TECHNICAL REQUIREMENT:**

- (i) Supply Voltage : Single Phase AC, 230 Volt +10%
- (ii) Frequency : 50 Hz  $\pm$  3%

### **DOCUMENTATION:**

1. The supplier shall furnish nicely printed and bound volumes of the instruction manuals in English language, prior to the dispatch of the equipment. The instruction manual shall contain step by step instructions for all operational & maintenance requirements.
2. The instrument shall be supplied with valid calibration certificate. The calibration certificate traceable to National/ International Standards from ISO/ IEC 17025 accredited laboratory.

### **2.0. TECHNICAL SPECIFICATION OF COMPACT LAB DGA SET**

**A.** Dissolved gas analyzer suitable for analysis of small quantities of dissolved gases in insulating oil filled in power transformers and other electrical equipment for carrying out Dissolved Gas Analysis and interpretations of test results as per national and international standards. Equipment should be user Friendly. The test kit shall have the feature of fully automatic operation with the help of a Laptop to control, analyze and produce date & time stamped hard copy of the test results.

1. The unit shall have Internal Cylinders for storage of Carrier Gas and Fuel Gas to be used to run kit continuously during main cylinder replacement, support almost 100 samples.
2. The unit must have capability to perform all needed analysis within a short period of time. The measurement from the point of oil injection towards receiving the results shall not take longer than 30 Minutes as per ASTM D3612/IEC 60567;2011.
3. The unit shall be capable to measure key gases including as a minimum Hydrogen, Carbon Monoxide, Carbon Dioxide, Methane, Ethane, Ethylene ,Acetylene. The ppm measuring values should range as follows

Gases	Range for dissolved gas-in-oil samples
Hydrogen (H <sub>2</sub> )	1 - 5,000 ppm
Carbon Monoxide (CO)	0.2 - 50,000ppm
Carbon Dioxide (CO <sub>2</sub> )	0.4 - 50,000ppm
Methane (CH <sub>4</sub> )	0.2 - 50,000 ppm
Acetylene (C <sub>2</sub> H <sub>2</sub> )	0.5 - 50,000ppm
Ethylene (C <sub>2</sub> H <sub>4</sub> )	0.2 - 50,000 ppm
Ethane (C <sub>2</sub> H <sub>6</sub> )	0.2 - 50,000ppm
Accuracy – other gases	$\pm$ 5 to 6% or $\pm$ LDL ppm (whichever is greater)

4. The unit shall have the capability to measure dissolved gas-in-oil samples as well as gas samples taken from Buchholz Relays without any additional accessories.
5. The unit shall be capable to measure independent gas concentrations in parts per million (ppm).
6. Additional accessories, if any, must be provided along with the unit and must be compact and easy to handle.
7. Testing procedure shall comply with testing requirements & safety features as set by International Standards such as ASTM 3612 / IEC 60567;2011 OR Latest International Standards.

**B. Technical Specifications:**

Sr. No.	Parameters	Specifications/ Requirements
1.	Functional Requirement	The dissolved gas analysis kit should extract, detect, analyze and display the dissolved gases in transformer oil based on as specified in relevant IEC-60567;2011/IEEEC57.104 and IEC60599. Kit should be suitable for all the available types of Insulating Oils in the Industry.
2.	Construction	The unit shall be compact and rugged.
3.	Detection of Gases	Concentration of all the fault gases i.e. H <sub>2</sub> , CH <sub>4</sub> , C <sub>2</sub> H <sub>2</sub> ,C <sub>2</sub> H <sub>4</sub> , C <sub>2</sub> H <sub>6</sub> , CO , CO <sub>2</sub> Shall be individually measured and displayed. The minimum detection limits of the instrument shall be strictly met the IEC-60567-2011.The Principal of the Kit must be GC (Gas Chromatograph)
4.	Extraction of Gases	Gases shall be extracted from insulating oil by either of the following <b>mercury free</b> extraction method;  Automated Head space gas extraction method OR Partial Vacuum Degassing method
6.	Calibration at site	The unit shall be inherently calibrated and shall be possible to be calibrated with the help of Certified Calibration gas to verify at any time and the facility be provided in the scope of supply.
7.	DGA Diagnostic features	The Kit should have built in DGA diagnostic software features like Rogers' Ratios, Duval's Triangle etc as per IEC 60599.
8.	Accuracy	As per IEC /ASTM
9.	Settable limits	The kit shall have the facility to preset limits for "Caution" and "Warning" thresholds for all gases.

10.	Oil sample volume	10 ml
11.	Gas sample volume	1 -5 ml
12.	Humidity	Up to 95%
13.	Temperature Range	0-50 degree C
14.	Display	The kit should have built in display preferably LCD/LED display and Laptop facility for better analysis and Graphical Representation for Gas Chromatographs.
15.	Software	The instrument should have built in/Laptop control for all the functions, data acquisitions and data storage based on latest Window based software. The internal diagnostic software should be capable of translating the measured data into valuable information by employing standard DGA interpretation rules.
16.	Interface	It should have the facility for communication with PC/Laptop for downloading the data from the instrument via USB port. Licensed copy of the software required to download data to computer shall be provided.
17.	printer	The kit should supplied with Printer
18.	Accessories	All the Desired accessories including calibration gas Cylinder shall be supplied with the kit
19.	Safety Features	All safety features shall be provided as per latest International standards
20	Input supply	230 V , +/- 10%, 50 Hz: single phase AC supply
21	Calibration	The instrument shall be supplied with valid calibration certificate. The calibration certificate traceable to National / International Standards from ISO/ IEC 17025 accredited laboratory.
22	Working Environmental Condition	The equipment should effectively function from ambient temperature to 50 <sup>0</sup> C & RH 95% non-condensing.
23	Transport case	Transport case shall be provided for Kit and Accessories <b>(Housing: Pelicase, waterproof, IP 67)</b>
24.	Deviations	Deviations if any from the specifications given above which provides improvement in the functioning of the above equipment shall be clearly brought out with their advantages.
25.	Additional features	Any additional features other than the above may be brought out clearly.
26.	IP Rating	The unit shall have an ingress protection rating of IP20 when operating and IP67 when closed for storage.
27	Weight/Dimension	Should be portable and light in weight

### C. Power Supply & others:

1. Suitable for Single Phase 230V AC +/-10%, 50Hz +/- 3 %.
2. The calibration certificate should not be older than months from the date of supply of test kit.
3. The acceptable criteria of the equipment shall be successful demonstration.
4. The kit shall be compatible for EMC/EMI/Safety environment requirement as per IEC.

**Accessories as required:** Mains Cable, communication cable, CD with software and Expert System or as required calibration gas, 2 x 10ml glass syringe/ vial incl. 2-way valves, 5 aerosol filters, glass tube for FID, Automatic Sample Collection Kit consists of Oil Bottle, Syringe etc., instruction manual etc.

**1.0 GUARANTEED TECHNICAL PARTICULARS (GTP) FOR DGA TEST SET**

Sr. No.	Description	Manufacturer's Guaranteed Data		
1.	Manufacturer's name and address			
2.	Manufacturer's Model			
3.	Functional Requirement			
4.	Construction			
5.	Detection of Gases			
6.	Extraction of Gases			
7.	Ability to test Gas Samples from Buchholz Relays			
8.	Consumable gases			
9.	DGA Diagnostic features			
10.	Performance parameters			
11.	Accuracy			
12.	Settable limits			
13.	Oil sample volume			
14.	Gas sample volume			
15.	Humidity			
16.	Temperature Range			
17.	Display			

## TECHNICAL SPECIFICATIONS FOR AUTOMATIC OIL TAN DELTA & RESISTIVITY TEST KIT.

### Scope:

The scope is for Supply of Automatic oil tan-delta and resistivity test Kit and complying to the latest relevant standards. The scope includes supply of the equipment with necessary accessories, installation and providing training. The equipment shall use the latest state of art technology and may comprise of all necessary components and accessories in order to ensure proper and hassle free working of the supplied equipment.

### Features:

<ul style="list-style-type: none"> <li>• Highly precise induction heating of the cell with accurate temperature control</li> <li>• Equipment has built in heater and temperature sensor.</li> <li>• Equipment is suitable for measuring Resistivity, Tan Delta, permittivity and loss factor in a single test only.</li> <li>• The testing set shall have oil drain facility: Manual and Fully Automated Microprocessor Controlled.</li> </ul>
<ul style="list-style-type: none"> <li>• Functional design for high efficiency, user-friendliness and safety in case of minimum space requirement</li> </ul>
<ul style="list-style-type: none"> <li>• Test cell according to IEC 60247</li> </ul>
<ul style="list-style-type: none"> <li>• Automatic calibration of the empty cell for quick test sequences</li> </ul>
<ul style="list-style-type: none"> <li>• Emptying of the test cell possible without disassembly</li> </ul>
<ul style="list-style-type: none"> <li>• Direct temperature measurement by placing the sensor in the measurement electrodes</li> </ul>
<ul style="list-style-type: none"> <li>• Fully automatic operation/testing sequence</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Data Entry and storage</b> :Capacity of Minimum 10test results and also provision of data transfer through USB / RS232 ports shall be provided for removable data storage(Flash drive/Pen drive). Ergonomic operating unit with oil-proof membrane keyboard, easy to read Colour LCD and integrated printer</li> <li>• Test cell with safety ring, three electrodes and quartz glass rings</li> <li>• Emptying of the test cell possible without disassembly</li> </ul>

Sr.No	Parameter	Specification
1	Power supply	180-240V AC
2	Max. power consumption	500 VA
3	Display	Built in LED /LCD Colour Display
4	Pre-programmed standards	IEC 60247:2004 Standard, IEC 60247:2004 Routine, VDE 0380- 2:2005_01 Standard, VDE 0380-2:2005_01 Routine, BS 5737:1979 Standard, BS 5737:1979 Routine, ASTM D924-08 Standard, ASTM D924-08 Routine, ASTM D1169-11 Standard, ASTM D1169-11 Routine, IEC 61620:1998-11, JIS C2101:2010
<b>5</b>	<b>Test cell according to IEC 60247</b>	
	Description	a) Test Cell Shall be integral part with main unit. b) Three terminal stain steel test cell as per IEC 60247. c) The cell spacers / gaskets shall be made of materials that is electrically insulating and chemically inert like PTFE / Quartz, resistant to all types of insulating liquids ( such as mineral oil, synthetic ester, natural esters, silicone oils etc.) over the temperature range and the cleaning agents which may be used.
	Content	45 ml
	Idle capacity tolerance	67.8 to 73 pF
	Material	Preferably chrome- nickel steel

	Test Voltage	2000Volt or better		
	Oil test cell heater	Should be built in with main equipment along with temperature sensor.		
6	Heating time	The Test Cell heating to raise the temp. of liquid to 110°C in 20Minutes.		
7	Interface	USB /RS232 Port		
8	Printer	Matrix printer		
9	Ambient temperature	0 to +50 °C		
10	Relative humidity	90% Non-condensing		
11	Test voltage AC	Upto 2000 VRMS or better. accuracy ± 1%		
12	Test voltage DC	±125 V to ±500 VDC on both the polarities accuracy ± 0.5%		
13	Dielectric Constant:	1 to 30when using a typical oil test cell (C=70pF)		
14	Degree of protection	IP 32		
15	Typical test cycle duration	approx. 25min for IEC 60247		
16	Safety and EMC	CE-compliant in accordance with Low Voltage Directive (2014/35/EC), EMC Directive (2014/30/EC), EN 60068-2-ff Environmental testing		
		<b>Range</b>	<b>Resolution</b>	<b>Accuracy</b>
17	Dissipation factor measurement	1x10-6 to 4.0	1x10-6	± 1%
18	Relative permittivity	1...25	1x10-2	± 0.5% of measured value
19	Resistivity measurement	2.5 MΩm...100 TΩm	1x10-2 (complete range)	± 1%
20	Temperature measurement	Selectable between Ambient and 110°C	0.1 °C	± 0.4% of average value

## Technical Specifications of Turns Ratio Tester (Portable)

### Scope:

The scope is for Supply of Turns Ratio Tester and complying to the latest relevant standards. The scope includes supply of the equipment with necessary hardware, software, accessories, installation and providing training. The equipment shall use the latest state of art technology and may comprise of all necessary components and accessories in order to ensure proper and hassle free working of the supplied equipment

### GENERAL: -

Instrument should be a portable and intended for diagnosing of turn ratio, phase deviation. It has an excellent IP protection allowing the use of the instrument in harsh environments.

### MEASUREMENT PARAMETERS: -

- Turn ratio measurement of single and three phase transformers.
- Phase deviation between high voltage and low voltage winding.
- Excitation current (1mA to 0.5Amp.).

### TECHNICAL PARAMETERS: -

#### A ) TURN RATIO

- Excitation Voltage : 1 V, 5 V, 10 V, 40 V & 80 Vac(Suitable Steps)
- Range : 1 to 1000 Auto-Ranging
- Resolution : 0.1 at 80 V
- Accuracy : 0.2% at FS

#### B ) TURN RATIO DEVIATION

- Test Frequency : 50 Hz  $\pm$ 10%
- Range : -100% to +100%
- Resolution : 0.1%

#### C) EXCIATATION CURRENT

- Test Frequency : 50 Hz  $\pm$ 10%
- Range : 1mA to 0.5Amp.

#### D) PHASE DEVIATION

- Test Frequency : 50 Hz  $\pm$ 10%
- Range : 0° TO + 360°
- Resolution : 0.01°
- Accuracy :  $\pm$ (0.5°)

### OTHER FEATURES:-

- 1) Instrument should have Pass / Fail Indication.
- 2) Instrument should have visual test function to maintain safety standards prior testing the transformer.
- 3) Instrument should have Built-in help screens.
- 4) Instrument should have Pre-programmed sequences of measurements can be carried out in Auto Sequences menu. The sequence of measurements, their parameters and flow of the sequence can be programmed.

DISPLAY: - Instrument should have Back-lite LCD/LED Display

APPLICABLE STANDARDS: - The instrument shall conform to the provisions of relevant International Standards for **EMI/EMC/Safety Environment Requirement as per IEC.**

MEMORY: - Instrument should have inbuilt memory for storage of measurement.

**PROVISION OF SOFTWARE:** - The instrument shall have supplied with software and USB & Bluetooth interface which can download digital data to a computer or Laptop. The software shall be provided free of cost.

**OPERATING SUPPLY:** The instrument should work on rechargeable battery supply and Mains power supply 230±10% with 50±5% Hz.

**TEMPERATURE RANGE:** The instrument shall have operating temperature range from 0 to 50°C

**RELATIVE HUMDITY:** The instrument shall have RH better than 85% non-condensing.

**PORTABILITY:** The instrument should be light weight and easily portable. The instrument along with leads/ accessories shall be provided in a compact, sturdy, light, protective bag/Hard Case, which should be robust and rugged enough.

**ACCESSORIES:** All the Standard Accessories for desired monitoring, operation & control of instrument shall have to provided.