

# **TECHNICAL SPECIFICATION**

## **for TROLLEY MOUNTED 3-Ph POWER ANALYZER TESTING KIT** **for TESTING OF 11KV/433V DISTRIBUTION TRANSFORMER CAPACITY UPTO 1000KVA,**

1. **SCOPE :** A complete Trolley mounted Power Analyzer Testing kit to perform No Load Test (OC Test), Full Load Test (SC Test) to measure No Load & Full Load Losses, Efficiency, Impedance and other electrical parameters of 3-Phase Distribution Transformer 11KV / 433V ranging from 10KVA to 1000 KVA rating along with computer display inbuilt in single control panel with the following equipments-
  - 1.1 3-Phase Power Analyzer of standard make with ability to interface with computer
  - 1.2 3-Phase Intermediate Transformer of 415/660V & 55 Ampere Capacity
  - 1.3 3-Phase Motorized Oil Cooled Variac of 100 Amp , 415 Volts Input & 0 – 470 Volt output
  - 1.4 Suitable switch gears, Panel meters & required accessories.
  - 1.5 Control panel (Power Analyzer, switch gears, Panel meters & other accessories inbuilt in single control panel)

## **2. TECHNICAL SPECIFICATIONS OF 3-PHASE POWER ANALYZER WITH SOFTWARE**

### **2.1. POWER ANALYZER**

- 2.1.1. 3-Phase Power Analyzer of accuracy class 0.1, should have basic accuracy + 0.1% of Reading + 0.1% of Range,
- 2.1.2. Frequency Band width, 50±3 Hz or better
- 2.1.3. Voltage range should be 0 to 600V (Phase to Neutral) TRMS, Without need of external PT.
- 2.1.4. Current range should be minimum 80mA to 80 Amp Capacity (Direct) TRMS, without use of external CT.
- 2.1.5. Six extra input channel (10V DC)
- 2.1.6. It should be capable of performing accurate simultaneous measurements of TRMS Voltage, Current, Active Power, Apparent Power & Reactive Power, Frequency, Power Factor etc.
- 2.1.7. It should be capable to measure Mean value, Peak value and RMS value of Voltage and current.
- 2.1.8. It should have inbuilt memory storage facility to store at least 1000 or more readings.
- 2.1.9. It should have one USB Port at front side as well as one RS-232 port at rear side of instrument to communicate with PC interface.
- 2.1.10. It should have two displays (Large Blue Color 20 x 4 LCD Display & 7-Segment Red LED Display) and
- 2.1.11. Hold feature to freeze all measurement of Power Analyzer
- 2.1.12. 24 Nos. of push buttons to perform easy operations.
- 2.1.13. CTPT Ratio and Power Scaling setting etc. features must not be existed in Power Analyzer to avoid malfunction in measurement.
- 2.1.14. High speed data measurement mode to measure basic parameters in 1 Sec (Slow), 0.5 Sec (Medium) & 0.25 Sec (Fast Speed) approx or better should be provided in Power Analyzer. User should be able to set Measurement Speed (Update Rate) as 1 Sec (Slow), 0.5 Sec (Medium) & 0.25 Sec (Fast Speed).
- 2.1.15. The fully floating isolated inputs shall have a high immunity against electrical disturbances, high dynamic common mode rejection and wide measuring ranges. Design of input terminal has to withstand momentary over load condition.

- 2.1.16. Computer Interfacing Software for Power Analyzer software CD.
- 2.1.17. It should have double fuse protection system.
- 2.1.18. Mechanically, it should be designed to use in Rack/Panel mounting as well as table top without additional accessories.
- 2.1.19. It should be made using aluminum sheet & extrusion with proper powder coated finish.
- 2.1.20. **Power Analyzer must contain Auto over Voltage cut-off facility.**
- 2.1.21. This Power Analyzer must be a shock proof and vermin proof.
- 2.1.22. Power Analyzer should be complied Safety Standard IEC 61010-1(with latest amendments). **Test Certificate must be attached with technical Bid.**
- 2.1.23. Calibration certificate carried out must at ERDA/CPRI/NABL accredited lab are to be supplied with instrument.
- 2.1.24. Software for establishing interface of Power Analyzer with the Computer must be provided with power analyzer.

## **2.2 POWER ANALYZER SOFTWARE: -**

- 2.2.1 Software for establishing interface of Power Analyzer with the Computer must be provided with power analyzer. Software should be such that editing of measured values becomes impossible.
- 2.2.2 Software shall be installed by the supplier as when required & provide necessary technical assistance / training once at site (after delivery of equipment & at time mutually agreed upon) free of cost.
- 2.2.3 The software should be user friendly, easy to install in PC & Laptop.
- 2.2.4 It should be possible to store the results by processing one key only instead of pressing a series of keys.
- 2.2.5 It should be possible to send the stored data from power analyzer to computer in one stroke only.
- 2.2.6 It should be possible to take print out of selected test result by giving only one command indicating the locations of the selected data.
- 2.2.7 Storing of results in power analyzer should be user friendly. It should be possible to store results by pressing one key only instead of pressing a series of keys and should be done in minimum possible time (quickly).
- 2.2.8 It should be possible to store view & transfer transformer-wise test results from power analyzer to computer by installing suitable software in PC / Laptop.
- 2.2.9 It should have facility to see test reports as per testing operator / user wise, make and Capacity wise.
- 2.2.10 Test report should be available in pdf format for further record.
- 2.2.11 E-mail facility should be available in software for sending report to different offices.
- 2.2.12 Authentic User login facility must be provided in this Software.
- 2.2.13 Test data must be stored in Data Base as well as PC/Laptop.
- 2.2.14 Software support and required update (Online/Telephonic) must be given free of cost for Within 63 months from the date of receipt of material or 60 months from the date of Commissioning whichever is earlier.
- 2.2.15 Free demo software should be provided with power analyzer to see all basics parameters simultaneously in computer & to print test report. Software should be also capable to collect 1000 stored data in one stroke from power analyzer it should have facility to save test report in MS-excel format for further calculations and to generate users own test reports of device under test.

## 2.3 POWER ANALYZER STANDARD / ACCESSORIES

- 2.3.1 Power Supply Cord
- 2.3.2 Current terminal with nut inbuilt
- 2.3.3 RS-232 serial interface cable
- 2.3.4 USB interface wire
- 2.3.5 Software CD
- 2.3.6 Two number operation manuals with each Power analyzer
- 2.3.7 Test & Calibration Certificate with NABL Traceability
- 2.3.8 Link for Neutral Terminals
- 2.3.9 Extra Fuses

## 2.4 INPUT SPECIFICATIONS

<b><u>INPUT SPECIFICATIONS</u></b>		
	<b>Neutral Common</b>	<b>Floating Input</b>
<b>Parameter</b>	<b>Voltage</b>	<b>Current</b>
Input type	Resistance voltage divider	Current to voltage converter
Rated Values (range)	Mini. 600 V Phase to Neutral	Direct input: Mini. 80A RMS Direct
Measuring instrument Loss (Input Resistance)	Input resistance: approximately 1M $\Omega$	Direct input: Approximately 1m $\Omega$
Maximum instantaneous allowed input (cycle 20mSec duration)	Peak Voltage of 1.6 KV or rms value of 1.1 KV Minimum (whichever is less)	Peak current of 500 A or rms value of 400 A Minimum (whichever is less)
Maximum continuous allowed input (1 Sec duration)	Peak Voltage of 850V or rms value of 600V Minimum (whichever is less)	Peak current of 120 A or rms value of 80 A Minimum (whichever is less)
Input terminal type	Banana Socket (wire fit type)	Direct input: Large binding post (with 1/4" BSW copper stud with insulated nut)
A/D converter	Simultaneous conversion of voltage and current input Resolution: 24 bits	

## 2.5 GENERAL SPECIFICATIONS

<b><u>GENERAL SPECIFICATIONS</u></b>	
Warm-up time	30 minutes or less
Operating temperature	5° to 55° C
Operation humidity	20% to 75% RH (non condensation)
Storage temperature	0° to 55° C
Insulating resistance	40M $\Omega$ or higher at 600 V DC all of the following area- Voltage input terminal to case Current input terminal to case Voltage input terminal to Current input terminal Case to power supply
Insulation withstand voltage	2500 V AC for one minute at 50 Hz. Across all of the following area- Voltage input terminal to case Current input terminal to case Voltage input terminal to Current imputer terminal
Power Supply	210 to 250 V, AC 50 Hz with high voltage cut off relay
Consumed power	30 VA maximum
Weight	5.5 Kg. approximate**

## 2.6 CALCULATION FUNCTIONS

CALCULATION FUNCTIONS			
	3 Wire (2-Watt Meter)	V Phase to Phase(3-Watt Meter)	4 Wire (3-Watt Meter)
Volt V	$V=(V1 + V2)/2$	$V1 = \sqrt{3} V1(V1+V2)/2$ $V2 = \sqrt{3} V2(V2+V3)/2$ $V3 = \sqrt{3} V2(V3+V1)/2$ $V = (V1 + V2 + V3)/3$	$V = (V1 + V2 + V3)/3$
Current I	$I = (I1 + I2)/2$	$I = (I1 + I2 + I3)/3$	
Active PowerP	$P=(P1 + P2)$	$P= P1+P2+P3$	
Power Factor PF	$PF=(PFI+PF2)/2$	$PF=(PF1 + PF2+PF3)/3$	
ApparentPower	$S1 = V1 \times I1$ $S2 = V2 \times I2$ $S = S1 + S2$	$S1 = V1 \times I1$ $S2 = V2 \times I2$ $S3 = V3 \times I3$ $S = S1 + S2 + S3$	
Reactive Power	$Q = \sqrt{S^2 - P^2}$		
Mean Volt	$V_{mean} = 1.11072 \times \text{Voltage rectified}$		
Crest Factor	$CF= \text{Peak Value} / \text{RMS Value}$		
Form Factor	$FF = \text{RMS Value} / \text{Average Value}$		
<b>Notes:-</b> 1. Measured Apparent Power, Reactive Power, Power factor, Crest Factor, Form Factor etc. are calculated from Voltage, Current and Active power. (Therefore, if the input contains distorted wave, these values may not match to those of other measuring instrument based on different measurement principles) 2. If either voltage or current falls to 10% of the range rating or less then the Apparent Power (S), Power Factor (PF) and Reactive Power (Q) may be displayed with more errors than specified. 3. No sign of Power Factor displayed when Current lag the voltage and negative sign is displayed when Current lead the Voltage.			

## 2.7 MEASUREMENT FUNCTIONS

MEASUREMENT FUNCTIONS		
Parameter	Voltage / Current / Active Power	
System	Digital sampling, sum of average methods	
Accuracy (within one year after calibration*) Conditions:- Temperature :- 25 $\pm$ 5 $\circ$ C Humidity :- 30 - 75% RH Input waveform:- Sinewave Power factor :- 1.0 Digits :- 5/6 digits Sample Avg :- 10 sample *Normal test & input condition	Frequency range	Accuracy
	50 $\pm$ 3 Hz:	$\pm (0.1\% \text{ of Reading} + 0.1\% \text{ of Range})$
Additional power factor effect on active power measurement	At 50 Hz 0.035 or time delay errors 2.5 $\mu$ s	
Effective input range	10-100% of voltage / 1-100% current range rating	
Sample Average Setting	1 to 10 Sample selectable	
Speed Setting (Measurement Updation)	1 Sec (Slow), 0.5 Sec (Med.), 0.25 Sec (Fast)	
Lead / Lag Detecting	Lead / Lag is detected correctly when phase difference equal to or greater than + 5% with both voltage and current inputs as sine waves equal to or greater than 50% of rated range-value and the frequency is between 45 Hz to 65 Hz.	
Frequency Measurements	Conditions: For Input $\square$ 3% of V1 From 45 to 65 Hz or better. Accuracy + 0.05% Frequency measured Between V1 input to Neutral Terminal	

### **3. TECHNICAL SPECIFICATIONS OF VARIAC (Dimmer)**

Three-Phase Motorized control Variac (Auto Transformer) is to be supplied with suitable voltage & current rating as per requirement of Testing. This Motorized Variac will be used to supply controlled power input as per the specified test condition. It should be having low losses with better efficiency and easy to handle. It is designed with a movable carbon tip and brush arm for side moment on the commutator. The Variac (Auto Transformer) should have following features-

- 3.1 3-Phase Motorized Variac (Auto Transformer)
- 3.2 Input voltage range 3-ph, AC, 415 Input
- 3.3 Output voltage (variable) range: 3-ph, AC, 0 - 470V smooth Output.
- 3.4 Current range shall be 100Amp Max
- 3.5 It shall be with zero limit switch and Zero start interlock facility.
- 3.6 It shall be copper wound.
- 3.7 It shall be having silver plated commutator.
- 3.8 It shall be Oil Cooled type. (Oil will be in Purchaser's Scope)
- 3.9 Two push buttons of standard make to operate Variac should be provided in Panel.
- 3.10 It shall be portable with four wheels.

### **4. TECHNICAL SPECIFICATIONS OF 3-PHASE INTERMEDIATE TRANSFORMER**

For measurement of no-load and full load losses of the transformer, the Intermediate 3-Phase Transformer is to be supplied with suitable voltage rating as per requirement of Testing. This intermediate transformer will be used to supply controlled power input as per the specified test condition. The Intermediate transformer should have following features-

- 4.1 3-Phase
- 4.2 Dry type Air Cooled.
- 4.3 Input voltage of 3-Ph AC 415 V,
- 4.4 Output voltage of 3-Ph AC 660 V,
- 4.5 Secondary Current shall be 55 Amp per Phase.
- 4.6 It should be mounted inside the Panel.

### **5. TECHNICAL SPECIFICATIONS OF Switch gears, Panel meters & required accessories.**

- 5.1 **Plug and socket** for input: 3-Ph, 4-Pole suitable rating
- 5.2 **MCCB for input**: 3-Ph, 4-Pole, 125 Amp with rotary handle isolator for system protection.
- 5.3 **MCB for output** of OC/SC test for over current protection: 3-Ph, 4-Pole, 63 amp
- 5.4 **MCB for control protection** of 2-pole, 6 Amp or of suitable rating.
- 5.5 **VAF meter** for 3-Phase Mains **input supply** (Selec / Rishabh or similar reputed make) with required CT and PT should be provided in Panel for display of input current and voltage of all three phase simultaneously and frequency.
- 5.6 **VAF meter for output supply** For 3-Phase output supply, 2 nos VAF meter (Selec / Rishabh or similar reputed make) with required CT & PT should be provided in Panel for display of output current & voltage separately of all three phase simultaneously.
- 5.7 **Control transformer** 440/ 230V/ 50VA for power analyzer
- 5.8 **Over voltage Protection** for HV cut off against over voltage by suitable VPR relay.
- 5.9 **Over current Protection** shall be provided by suitable CPR relay.
- 5.10 **Protection** for all meters shall be provided.
- 5.11 **Suitable Stabilizer** for stabilized Supply to power analyzer with safety from over and under voltage variation must be provided in Panel.

- 5.12 **Four pole contactor** of 95A Rating for Dimmer set with complete wiring for input terminals to output terminals.
- 5.13 **Push button-** Two no Push buttons of suitable rating for Operating Dimmer set for Motorized Control of Output
- 5.14 **Hooter and Tower Light** must be provided as Test On indication. Hooter cable with 20m Minimum length.
- 5.15 **Input Cable** of copper for mains input of 25 sqmm, 4-core, colour coded, 10 Mtr long, shall be provided.
- 5.16 **Output Cable** of copper of 25sqmm, 4-core, colour coded, 40 Mtr long Test Cable with Big Alligator Clips for OC-SC Test should be provided.
- 5.17 **Intermediate input cables** of copper of 4-core, 25sqmm, 5Mtr (min) length, shall be provided.
- 5.18 **Intermediate output cables** of copper of 4-core, 16sqmm, 5Mtr(min) length, shall be provided.
- 5.19 **Dimmer input cable** of copper of 4-core, 25 sqmm, 5 Mtr (min) length, shall be provided.
- 5.20 **Dimmer output cable** of copper of 3-core, 25 sqmm, 5 Mtr (min) length, shall be provided.
- 5.21 **Dimmer control cables** of copper of 5-core, 1sqmm, 5 Mtr (min) length, shall be provided.
- 5.22 **Control wiring cables** of copper of 1sqmm, shall be provided.
- 5.23 **Indication Lamps** for R, Y, B, & Test On/Off for all test, shall be provided.
- 5.24 **Emergency Stop Switch & indication** to avoid serious accident, shall be provided.
- 5.25 **Panel door opening inter-lock-** The doors opening of control panel must be inter locked with test OFF. If any door of the panel is opened the mains supply must be OFF to avoid in any accident.

**Note :** These all Switchgears & Cables should be of ISI/ IEC mark. Switchgears should be of Schneider / L&T/ cutler hammer or similar reputed make. Push Button of Rass control/ Teknik Rotary switch Jainson or equivalent make. **All cables and lugs required than above for completion of work shall be in the scope of supplier.**

## **6. TECHNICAL SPECIFICATIONS OF TESTING CONTROL PANEL : -**

The testing control panel should be proper powder coated, Desk Type with lifting hook. Approximate dimension Width-1000mm x Depth-760mm x Height-1500mm which may vary as per design of manufacturer.

## **7. STANDARDS**

Test Bench should be suitable to test Distribution Transformer as per all respects to the relevant Testing standards like IS 2026 or equivalent International Electrical Standards.

## **8. GUARANTEE**

All the equipment shall be guaranteed for reliable and trouble free operation for **39months** from the date of receipt of material or **36months** from the date of commissioning whichever is earlier. The supplier firm shall have to replace the defective parts/equipment/materials free of cost during guarantee period. The Contractor shall remain liable to replace defective parts/equipment/materials free of cost within 15 days from the date of intimation regarding this sent by office of site in-charge, during guarantee period.

## **9. Calibration Service**

The Firm must provide onsite Calibration & verification Services of Equipments during Guarantee Period at his own cost.