

PRE COMMISSIONING TESTS ON EQUIPMENT AT 33/11 KV SUB STATIONS

TESTS ON TRANSFORMERS

1. IR Values

- a) For 33/11 KV Power Transformer 2500 V megger is to be need.
- b) Power Transformer neutral Earthing is to be disconnected.
- c) Line terminal of the megger is to be connected to one of the HV Bushings of Power transformer and Earth terminal of megger is to be connected to Power transformer Body Earth Point.

IR Values are to be read on the megger by meggering the Power transformer

- i) The above Value is to be noted as HV to Body
- ii) Then IR Value between LV terminal and body of Power transformer is to be measured & noted.
- ii) IR Values between HV & LV terminals are to be measured & noted.
- iv) The temperature of transformer oil at which the IR Values are measured is also to be noted.
- v) Particulars of megger is also to be noted.

The maximum value shall be $60M\Omega$ at $60^{\circ}C$ temperature for transformer which are in service. For new transformer the value obtained shall be tallied with manufactures test results.

2. D.C. Resistance or Winding Resistance

The Resistance of HV winding LV winding between their terminals are to be measured with precision milli ohm meter/ micro ohm meter.

HV side	RY=	YB=	BR=
LV side	ry =	yb =	br =
	rn =	yn=	bn =

The values shall be compared with original test results.

3. Turns Ratio Test

With turns Ratio meter, turns Ratio between HV & LV windings at various taps to be measured & recorded.

At normal tap for 33/11 KV Delta/Star transformer the turns turns ratio is 5.196. At other taps values will be as per the percentage raise or lower at the respective tap positions.

4. Voltage Ratio Test

When “Turns Ratio meter” is not available, Voltage Ratio Test is done at Various tap position by applying 3 phase LT(415V) supply on 33 KV side of Power transformer. At Various taps applied voltage and Resultant voltages LV side between various Phases and phases & neutral measured with precision voltmeter & noted.

5. Short Circuit Test

The four terminals on LV side of Power transformer are shorted with 50 sq. mm. copper cable. Three phase LT supply is applied on HV side of power transformer at normal tap and currents measured in all the phases on HV side and phases & neutral on LV side values noted.

The Resultant HV & LV currents areas follows:-

$$\begin{array}{l} \text{HV side current} \\ \text{in all Phases} \end{array} = \frac{\text{LT Voltage applied on 33 KV side of PTR}}{33000 \text{ X Impedance Volts / 100}} \times \text{Rated HV of PTR}$$

$$\begin{array}{l} \text{LV side phase} \\ \text{current} \\ \text{Current in all phases} \end{array} = \frac{\text{LT Voltage applied on 33 KV side of PTR}}{33000 \text{ X Impedance Volts / 100}} \times \text{Rated LV of PTR}$$

LV side neutral current shall be zero or less than 1.0 amp.

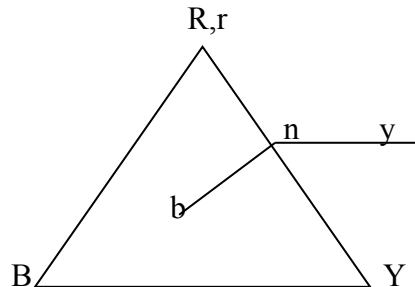
6) Magnetic Balance Test

415V, Two phase supply is to be applied to any two phases terminals on HV side of Power transformer and voltages in other two phase combination are to be measured. Sum of the Resultant two values shall be equal to the voltage applied.

	RY	YB	BR	Result
a)	V (415 V)	V ₁	V ₂	V= V ₁ + V ₂
b)	V ₁	V (415 V)	V ₂	V= V ₁ + V ₂
c)	V ₁	V ₂	V (415 V)	

7. Vector Group Test

Connect HV side 'R' Phase terminal to LV side 'R' Phase terminal of Power transformer. Apply 3Phase 415 V supply to HV side of Power transformer. Measure Voltages between various terminals as follows.



Voltages between Rn ; Yn ; RY	$V_{RY} = V_{RN} + V_{YN}$
Voltages between Yb ; Yy ;	$V_{Yb} = V_{Yy}$
Voltages between Bb ; By ;	$V_{Yb} > V_{Bb}$

8. BDV Test of Oil

Oil samples from top oil & bottom oil of Power transformer main tank as well as OLTC tank are to be collected and tested. Across 2.5 mm gap test Kit, The oil shall stand for KV For/ minute.

9. Magnetization Current

Three phase LT Voltage of 415 V applied on HV side of Power transformer and currents are to be measured with milli ammeter.

The value shall be = $\frac{1 \text{ to } 2 \text{ percent of rated full load current of PTR}}{33000} \times \text{Applied Voltage}$

PRE COMMISSIONING CHECKS ON POWER TRANSFORMERS

Check that

- 1) Top & Bottom valves of radiators are in open position
- 2) All drain valves are in closed position with dummy plates in position duly fitted with bolts & nuts
- 3) All filler valves in closed position with dummy plates in position duly fitted with bolts & nuts
- 4) No oil leakages from radiators, valves, dummies, top cover, inspection covers, oil level gauges etc.
- 5) Silica gel breather is in position with silica gel filled & oil in oil cup
- 6) The air path of silica gel breather is free with out any seals to holes of the oil cup
- 7) Equalizing valve of the interconnecting pipe of vent pipe to conservator tank is in open position
- 8) Top oil filling point of conservator tank is in closed position with cover duly bolted.
- 9) The valves on either side of Bucholtz relay are in open position.
- 10) Thermometer pockets on main tank top cover are having oil inside & Thermometer sensing bulbs are in position duly nuts fixed properly.
- 11) The double earthing of neutral of Power transformer is done as per standards.
- 12) The double earthing of body of Power transformer is done as per standards.
- 13) The oil levels in conservator tank, OLTC Conservator tank.
- 14) The operation of main Bucholtz relay & OLTC Bucholtz relay (Trips &alarms to be checked)
- 15) Operation of Transformer alarms.
- 16) The operation of PRV to trip the breakers or operation of alarms
- 17) The vent pipe diaphragm is intact.
- 18) The lock pieces are provided, duly welded to base channels, for the support wheels of transformers (If wheels are provided)
- 19) Tightness of all bolts, nuts, clamps, jumpers etc.

Before charging the “PTR” air is to be released from air releasing points of main tank cover of PTR, OLTC top cover, Bucholtz relays, radiators, bushings, (All releasing bolts, screws, valves shall be kept in position fully tightened after releasing air from respective points).

Tests on Breakers

- A) I) Status of Breaker “Open”
Measure IR values between “IN” & “Out” terminals Each limb of breaker shall be more than 3000 MΩ
- II) Status of Breaker “Close”
Measure resistant of each limb by connecting “IN” & “Out” terminals to a precision Micro ohm meter.

The values shall tally with manufacturer’s test report.

III) Status of Breaker “Close”

Measure IR values between phase & Body ground terminal of breaker for all limbs the values shall be more than 3000 MΩ

B) Opening time & closing time tests to be done on all limbs. The values shall tally with test results of the Manufacturer.

C) As follows:

- a) IR values of current Transformers are to be measured.
- b) Polarity check on current transformers is to be made.
- c) Primary injection test on current transformer is to be done to check operation of relays functioning of meters.
- d) Secondary Injection test on relays is to be done.
- e) DC tests on breakers panel are to be done.
- f) Calibration of meters is to be done.
- g) D.C. interlock are to be tested.
- h) Check that all Jumpers, clamps etc. are in to CT
- i) Clean all the bushings.
- j) Ensure no leakages from the CTs.

Tests on Potential Transformers

- A) IR value are to be checked with megger.
- B) Ratio test is to be done.
- C) Polarity check is to be done.
- D) Check that there are no oil leakages
- E) Clamps & Jumpers properly tightened.

Tests on Lightning Arrestors

- a) IR value are to be checked.
- b) Jumper connection to be checked

Other tests in a Sub Station

- a) Battery charger & Battery to be checked for proper operation
- b) Earth Resistance is to be measured & noted.
- c) Meggering of Bus Bars is to be done.
- d) Check the entire earthing system in the Sub Station is as per standards.