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Literature Review of Multipurpose Portable Transformer Testing Kit

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Abstract: *Manufacturers test thousands of distribution as well as power transformer at worldwide location each week. In this paper , I wish to give an overview about different test conducted in distribution as well as power transformer of rating up to 11KVA TO 25 MVA .Equipment use in testing single phase dimmer stat, multimeter, digital voltmeter, digital insulation resistance, tong tester, MCB, fuse, banana connector, switches, testing wire connecting wire Testing of any electrical equipment indicate the extent to which the equipment is able to comply with customer's requirements .In this paper testing of distribution as well as power transformer considered. A manufacture's own criteria have to be fulfilled in addition to requirements specified by customers and applicable standards.*

Keywords: *Testing of banana connector, digital voltmeter, fuse, insulation resistance, MCB, single phase dimmer stat.*

I. Introduction

Now, this kit of cost of transportation and only one person will be sufficient to carry the kit as it is compact and brief case mounted making this kit an excellent device for a power transformer company to own. At site, to verify the operation of transformer the five basic tests have been performed on it. The five basic tests were Insulation Resistance, Turns Ratio, Magnetizing Balance, Magnetizing Current, Short Circuit test. For performing this above test they carried separate testing equipment for each test.

The topic for project is "Multipurpose Transformer Testing Kit". The kit is designed for the purpose of testing of transformer at different site where transformer is installed, to verify the operation of the transformer .These all five tests require large number of equipment's to be carried separately when needed. This leads to increase in cost of transportation, more men power to carry them and chances of damaging the instruments when carried in bulk are high. Hence, finding solution to the problem, we designed a kit which can be carried by a single person having all the basic tests in one kit i.e. Insulation resistance test, turns ratio test, short circuit test, magnetizing current and magnetizing balance test. This kit is designed to test transformers of any rating. Thus , giving many advantages over the previous method.

II. Methods

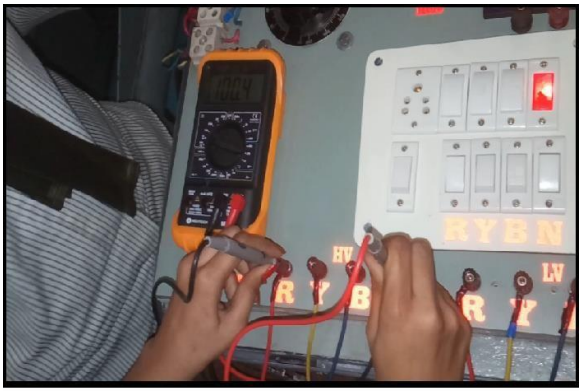
1. Insulation resistance test

Insulation resistance test of transformer is essential test. This test is carried out to ensure the healthiness of overall insulation testing of power transformer.

Procedure:

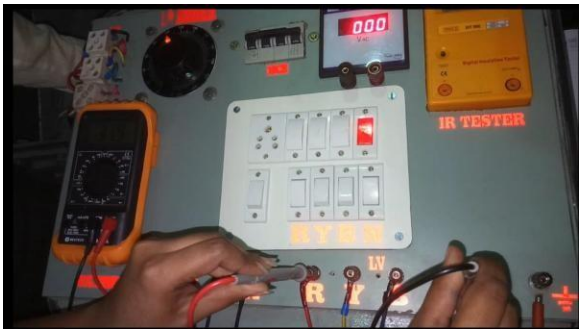
1. First disconnect all the line and neutral terminals of the transformer.
2. Megger leads to be connected to LV and HV bushing studs to measure insulation resistance IR value in between the LV and HV windings.
3. Megger leads to be connected to HV bushing studs and transformer tank earth point to measure insulation resistance IR value in between the HV windings and earth.
4. Megger leads to be connected to LV bushing studs and transformer tank earth point to measure insulation resistance IR value in between the LV windings and earth. IR should be high i.e. Up to 1000mohm.it is 1 minute test & IR values to be recorded at intervals of 15 seconds, 1 minute.Turns ratio of a transformer is the ratio of number of turns in high voltage winding to that in low voltage winding.

2. Voltage ratio test: Turns ratio of a transformer is the ratio of number of turns in high voltage winding to that in low voltage winding.



Procedure:
1) We just apply single phase supply to LV winding, with keeping LV winding open.
2) Then we measure the induced voltages at HV and LV terminals of transformer to find out actual voltage ratio of transformer.
3) We repeat the test for all tap position separately.
4) Take ratio of voltage at HV to LV and compare it with name plate ratio.

3. MAGNETIC BALANCE TEST: Magnetic balance test of transformer is conducted only on three phase transformer to check the imbalance in the magnetic circuit.



Procedure:
1. First keep the tap changer of transformer in normal position.
2. Now disconnect the transformer neutral from ground.
3. Then apply single phase 230 v ac supply across one of the HV winding terminals and neutral terminal.
4. Measure the voltage in two other HV terminals in respect of neutral terminal.
5. Repeat the test for each of the three phases.

The voltage induced in different phases of transformer in respect to neutral terminals given in the table below:

Applied voltage	RN	YN	BN
Voltage applied across R phase	100%	60 to 80%	40 to 20%
Voltage applied across Y phase	50%	100%	50%
Voltage applied across B hase	40 to 20%	60 to 80%	100%

4. Magnetizing current test: Procedure:
1. First of all keep the tap changer in the lowest position and open all HV and LV terminals.
2. Then apply single phase 230 v supply on transformers.
3. Measure the supply voltage and current in each phase.
4. Now repeat the magnetizing current test of transformer test with keeping tapchanger in normal position.

5. And repeat the test with keeping the tap at highest position.

5. Short circuit test

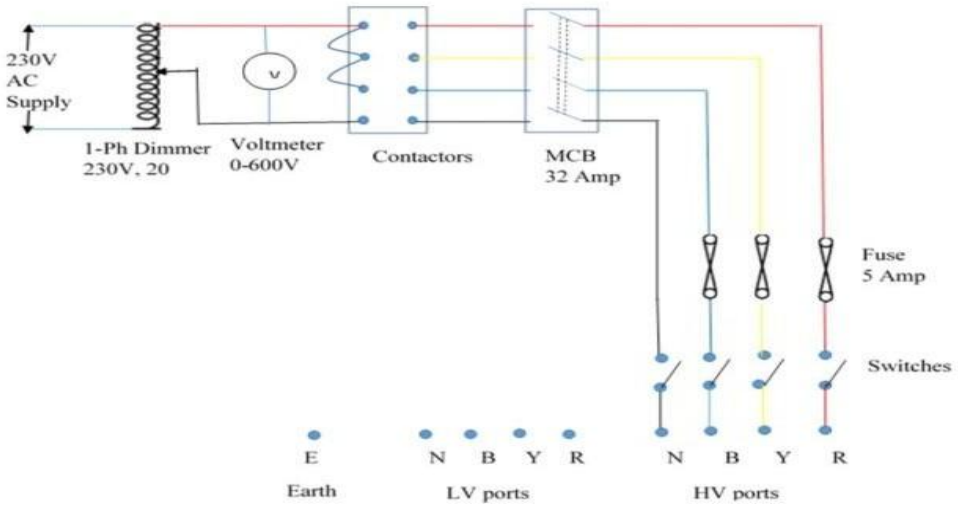
In this test primary applied voltage, the current and power input is measured keeping the secondary terminals short circuited. The supply voltage required to circulate rated current through the transformer is usually very small and is of the order of a few percentage of the nominal voltage.

Procedure:

1) Connect testing board HV wire to HV side of transformer.
2) Short LV winding of transformer.
3) Connect single phase supply to testing board.
4) Set the transformer on its maximum / normal / minimum position.
5) Switch on the single phase supply.
6) Check incoming supply with help of multimeter it should be 230 V.
7) Switch on M.C.B.
8) Measure HV voltage HV current & LV current.
9) After measuring all parameter switch off M.C.B.

Then by using formula find out the impedance of transformer V applied x I rated x 100
% z = V rated I measured Where
V applied is voltage applied to transformer to HV side V rated is rated voltage of transformer on HV side
I rated is rated current of transformer on LV side
I measured is measured current of transformer on LV side.

III. Circuit Diagram



Description of circuit diagram :

- Single phase 230 Volt AC supply is given to the dimmer stat of rating single phase 230Volt 20Amp.
- Output of the dimmer stat is display on the voltmeter.
- By using contactor, two wire systems is converted in to four wire system i.e. R, Y, B, neutral.
- These four wires are connected to the MCB of 32 Amp.
- Four wires from MCB are connected to the fuse then fuse to switches.
- From switches it is connected to the HV port of transformer.

ACTUAL IMAGES:

Hardware Components:

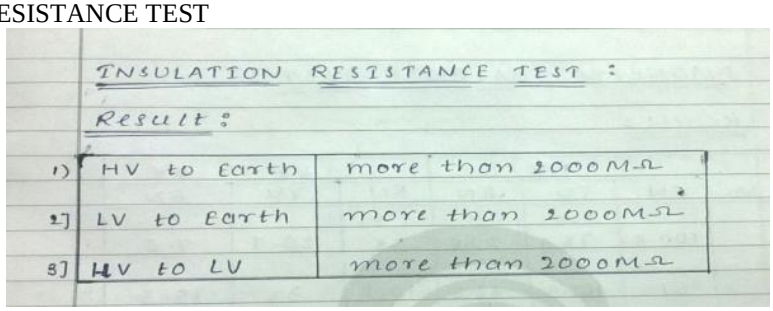
1. Single phase dimmer stat (1 phase 230V, 20 A)
2. Digital Voltmeter (650V)
3. Multimeter (10Amp, 600V)
4. Digital insulation tester (2000Mohm, 1KV)
5. Tong tester (1000)
6. MCB (miniature circuit breaker) (32Amp)
7. Fuse (5Amp, 230V AC)
8. Banana Connector.
9. Testing wire.
10. Connecting wire.

IV. Literature Survey

1) 90 SM 317-8 JANUARY 1991 "REAOSANT POWER SUPPLY KIT SYSTEM FOR HIGH VOLTAGE TESTING" H. G. Gerlach Harns Kull AG, CH-4552 Derendingen Switzerland. In power engineering ,reasonce of narrow-band quality is not considered to be a steady-state operating condition .Frequency variation was therefore not applied in reasonant ac testing installation until the early eighties.
2) M. Wang and A. Vandemaar published that life of transformer can be as long as 60 years with appropriate maintenance. When transformer is new it has sufficient electrical and mechanical strength to withstand stresses. To prevent failure preventive maintenance is carried out by using traditional diagnostic techniques for detection of incipient fault in transformer.
3) Shivaji chakravorti has workshop at Maha Transco on condition monitoring of oil-paper composite insulation system of power transformer. He explained various diagnostic techniques used for power transformer. He explained various diagnosis techniques used for detection of incipient fault in Transformer .

V. Observation Table

1 .INSULATION RESISTANCE TEST

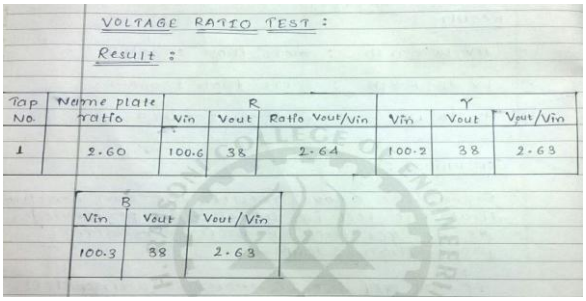


INSULATION RESISTANCE TEST :

Result :

1)	HV to Earth	more than 2000MΩ
2]	LV to Earth	more than 2000MΩ
3]	HV to LV	more than 2000MΩ

2.VOLTAGE RATIO TEST:



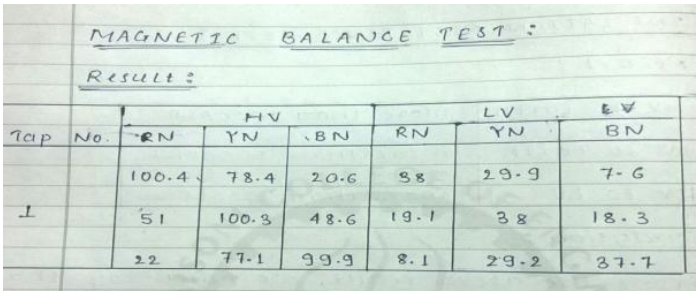
VOLTAGE RATIO TEST :

Result :

Tap No.	Name plate ratio	R			Y		
		Vin	Vout	Ratio Vout/Vin	Vin	Vout	Vout/Vin
1	2.60	100.6	38	2.64	100.2	38	2.63

B		
Vin	Vout	Vout/Vin
100.3	38	2.63

3 .MAGNETIC BALANCE TEST:

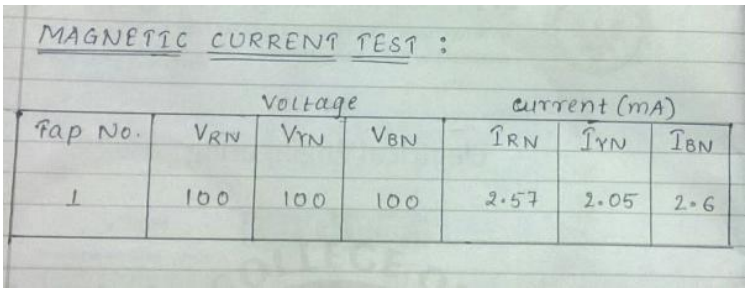


MAGNETIC BALANCE TEST :

Result :

Tap	No.	HV			LV		
		RN	YN	BN	RN	YN	BN
		100.4	78.4	20.6	98	29.9	7.6
1		51	100.3	48.6	19.1	38	18.3
		22	77.1	99.9	8.1	29.2	37.7

4. MAGNETIZING CURRENT TEST:



MAGNETIC CURRENT TEST :

	Voltage			current (mA)		
Tap No.	V_{RN}	V_{YN}	V_{BN}	I_{RN}	I_{YN}	I_{BN}
1	100	100	100	2.57	2.05	2.6

VI. Conclusion

1. After the completion of our project, the testing process will be improved.

2 .In previous methods as we had to carry different testing equipment's for various tests which causes trouble to carry huge luggage while going on site and there will be more chances of the equipment gets damaged. But in MPTT panel, the danger of equipment's getting damaged is reduced.

3. Use of digital equipment's such as voltmeter, ammeter, IR tester, and tong tester, multimeter provides minimization in errors and provide accurate.

VII. Future Scope

We may use PLC SCADA or any other automation system to convert this manual operation of kit to automatic where the values for all the tests will be directly displayed on the screen.

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