FABRICATION OF SINGLE PHASE TRANSFORMER TEST PANEL

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ABSTRACT : Transformer test panel has many functions, which may be used independently or simultaneously for different purpose and on this panel we perform some tests. For this panel single phase transformer is used. Open circuit test is performed to determine the iron losses or no load losses of the transformer during this test secondary side or high voltage side of the transformer is open circuited. Short circuit test is performed to determine the copper losses of the transformer. During short circuit test secondary side or low voltage side of the transformer is short circuited by thick wire. Back to back test is performed to determine the open circuit test and short circuit test at same time thus to find the temperature rise of the transformer when transformer is fully loaded. By using this readings we are going to find this all parameters of open circuit test and short circuit test and sumpner's test automatically by using aurdino programming. Panel will give us correct and accurate results by using digital meters, panel will reduce the time required for calculations and connection, panel is safe and efficient.

I. INTRODUCTION

Transformer is a static device which transfer power or electrical energy or electrical quantities like voltage and current between two circuits or winding without changing is frequency. Transformers work on the principle of Faraday's law of MUTUAL INDUCTION. Transformer are used for voltage in electric power applications, for which we need to check how much the transformer is efficient and is its output voltage before use. To test this we have to find efficiency and voltage regulation of transformer. Hence, to find voltage regulation and efficiency we will perform open circuit test, short circuit test, and transformer
Here we are going to make transformer test panel which will used in machine laboratory of college this panel has many functions, which may be used independently or simultaneously for different tests. We are making this panel where single phase transformer tests will performed.

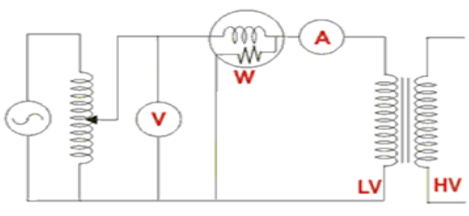
II. OPEN CIRCUIT TEST

Open circuit test is also called as NO LOAD test. Open circuit test is performed to determine the iron losses and O.C test is performed on low voltage side of the transformer or primary side of the transformer whereas, secondary side is open . During this test primary winding draws no load current and at the same time primary winding have some copper losses of negligible amount. Here as the secondary current is absent due secondary open circuited hence, there is not any type of losses at secondary. Open circuit test is conducted at rated voltage. Core losses or Iron losses depends on the voltage of the transformer. Hence, core losses are calculated by open circuit test. Since, we can say that core losses are depends on the voltage only. If voltage is there flux is also produced and core losses are calculated
Sometimes a voltmeter is connected across secondary to measure voltage V_2.
$V_2 = E_2$

THE OBSERVATION OF OPEN CIRCUIT TEST

Voltmeter reading	Ammeter reading	Wattmeter reading
V_1(rated voltage)	I_0 (ampere)	W_0(Watt)

As no load current I_0 is very small as compared with the full load primary current. The no load current I_0 is about 3 to 5% of the full load value. The primary copper losses will be negligible because I_0 is small. The circuit diagram of open circuit test is shown below



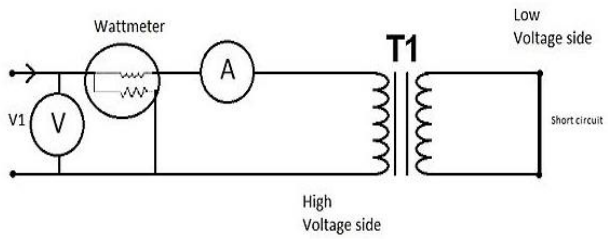
Open Circuit Test on Transformer

III. Short Circuit Test

Short circuit test is performed on the high voltage side of the transformer where the low voltage side of transformer is short circuited with the help of thick copper wire. This is used for the determination of the transformers impedance losses is carried out with relatively low applied currents of the same magnitude as in operation. A different form of short-circuit testing is done to assess the mechanical strength of the transformer windings, and their ability to withstand the high forces produced if an energized transformer experiences a short-circuit fault. Currents during such events can be several times the normal rated current. Iron losses are the function of applied voltage. Since the applied voltage in short circuit is very small, thus iron losses will be negligible small.

THE OBSERVATION TABLE OF SHORT CIRCUIT TEST

Voltmeter reading	Ammeter reading	Wattmeter reading
V_{SC}	I_{SC}	W_{SC}

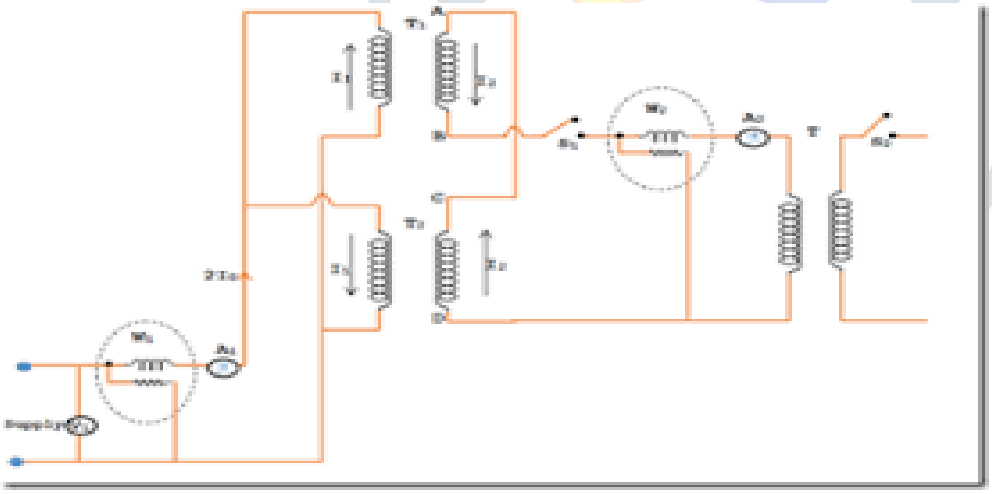


IV. Back To Back Test

Back to back test is efficient and minimum power consumption test which is done without actual loading to find regulation and efficiency of large power transformer. Improved method of testing transformer efficiency and other parameters. Back to back test gives the actual value of total losses accurately. In this test transformer are tested at full load condition. The secondary current can be varied to any value using regulating transformer. Determination of copper losses at full load condition or at any condition is possible.

In back to back test two identical transforms are required whose primary is connected in parallel across the supply V_1 and secondary of both the transformer is connected in series. The switch S2 is closed. Now no load current I_0 flows in the primaries and secondary current I_2 is zero. When the switch S_2 is closed and the voltage at the output of the regulating transformer is varied until the full load current I_2 flows in the secondary circuit. W_1 & W_2 are the core losses and copper losses of the both transformer respectively.

Back to back test is important to test every electrical machine at its rated capacity and it's inconvenient for machine of large rating to actually full load the equipment and test. So for all the electrical machine some from of back to back test becomes important.



V. Voltage Regulation

The voltage regulation of the transformer is the change in the output voltage from no-load to full-load. An transformer is open circuit, means load is not connected with secondary side. At this time the secondary side voltage of the transformer will be its secondary induced EMF E2. If full load is connected to the secondary side of the transformer.

$$\%R = \frac{\text{I2R2 Cos}\emptyset 2 \pm \text{I2X2 Sin}\,\emptyset 2}{\text{V2}} X\ 100$$

$$\%R = \frac{\text{I1R1 Cos}\emptyset 1 \pm \text{I1X 1Sin}\,\emptyset 1}{\text{V1}} X\ 100$$

VI. EFFICIENCY

The Efficiency of the transformer is defined as the ratio of output power to the input power.
Efficiency = output / input.

$$Efficiancy\ (\eta) = \frac{V_2 I_2 COS\emptyset_2}{V_2 I_2 COS\emptyset_2 + W_1 + W_2}$$

VII. CONCLUSION

This paper has represented the problem on calculating efficency and voltage regulation by lengthy techniques where as we had made a panel where open circuit test, short circuit test and back to back test are performed automatically and for this we are using arduino for making the whole concept of panel automatically. Panle has the main advantage of automatic operation to finding voltage and regulation of the transformer which dierectly or indierectly reduce time required for the calculation and errors found in calcultaion. This this way this panel is used in the college machine lab.

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