Electrical Machines and Power Electronics Lab

Experiment-1 Report

Open circuit, short circuit test & Load test on single phase transformer

Group: W02

Aim:

To obtain the equivalent circuit parameters from OC and SC tests and to estimate efficiency & regulation at various loads.

Precautions:

1)Make sure the connections were made correctly.
2)Always do experiments within rated parameters to avoid coil burnout.

Machine Specifications:

Single phase transformer;
Rated L_v 200V;1.5A
Rated H_v 230V; 1.3A

Summary Of Experiment:

Open Circuit or No Load Test:

The circuit was built as per the diagram, the n test is performed to find out the shunt or no load branch parameters of an equivalent circuit of a transformer. This test results in the iron losses and no-load current values, thereby we can determine the no-load branch parameters with simple calculations. Secondary side load terminals of the transformer are kept open and the input voltage is applied on the primary side

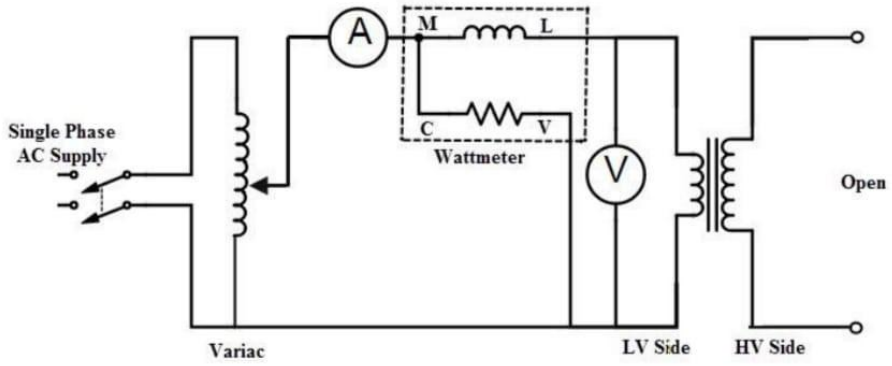


Fig. 1 Connection Diagram for OC test on a transformer

Short Circuit Test:

The circuit was made as in the manual, the **test is performed to find series branch parameters of an equivalent circuit** such as equivalent impedance (Zo1 or Zo2), total winding resistance (Ro1 or Ro2), and total leakage reactance (Xo1 or Xo2). Also, it is possible to determine copper losses at any desired load and total voltage drop of the transformer referred to as primary or secondary. In this test, LV winding is shorted by a thick wire. And the test is conducted on the HV side (as primary).

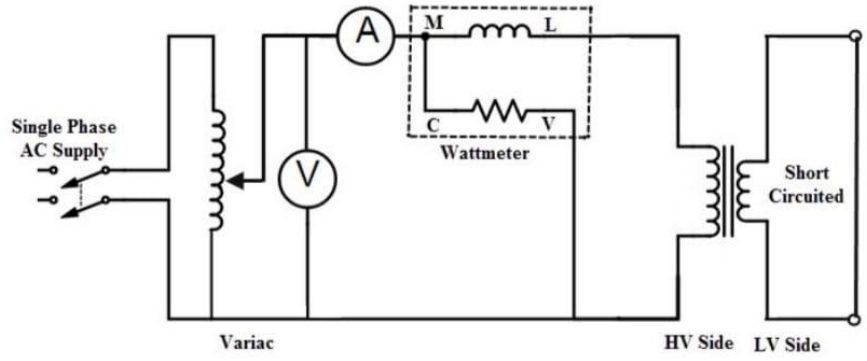


Fig. 2 Connection Diagram for SC test on a transformer

Load Test:

The circuit was made as in the manual. Load test **used to determine the performance of the transformer at various loads**. The lamp load is connected at the secondary winding of the transformer as a varying load. The voltmeter, ammeter, and wattmeter are connected at the primary side and secondary side

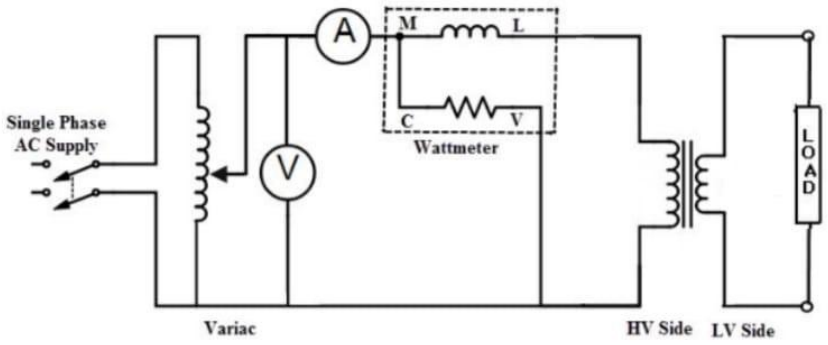


Fig. 3 Connection Diagram for load test on a transformer

Observations:

Open-Circuit Test Characteristics:

- In the Open circuit test we applied the rated input voltage to the LV side by using a variac and recorded the primary current, power drawn from the source and voltage.

V_{OC}(V)	I_{OC}(A)	P_{OC}(W)	cosϕ
200.2	0.123	12	0.487318

Short-Circuit Test Characteristics:

- For the Short circuit test we set the variac output voltage to zero, then adjusted the output of the variac SLOWLY such that rated current flows through the high voltage winding. And then recorded the applied voltage, current, and input power, and calculated the equivalent circuit parameters.

V_{SC}(V)	I_{SC}(A)	P_{SC}(W)	cosϕ
13.34	1.323	17	0.963237

Load Test Characteristics:

- For the Load test we kept the dimmer output at zero and selected the maximum load resistance, then switch on the supply and increased the input voltage using dimmer gradually till the rated secondary voltage of 200V, then applied the loads in steps by using load resistor panel till the rated current flows, then we recorded the VLV, ILV, CosϕLV, PLV, VHV, IHV and PHV, Calculated the efficiency and voltage regulation and compared with the efficiency and regulation obtained from equivalent circuit obtained from OCT-SCT test Plotted the graph of Regulation vs Secondary current and Efficiency vs Secondary current.

V_{HV}(V)	I_{HV}(A)	P_{HV}(W)	cosϕ	V_{LV}(V)	I_{LV}(A)	P_{LV}(W)	Efficiency(%)	Regulation(%)
231.6	0.106	12	0.488806	200.3	0	0	0	-0.04993
231.2	0.408	92	0.975304	197.2	0.401	79	85.86957	1.521298
230.7	0.741	169	0.988601	194	0.8	154	91.12426	3.195876
230.9	1.068	244	0.989452	190.1	1.174	223	91.39344	5.312993
230	1.397	318	0.989698	186.2	1.557	289	90.8805	7.518797

Plot the graph of Regulation vs Secondary current and Efficiency vs Secondary current here…….

Calculations:

Open Circuit test:

Power factor at no load = $P_{OC}/(V_{OC}*I_{OC})$ = 0.487318
$I_c = I_{OC}*\cos\phi$ = 0.05994A
$I_m = I_{OC}*\sin\phi$ = 0.107407A

So shunt parameters are
$X_m = V_{OC}/I_m$ = 1863.944Ω
$R_c = V_{OC}/I_c$ = 3340.003Ω

Short Circuit test:
$P_{SC} = I^2_{SC} R_{eq}$
So, $R_{eq} = 9.712\Omega$

$Z_{eq} = V_{SC}/I_{SC} = 10.083\Omega$

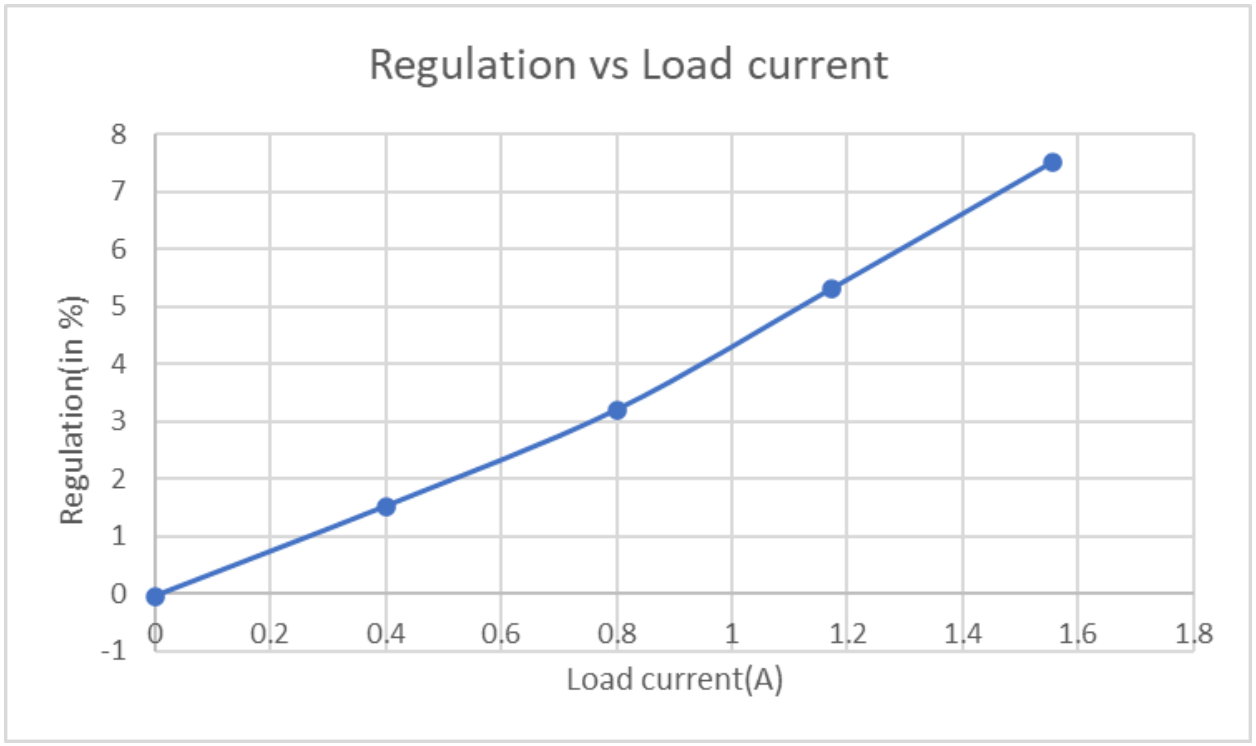
To find equivalent reactance, $Z_{eq}^2 = R_{eq}^2 + X_{eq}^2$
$X_{eq} = 2.708\Omega$

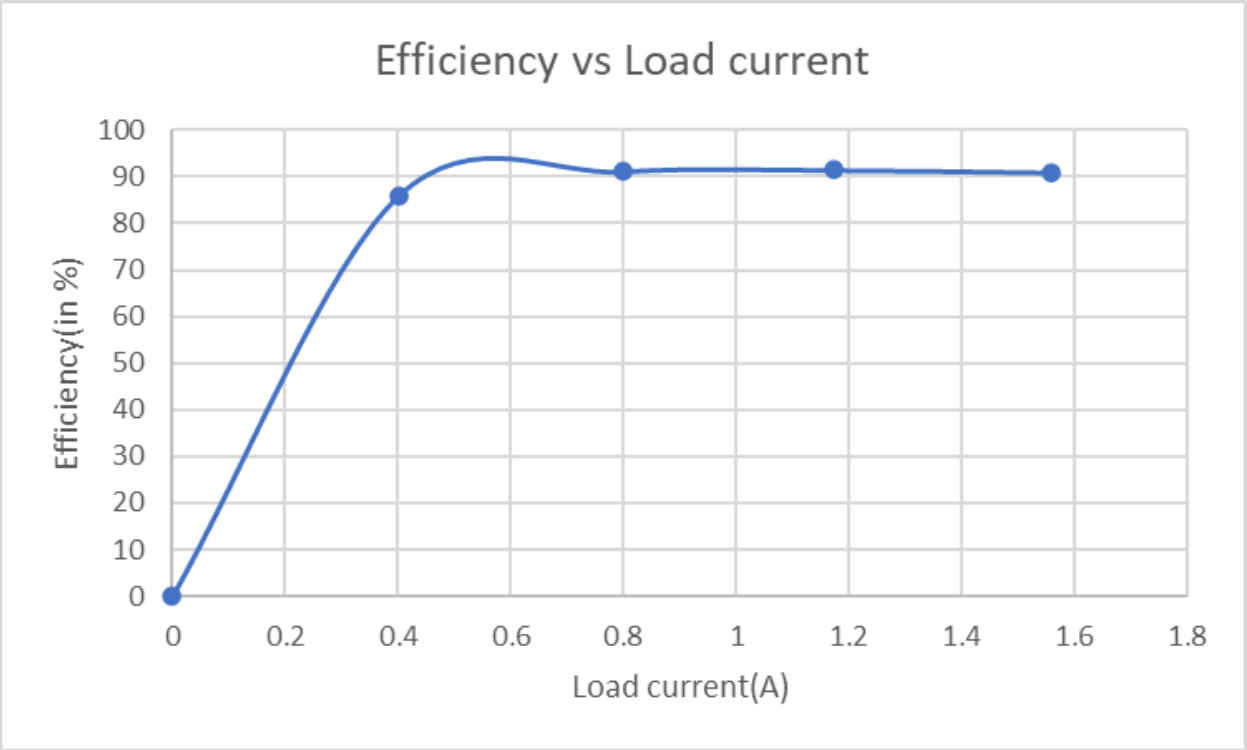
Load test:

Efficiency calculation,
$\eta = P_{secondary}/P_{primary} = P_{out}/P_{in}$

Regulation= $(E-V_S)/V_S$ *100% ,where E is no load voltage of secondary side and V_S is secondary voltage at load test.

Graphs:





Results & Conclusions:

- In this experiment we performed an Open circuit or No load test, short circuit test, and load test on a single-phase transformer.
- We obtained equivalent circuit parameters for the transformer, calculated its efficiency and voltage regulation, and also plotted the graph of Regulation vs Secondary current and Efficiency vs Secondary current.
- The obtained values were similar to what we calculated theoretically and the graph was also similar to what we obtained in theory.
- In this experiment we used 100W bulbs for a load test which was a new experience.
- Overall the experiment was good and interesting we learned a lot.