Indian Institute of Technology Hyderabad (IITH)

Electrical Machines Laboratory, Department of Electrical Engineering

Experiment-1: OC, SC and Load Tests on 1-ϕ Transformer

1. Aim of this Experiment

The objective of this experiment is to determine the values of R, X, B_m, and G_i through short circuit and open circuit test as well as to verify the equivalent circuit representation through a load test.

2. Circuit Description and Test Arrangement

The equivalent circuit of a 1-ϕ transformer in approximate form is shown in Figure 1. Here, R and X are the total resistance and leakage reactance respectively of the transformer windings referred to a particular side. Similarly, B_m, and G_i are the magnetizing susceptance and the iron loss conductance, respectively, referred to a particular side.

The circuit arrangements for open circuit test, short circuit test, and load test are shown in Figures 2, 3 and 4, respectively.

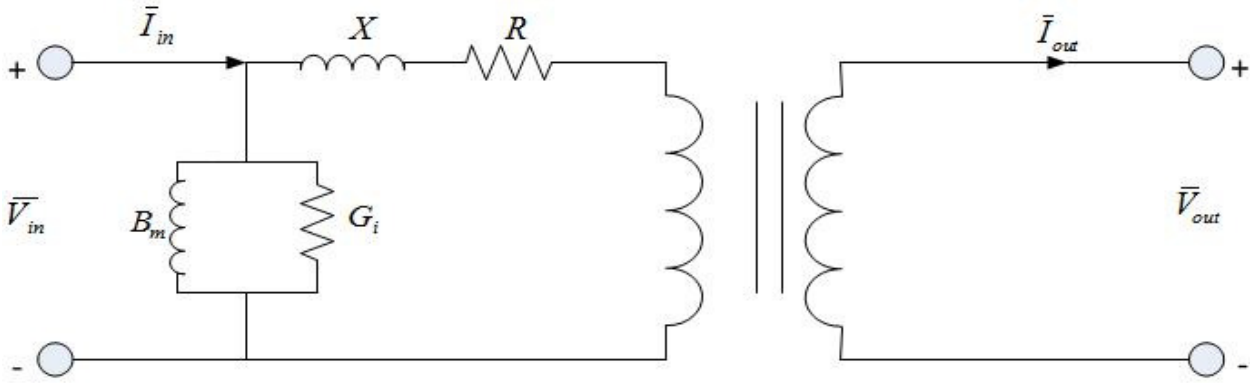

Figure 1. Equivalent circuit representation of a 1-ϕ transformer.

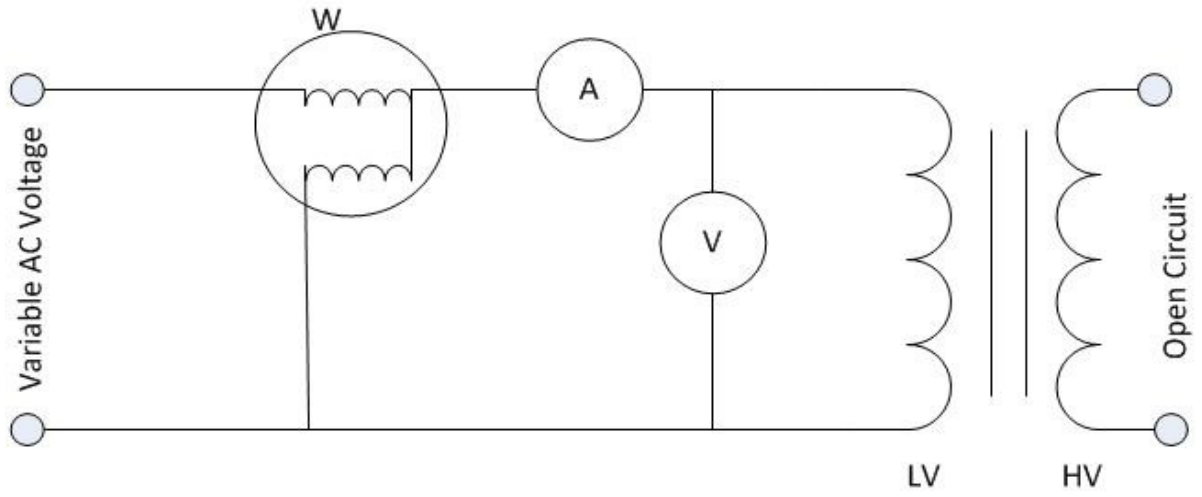

Figure 2. 1-ϕ transformer open circuit test arrangement.

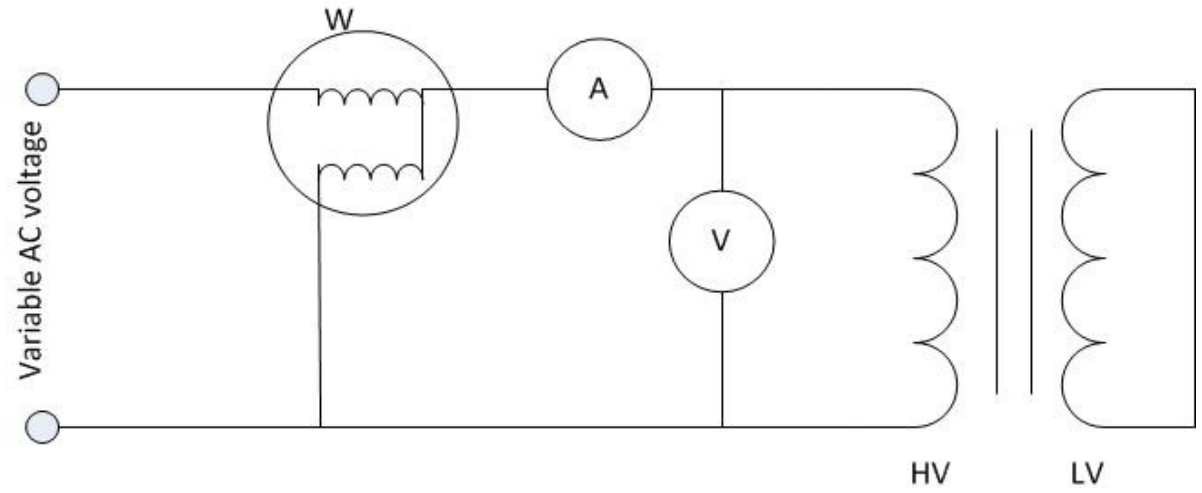

Figure 3. 1-ϕ transformer short circuit test arrangement.

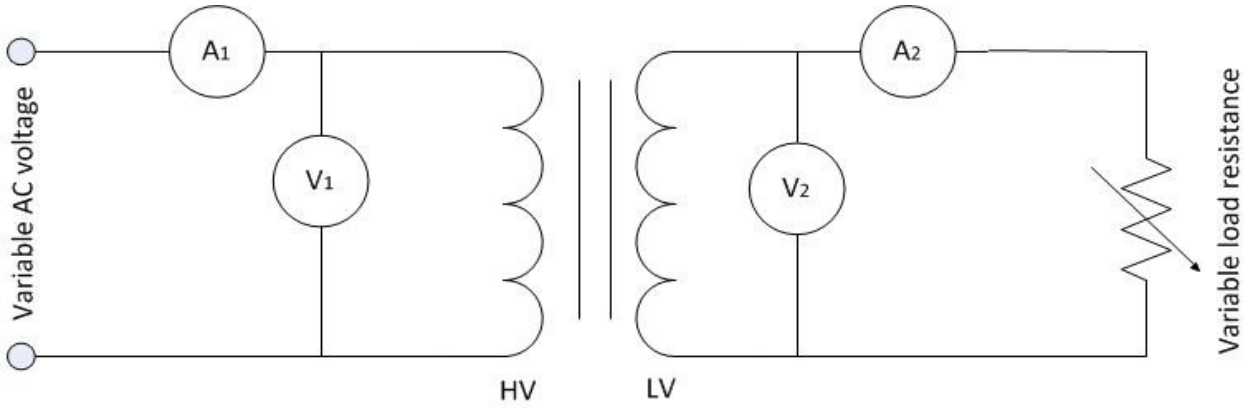

Figure 4. 1-ϕ transformer load test arrangement.

3. Test Procedure

OPEN CIRCUIT TEST:

a) Apply rated voltage on the LV side.
b) Note down the voltmeter, ammeter, and wattmeter readings (indicated by V_{OC}, I_{OC} and P_{OC}, respectively).
c) Determine G_i and B_m (referred to the LV side) by using the following formulae.

$$G_i = \frac{P_{OC}}{{V_{OC}}^2} \tag{1.1}$$

$$Y = \frac{I_{OC}}{V_{OC}} \tag{1.2}$$

$$B_m = \sqrt{Y^2 - {G_i}^2} \tag{1.3}$$

SHORT CIRCUIT TEST:

a) Establish rated current on the HV side by adjusting the input voltage.
b) Note down the voltmeter, ammeter, and wattmeter readings (indicated by V_{SC}, I_{SC} and P_{SC}, respectively).
c) Determine R and X (referred to the HV side) by using the following formulae.

$$R = \frac{P_{SC}}{{I_{SC}}^2} \tag{1.4}$$

$$Z = \frac{V_{SC}}{I_{SC}} \tag{1.5}$$

$$X = \sqrt{Z^2 - R^2} \tag{1.6}$$

LOAD TEST:

a) Apply rated voltage on the HV side.
b) Take the voltmeter and ammeter readings (indicated by V_{L1}, V_{L2}, I_{L1} and I_{L2}) for different settings of the resistance bank.
c) For a particular setting of the resistance bank, the value of load resistance (indicated by R_L) can be found from the readings of Voltmeter 2 and Ammeter 2.
d) For a given value of load resistance and input voltage, calculate the value of I_{L1} from the equivalent circuit.

4. Results and Discussions

OPEN CIRCUIT TEST:

V_{OC} = G_i (referred to LV side) = B_m (referred to LV side) =

I_{OC} = G_i (referred to HV side) = B_m (referred to HV side) =

P_{OC} =

SHORT CIRCUIT TEST:

V_{SC} = R (referred to HV side) = X (referred to HV side) =

I_{SC} = R (referred to LV side) = X (referred to LV side) =

P_{SC} =

LOAD TEST:

V_{L1} **(measured)**	V_{L2} **(measured)**	I_{L1} **(measured)**	I_{L2} **(measured)**	R_L **(calculated)**	I_{L1} **(calculated)**

5. Conclusions

Comment on the accuracy of the equivalent circuit representation.

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