Experiment No.(1)

Open Circuit tests of a single-phase Transformer

1-Objective:

The purpose of this experiment is to find the iron losses from no-load test and to determine the magnetizing branch parameters.

2-Theory:

The purpose of no load or open circuit test is to measure the iron losses and the components Iw and Im of the no load current and hence find the parameters Rc and Xm of the equivalent circuit of the transformer.

For this purpose, one of the windings is open circuited and rated voltage at rated frequency is applied to the other winding. Generally, in practice the H.V. winding is kept open and L.V. winding is excited and measurements are made on L.V. side. This is so because if the measurements are made on H.V. side the voltage to be applied and measured would be very large and no-load current Io will be very small. It is immaterial which winding is excited as long as normal voltage at normal frequency is applied since the iron losses and the fluxes will be same in both cases. The connection diagram for this test is shown in fig (1.3).

The equivalent circuit of the transformer for the no-load condition is shown in fig(2.a) but since Io is very small, the circuit will be reduced to that shown in fig (1.1.a).

Let Vo, Io and Po be the reading of voltmeter, ammeter and wattmeter respectively. Neglect the small $Io^2 \times R1$, copper losses. Hence from figure (1.1.b), we have:

Equations:

$$Iw = Po / Vo = Io \cos \varphi o$$

$$Im = \sqrt{(Io^2 - Iw^2)} = Io \sin \varphi o$$

$$Rm = V / Iw$$

$$Xm = V / Im$$

$$\cos \varphi o = Iw / Io = Io\, Vo / Po$$

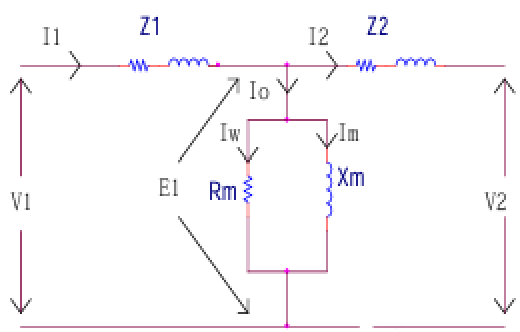

Fig. (1.1.1)

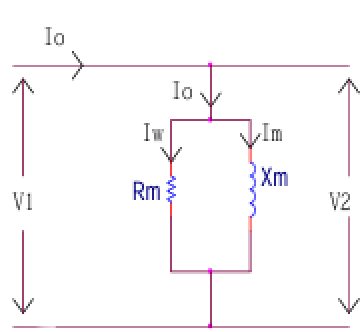

Fig. (1.1.2)

The relation between Iw and I_m is shown in Fig.(1.2).

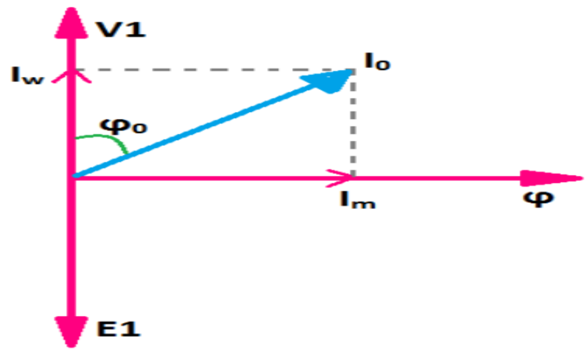

Fig.(1.2)

3-Procedure:

1. Connect the transformer as shown in Fig(1.3.a.b).

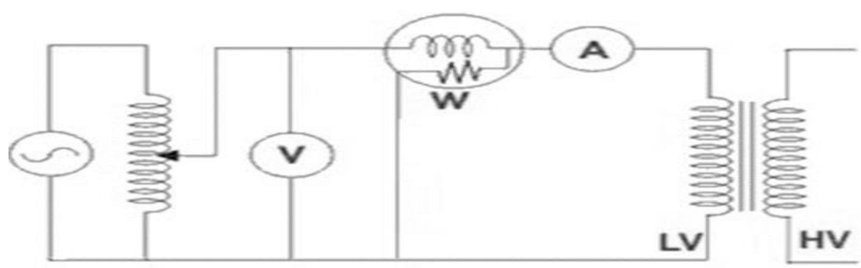

Fig.(1.3.a)

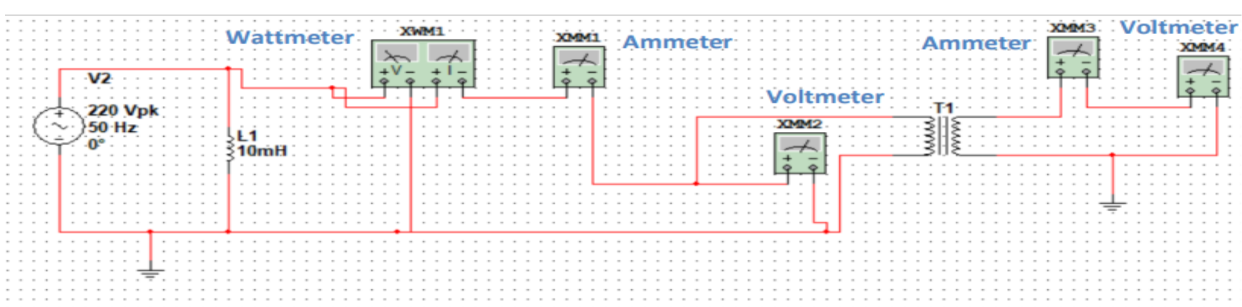

Fig.(1.3.b)

Fig.(1.3.a.b) open circuit test of single-phase transformer

2. Vary the input voltage from 0 to 125% rated value in steps, taking the readings at every step.

4-Calculation and Graphs.

Calculate Iw, Im and cos φo for each value of Vo.

Plot Io, Iw, Im, Po and cos φo against Vo.

Calculate the transformation ratio.

Calculate Rm and Xm for different values of Vo and find the average values.

5-Discussion:

Why should the supply frequency be maintained constant?

Why generally the voltage is applied to the L.V. side?

Why is the P.F. of the transformer is small at no-load?