Efficiency of Transformer

The iron core and the coper coils of a transformer both convert some electric energy into heat energy.

Any heat produced by the transformer represents in efficiency.

Since energy is equal to power times time, the efficiency of transformers is calculated in terms of power. The efficiency of a transformer is calculated by the following formula:

$$\text{Percent efficiency} = \frac{P_{sec}}{p_{pri}} \times 100$$

Primary power: Received power

Secondary power: Delivered power

The power loss in a transformer is caused by

1. Hysteresis loss
2. Eddy current loss
3. Copper (I^2R) loss

1. Hysteresis loss

Hysteresis loss is caused by residual magnetism, that is, by the magnetism that remains in a material after the magnetizing force has been removed.

The hysteresis loop in Fig. graphically illustrates hysteresis loss. The narrower the hysteresis loop, the lower the hysteresis loss.

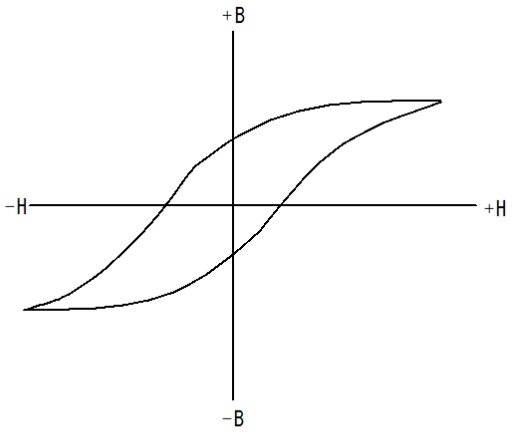

Fig. Hysteresis loop

2. Eddy Current Loss

The changing magnetic flux in the core of a transformer induces voltage into any conductors which surround it. Since the core is itself a conductor, the changing magnetic flux induces a voltage in the core as well as in the coil conductors. The voltage induced in the core causes current to circulate in the core. This current is called eddy current.

3. Copper Loss

Copper loss refers to the power dissipated in the windings of a transformer. Since this loss can be calculated by

$$\mathrm{P} = I^2R$$

It is called I^2R loss. The R in the formula is the ohmic, or dc, resistance of the turns in the winding.