Unit 3
No Load Transformer

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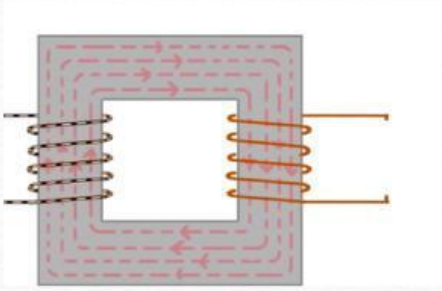
Definition

No load Transformer means a **transformer** which has **no load** connection at secondary winding only normal voltage is applied at the primary winding.



A transformer exciting current is the current or amperes required to energize the core. Even with zero load, a transformer will draw a small amount of current due to internal loss. The excitation current is made up of two components. The real component in the form of losses that are commonly referred to as no-load losses. The second form is reactive power measured in KVAR

4-8 % of rating of transformer

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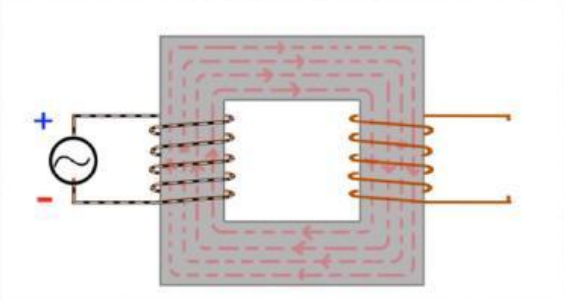

After applying A.C voltage V_1, it is seen that small amount of current I0 flows through the primary winding.

There is two losses

1. Iron Losses in the core i.e hysteresis loss and eddy current loss
2. Copper loss in the primary winding.

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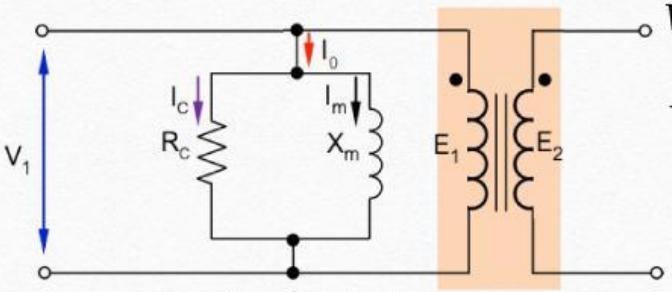
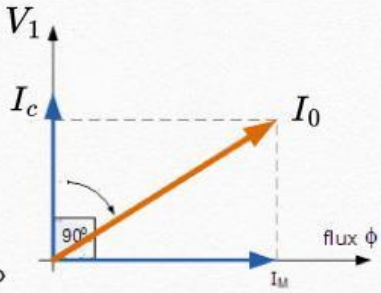
Equivalent Circuit and phaser diagram of No load transformer

Condition: This no-load primary current is made up of the following two components:

1. An in-phase current, IC Supplies the core losses (hysteresis and eddy current losses). It is in phase with the applied voltage (V_1).
2. Magnetizing Current (Im) — Produces the magnetic flux in the transformer core. It is a reactive current and lags the applied voltage (V_1) by 90°.



Equivalent circuit



$$R_c = \frac{V_1}{I_c} \qquad X_m = \frac{V_1}{I_m}$$

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$I_c = I_o \cos\phi$

$I_M = I_o \sin\phi$

$I_o = \sqrt{I_M^2 + I_c^2}$

Power loss formula

P=VI

$$V_1 I_c = V_1 I_0 cos\theta_0$$
$$P_c = V_1 I_0 cos\theta_0$$

$P_c =$ Power loss in iron core

$I_0 =$ Current at no load

$I_c =$ Current causes losses in the iron core

$I_M =$ Current used to create the magnetic field

$\theta_0 =$ Phase angle between V1 and Io

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Example 1: 1100/110V of 1 phase transformer connected 1100v into primary transformer with 1.5A and the angle between voltage and current is 70° Calculate

a.Power loss in iron core (Pc)

b.Current losses in the iron core (Ic)

c.Current used to create the magnetic field (IM)

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a.Power loss in iron core

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B. Current causes losses in the iron core (Ic)

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C. Current used to create the magnetic field (IM)

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Example 2: 1200/220V of 1 phase transformer connected 1200v into primary transformer with 3A and the power loss at no load is 850 w Calculate

a.Current losses in the iron core (Ic)

b.Current used to create the magnetic field (IM)

c.Equivalent resistance (Rc) of core

d.Equivalent reactance (Xm) of core

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a.Current causes losses in the iron core (Ic)

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b.Current used to create the magnetic field (IM)

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C.Equivalent resistance (Rc)of core

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d. Equivalent reactance (Xm) of core

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Example 3: 480/1200V of 1 phase transformer with 2A of Current causes losses in the iron core (Ic) and 5A of Current used to create the magnetic field (IM), Calculate

a.Power loss at core

b.No load current

c.Phase Angle between V and I

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