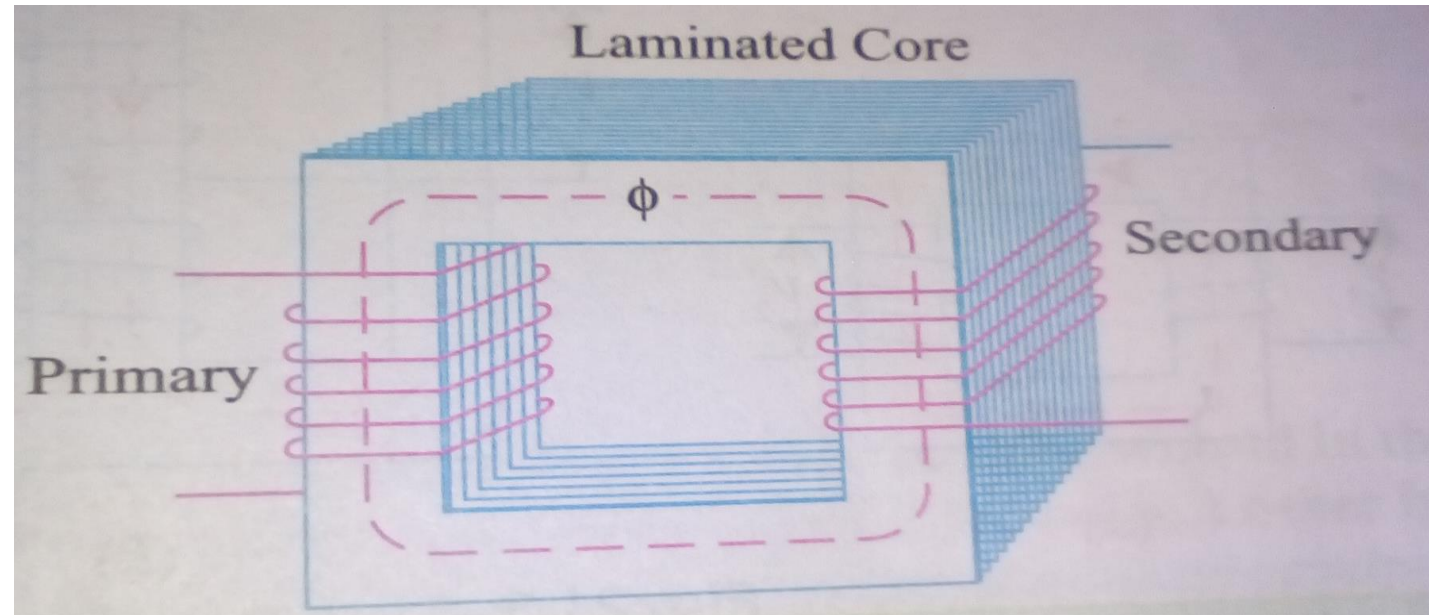


TRANSFORMERS

1. A transformer is a static piece of apparatus by means of which electric power of one circuit is transformed to electric power in another circuit.
2. Transformers are rated in volt-amperes (VA)
3. The physical basis of a transformer is **mutual inductance**.
4. If two coils of wire are brought into close proximity with each other so the magnetic field from one links with the other,
5. A voltage will be generated in the second coil as a result. This is called **mutual inductance**

1. The first coil, in which electrical energy is feed from a.c. supply mains is called **primary winding**.
2. Other from which energy is drawn out is called **secondary winding**.



TURNS RATIO

The turns ratio of secondary voltage to primary voltage is known as transformation ratio or turns ratio. When voltage is applied in the transformer then magnetic flux is set up in the coil

$$\Phi = \Phi_m \sin \omega t = \Phi_m \sin 2\pi f t$$

Emf induced (rms value) can be calculated by

$$E = 4.44 f N \Phi_m$$

- Let the N_2, N_1 be the turns in primary and secondary whereas E_1 and E_2 rms value of primary and secondary emf so

$$E_1 = 4.44 f N_1 \Phi_m$$

and

$$E_2 = 4.44 f N_2 \Phi_m$$

Then, the *transformation ratio* or *turns-ratio* can be expressed as

$$K = \frac{V_2}{V_1} = \frac{E_2}{E_1} = \frac{N_2}{N_1}$$

- By 1
- Step up-transformer : $N_2 > N_1$ then $V_2 > V_1$
- Step down-transformer : $N_1 > N_2$ then $V_1 > V_2$

the power (VA) in the secondary must equal the power (VA) in the primary. This can be expressed as:

$$E_1 I_1 = E_2 I_2$$

The current is inversely proportional to the turns ratio. This can be expressed as:

$$\frac{I_2}{I_1} = \frac{N_1}{N_2} = \frac{1}{K}$$

**The impedance ratio is equal to the turns ratio squared.
This is expressed as:**

$$\frac{Z_P}{Z_S} = \left(\frac{N_P}{N_S} \right)^2$$

Auto Transformer

1. An autotransformer is a device used to step up or step down applied voltage.
2. It is a special type of transformer in which the primary and secondary windings are both part of the same core.

Figure 18–8A shows an autotransformer

FIGURE 18–8

An autotransformer is a special type of transformer used to step up or step down the voltage.

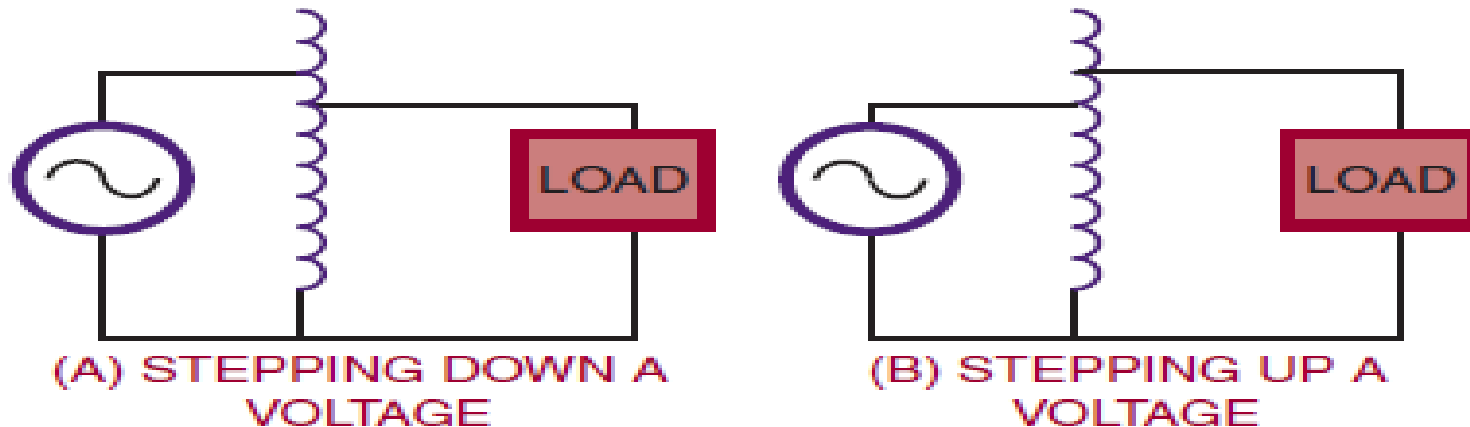


FIGURE 18-9
A variable autotransformer.



TRANSFORMERS HAVE MANY APPLICATIONS

1. Stepping up voltage

When a transformer is used to “increase” the voltage on its secondary winding with respect to the primary.

2. Stepping down voltage

When it is used to “decrease” the voltage on the secondary winding with respect to the primary.