

EXPERIMENT NO 06

TITLE: To study working, types, construction and parts of transformer.

OBJECTIVES: To understand functioning of transformer.

THEORY:

Transformer is an electrical device that transfers electrical energy from one circuit to other by electromagnetic induction. Some important components of transformer are:-

- 1) Laminated core
- 2) Windings
- 3) Insulating material
- 4) Breather
- 5) Tap changer
- 6) Conservator
- 7) Cooling tubes
- 8) Transformer oil
- 9) Buchholz relay
- 10) Explosion vent

The above parts can be further explained as follows:-

1) Laminated Core:

It is used to support the winding in the transformer. It provides low reluctance path to flow of magnetic flux. It is made up of laminated core (soft iron) to reduce eddy current loss and hysteresis loss. Diameter of the transformer core is directly proportional to copper loss and inversely proportional to iron loss.

2) Windings:

These are classified in two different ways

(a) Based on input and output supply

- | | |
|-------------|----------------|
| (i) Primary | (ii) Secondary |
|-------------|----------------|

(b) Based on voltage range

- | | |
|------------------|------------------|
| (i) High voltage | (ii) Low voltage |
|------------------|------------------|

3) Insulating material:

Insulating materials like papers and cardboards are used to isolate primary and secondary windings from each other as well as the transformer core. These windings are made up of copper due to high conductivity and ductility.

4) Breather:

Expansion and contraction of oil cause change in pressure of conservator. This change in pressure of conservator is balanced by flow of atmospheric air into and out of the conservator. This contains silica gel to provide moisture free air.

5) Tap changer:

To balance voltage variations within transformer, tap changers are used. These are two types of tap changers-on load and off load. In on load tap changers, tapping can be changed without isolating transformer from the supply while in off load, transformer needs to be disconnected from the supply.

6) Conservator:

It conserves transformer oil. It is an airtight metallic cylindrical drum which is fitted above transformer.

7) Cooling Tubes:

It is used to cool the transformer oil. The circulation of the oil within the transformer may be natural and forced. In the case of natural circulation, when the oil temperature rises, the hot oil naturally moves to the top and cold oil moves down, while in case of forced circulation, an external pump is used.

8) Transformer oil:

It performs two functions- i) Insulation ii) Cooling for core and coil assembly. Core and windings of the transformer must be completely immersed in oil. Normally carbon mineral oils are used for transformer oils.

9) Buchholz Relay:

It is a protective device housed over the connecting pipes from main tank to conservator tank. It is used to sense fault inside the transformer.

10) Explosion vent:

The boiling hot oil from the transformer is expelled during internal faults through the explosion vent to avoid explosion of the transformer. This is generally placed above the level of the conservatory tank.

Construction:

Basically, transformer consists of two inductive windings and laminated steel core. Coils are insulated from each other as well as steel core. A transformer also consists of a suitable container for the assembled core and windings such as tank, a suitable medium for insulating core and windings from its container such as transformer oil, suitable bushings for insulating and bringing out terminals of the windings from container, temperature gauge to measure temperature of hot oil and oil gauge to indicate oil level inside tank.

Working Principle:

The basic phenomenon behind working of transformer is mutual induction between two windings.

Types of Transformer:

1) Types on basis of construction:

(a) Core type transformer: Windings are wound on the core.

(b) Shell type transformer: The coils are former wound and mounted in layers with insulation between them.

2) On the basis of purpose:

(a) Step-up transformer: Voltage increases

(b) Step-down transformer: Voltage decreases

3) On the basis of types of supply:

(a) Single phase

(b) Three phase

4) On the basis of their use:

(a) Power transformer: Transmission network, high rating

(b) Distribution transformer: Distribution network, lower rating than power transformer

(c) Instrument transformer: Used in relay and industries

5) On the basis of cooling employed

(a) Oil immersed transformers: These transformers are further classified as (i) Oil immersed natural cooled (ii) Oil immersed forced air cooled (iii) Oil immersed water cooled (iv) Oil immersed forced oil cooled

(b) Dry type transformers: There are types of these transformers as (i) Air blast type (ii) Air cooled type

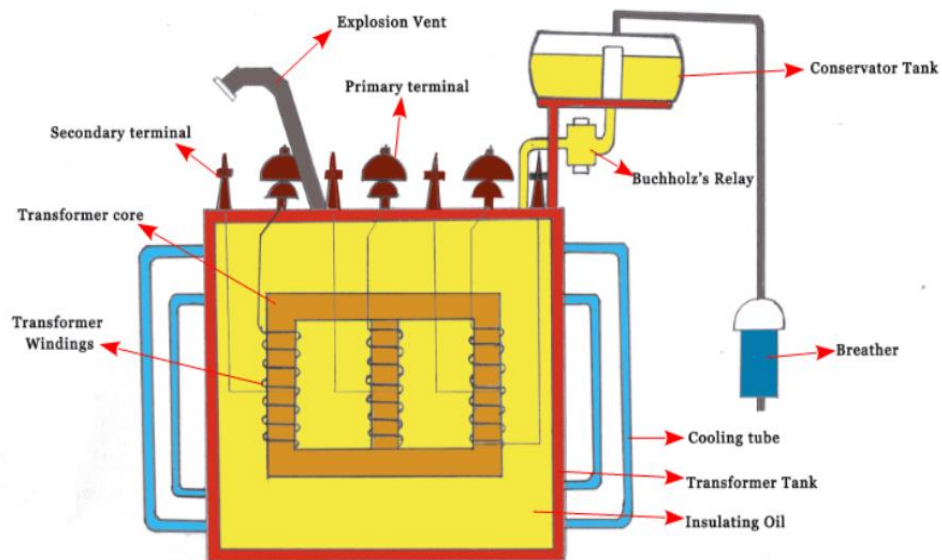
Diagram:

Fig.1 Transformer

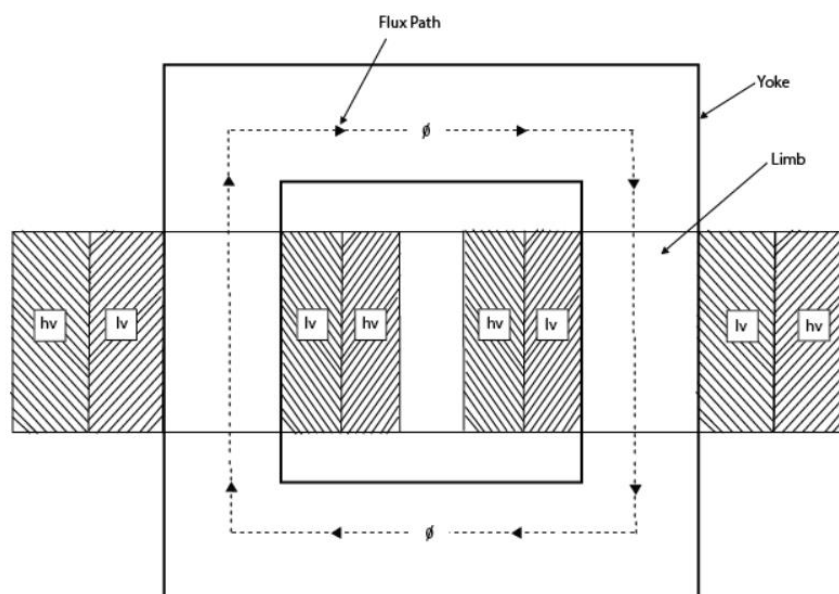


Fig.2 Core type transformer

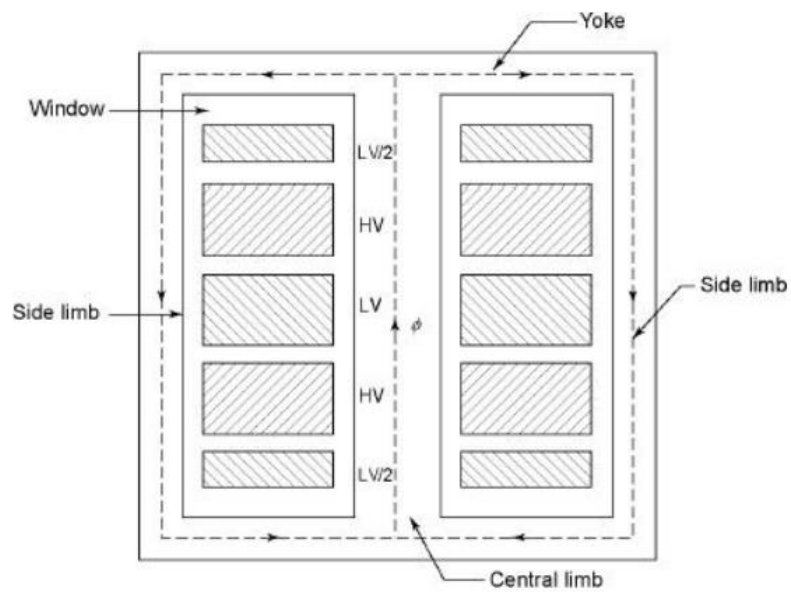


Fig.3 Shell type transformer

Conclusion:

The principle, working, construction and types of transformer has been studied.