RAMA UNIVERSITY

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FACULTY OF ENGINEERING & TECHNOLOGY

Electrical Machine-1

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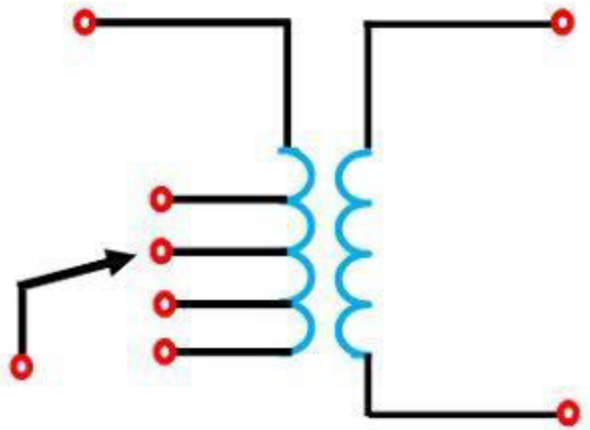
Tap-changing Transformers

The change of voltage is affected by changing the numbers of turns of the transformer provided with taps. For sufficiently close control of voltage, taps are usually provided on the high voltage windings of the transformer. There are two types of tap-changing transformers

1. Off-load tap changing transformer
2. On-load tap changing transformer

Off-load tap-changing transformer

In this method, the transformer is disconnected from the main supply when the tap setting is to be changed. The tap setting is usually done manually. The off load tap changing transformer is shown in the figure below



Off-load tap-changing transformer

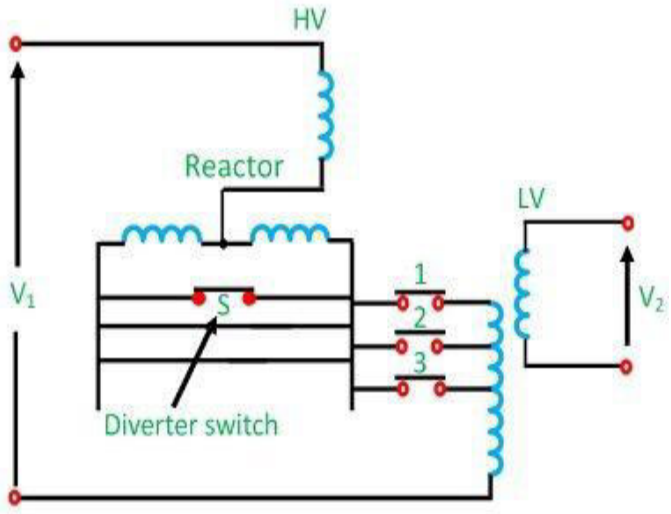
Circuit Globe

On-load tap-changing transformer

In order that the supply may not be interrupted, on-load tap changing transformer are sued. Such a transformer is known as a tap-changing under load transformer. While tapping, two essential conditions are to be fulfilled.

- The load circuit should not be broken to avoid arcing and prevent the damage of contacts.
- No parts of the windings should be short–circuited while adjusting the tap.

The tap changing employing a center tapped reactor R show in the figure above. Here S is the diverter switch, and 1, 2, 3 are selector switch. The transformer is in operation with switches 1 and S closed. To change to tap 2, switch S is opened, and 2 is closed. Switch 1 is then opened, and S closed to complete the tap change. It is to be noted that the diverter switch operates on load, and no current flows in the selector switches during tap changing. During the tap change only half of the reactance which limits the current is connected in the circuit.

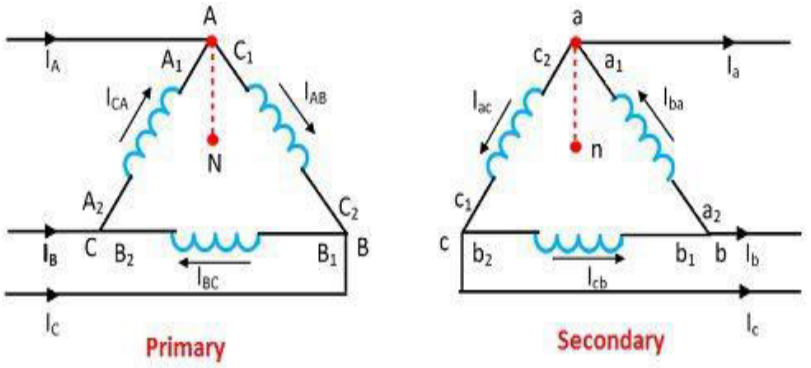


On-load tap changing using a reactor

Three-Phase Transformer Connections

The three phase transformer consists three transformers either separate or combined with one core. The primary and secondary of the transformer can be independently connected either in star or delta. There are four possible connections for a 3-phase transformer bank.

1. Δ – Δ (Delta – Delta) Connection
2. Y – Y (Star – Star) Connection
3. Δ – Y (Delta – Star) Connection
4. Y – Δ (Star – Delta) Connection



. Delta-Delta (Δ-Δ) Connection

The delta-delta connection of three identical single phase transformer is shown in the figure below. The secondary winding a_1a_2 is corresponding to the primary winding A_1A_2, and they have the same polarity. The polarity of the terminal **a** connecting $\mathbf{a_1}$ and $\mathbf{c_2}$ is same as that connecting $\mathbf{A_1}$ and $\mathbf{C_2}$. The figure below shows the phasor diagram for lagging power factor **cosφ**. The magnetising current and voltage drops in impedances have been neglected. Under the balanced condition, the line current is √3 times the phase winding current. In this configuration, the corresponding line and phase voltage are identical in magnitude on both primary and secondary sides.