

## Module-2

# Three-Phase Transformer, Parallel Operation of Transformer and Autotransformer



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## Module-2

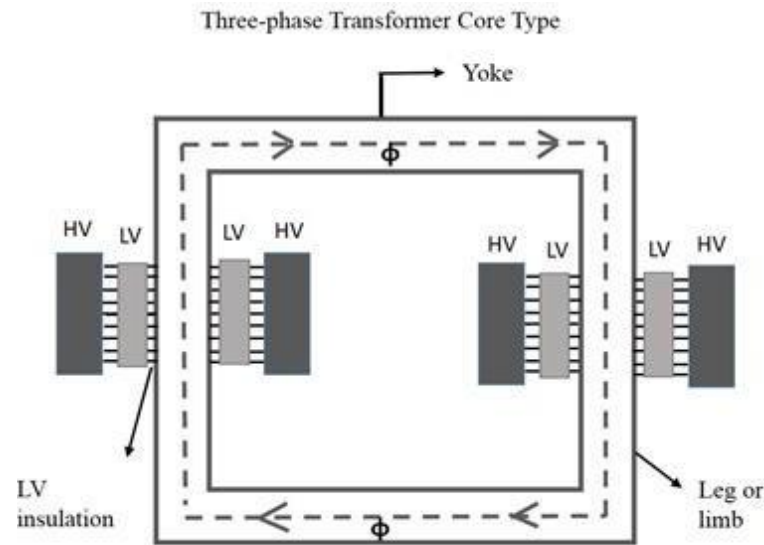
**Three-phase Transformers:** Introduction, Constructional features of three-phase transformers. Transformer connection for three-phase operation— star/star, delta/delta and star/delta, comparative features. Labeling of three-phase transformer terminals.

**Parallel Operation of Transformers:** Necessity of Parallel operation, conditions for parallel operation— Single phase and three phases. Load sharing in case of similar and dissimilar transformers. Numerical.

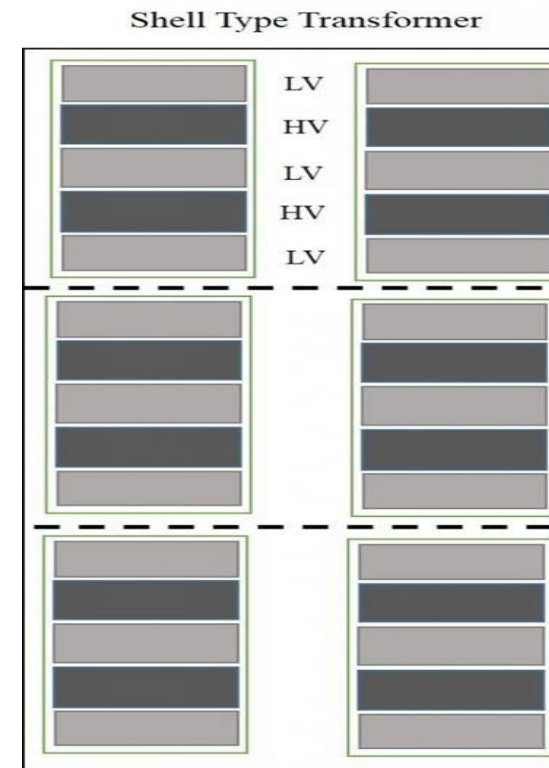
**Autotransformers and Tap changing transformers:** Introduction to autotransformer-copper economy, equivalent circuit, no load, and on-load tap changing transformers. Numerical.

## Constructional features of three-phase transformers:

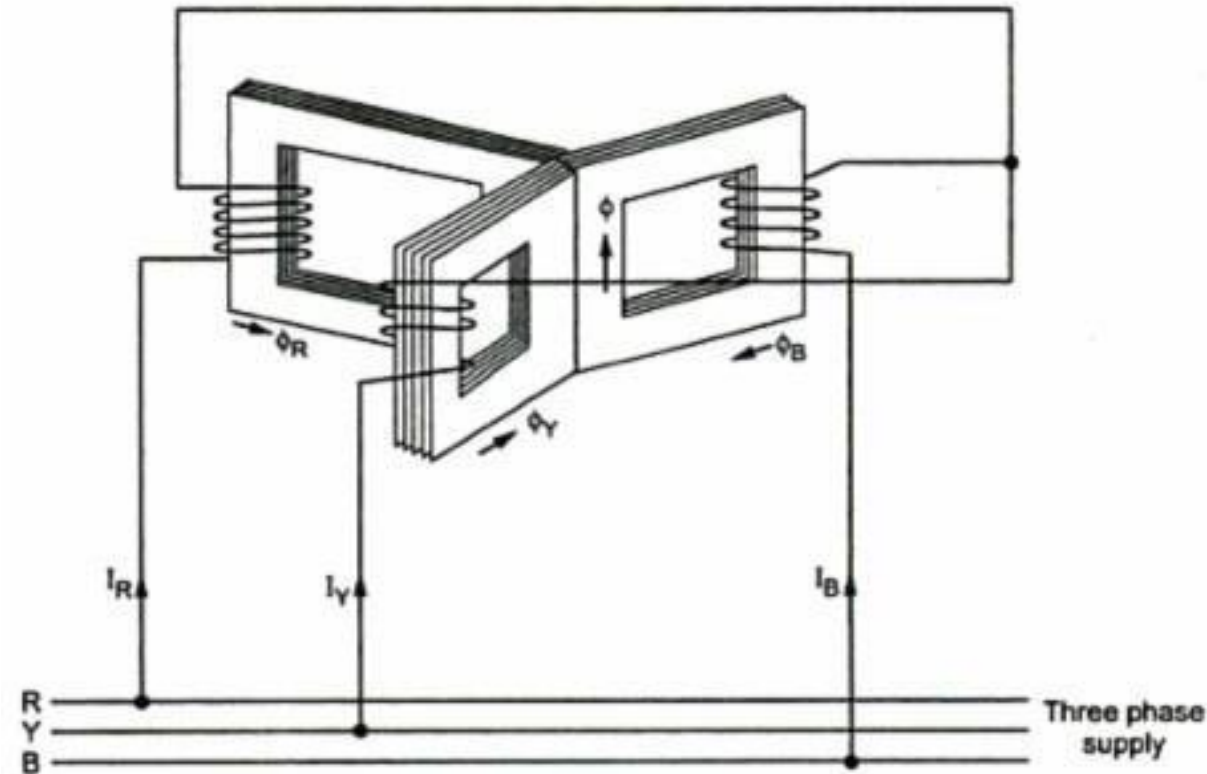
### Core Type Construction:



### Shell Type Transformer:



## Working of Three-Phase Transformers:



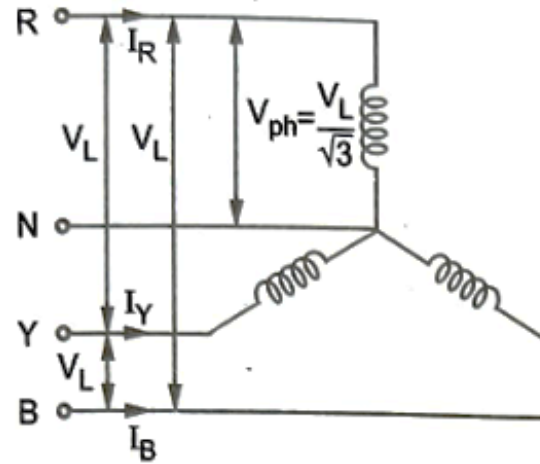
## Three-Phase Transformer Connection:

Primary and secondary windings of three phase transformers as three phase windings can be connected in different ways such as in star or delta.

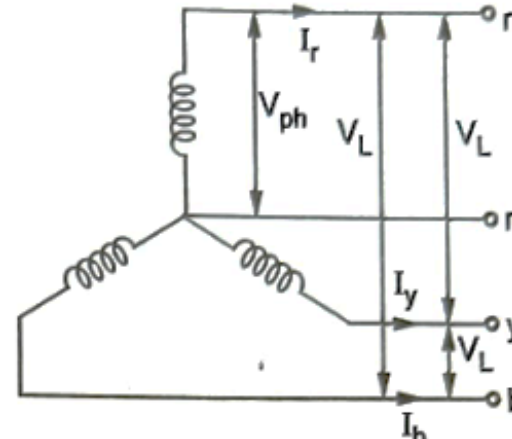
1. Star-Star (Y-Y) connection
2. Delta – Delta ( $\Delta$  -  $\Delta$ ) connection
3. Star-Delta (Y -  $\Delta$ ) connection
4. Delta-Star ( $\Delta$  - Y) connection
5. Open Delta or V connection
6. Scott connection or T-T connection



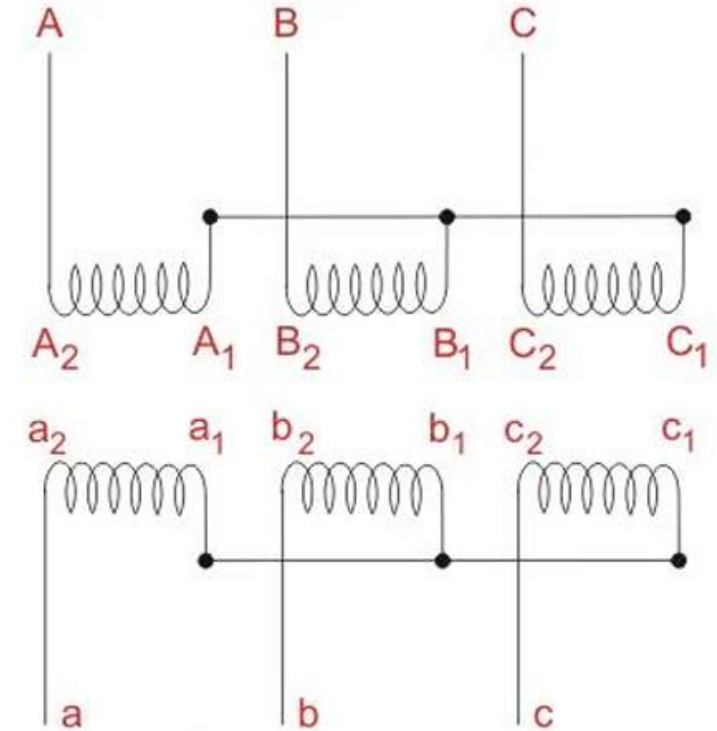
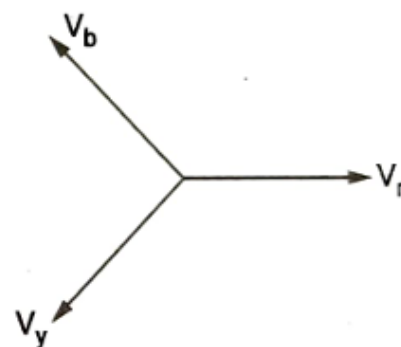
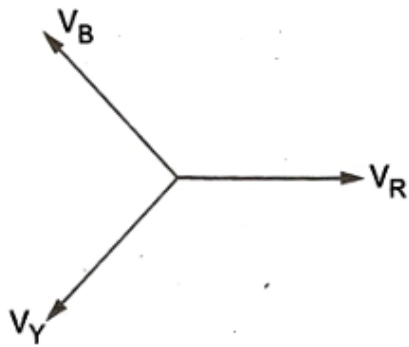
## Star-Star Connection:



Primary side

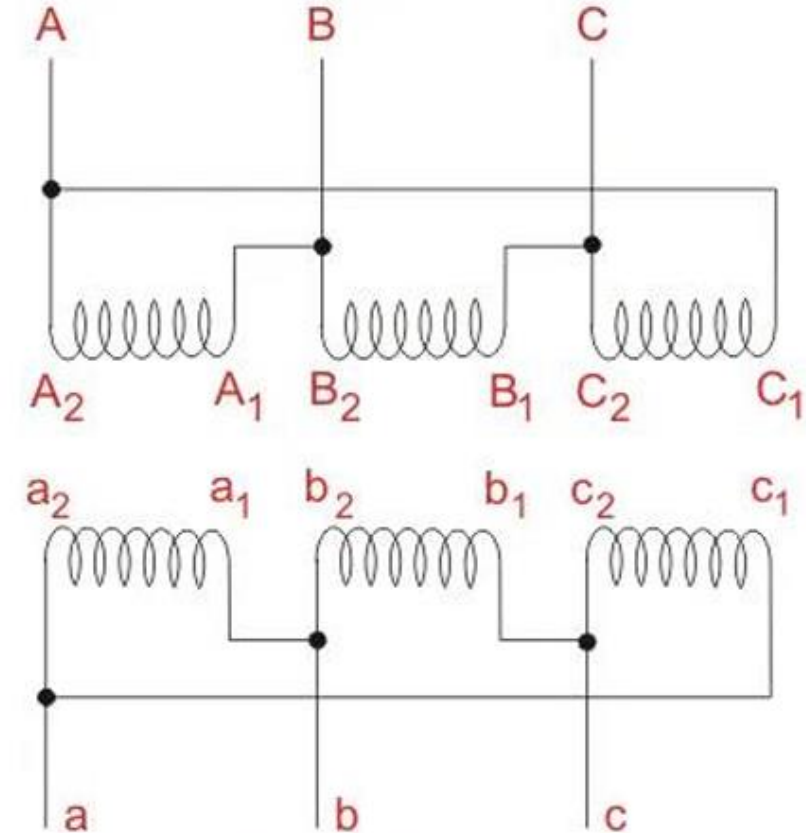
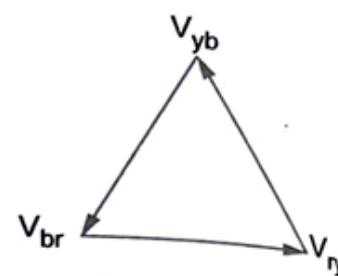
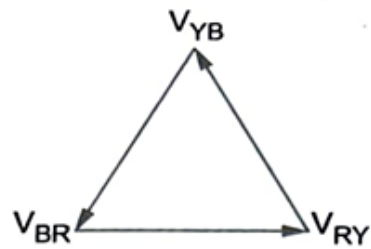
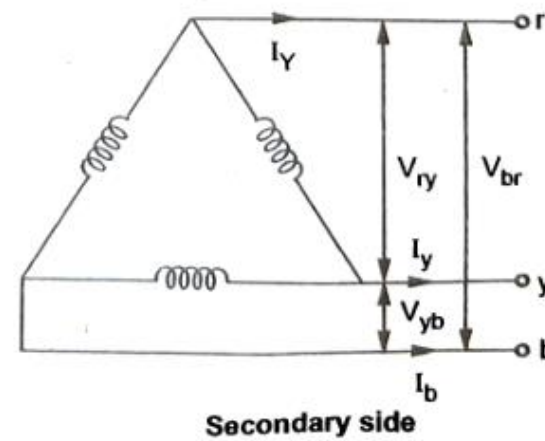
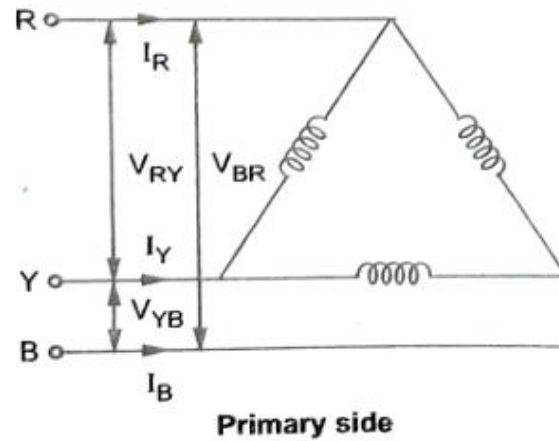


Secondary side



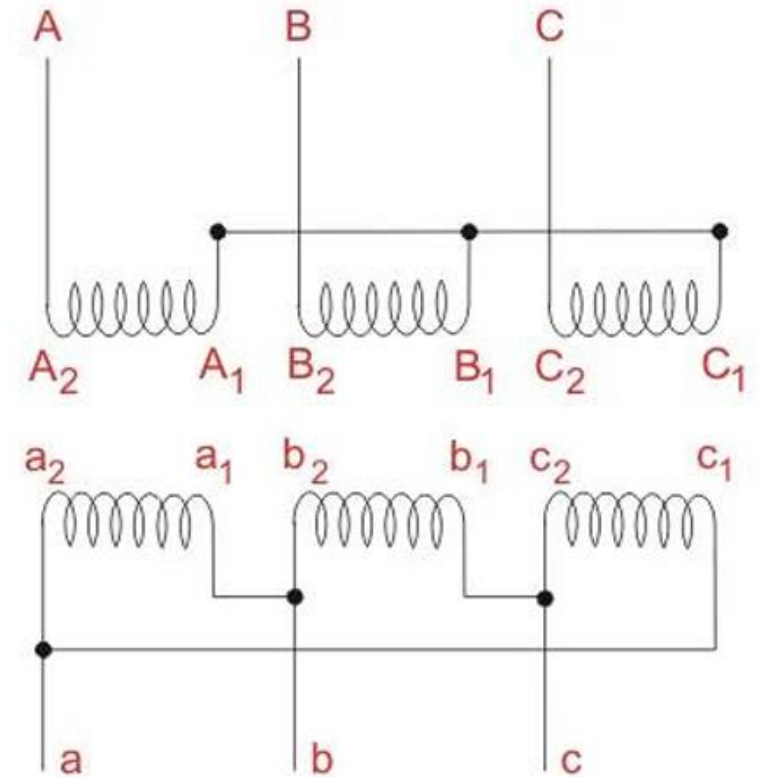
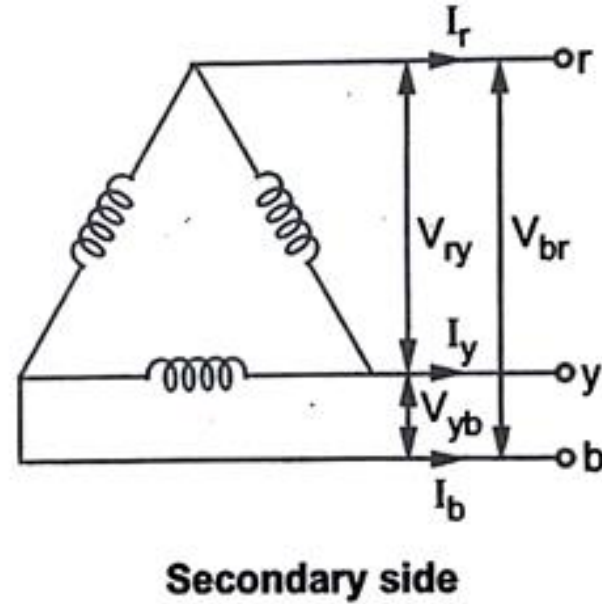
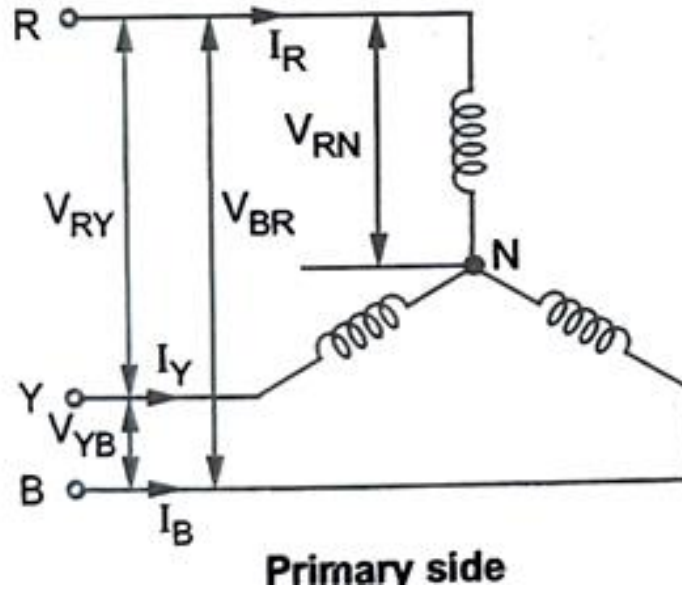
Star-Star Three Phase Transformer

## Delta-Delta Connection:



Delta-Delta Three Phase Transformer

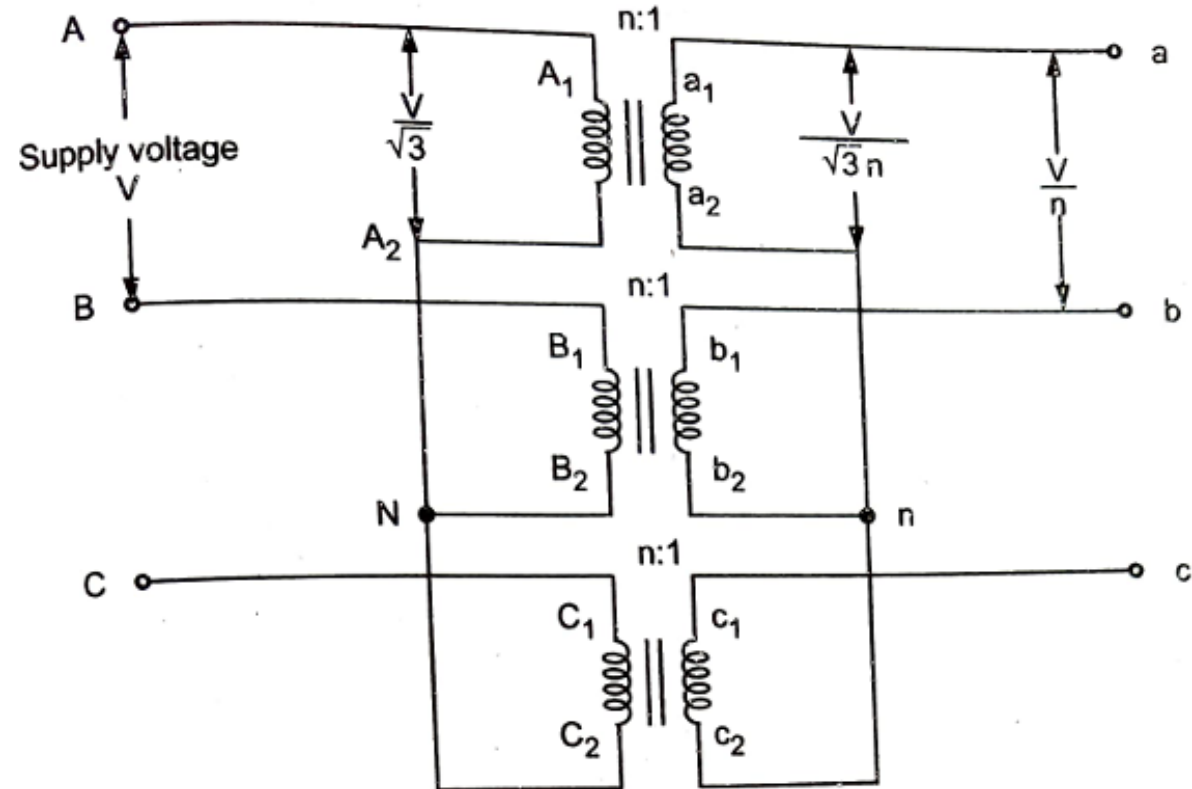
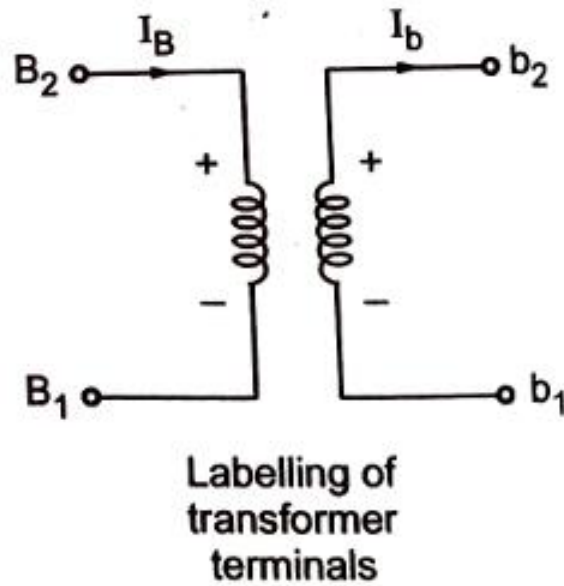
## Star-delta transformer:



Star-Delta Three Phase Transformer

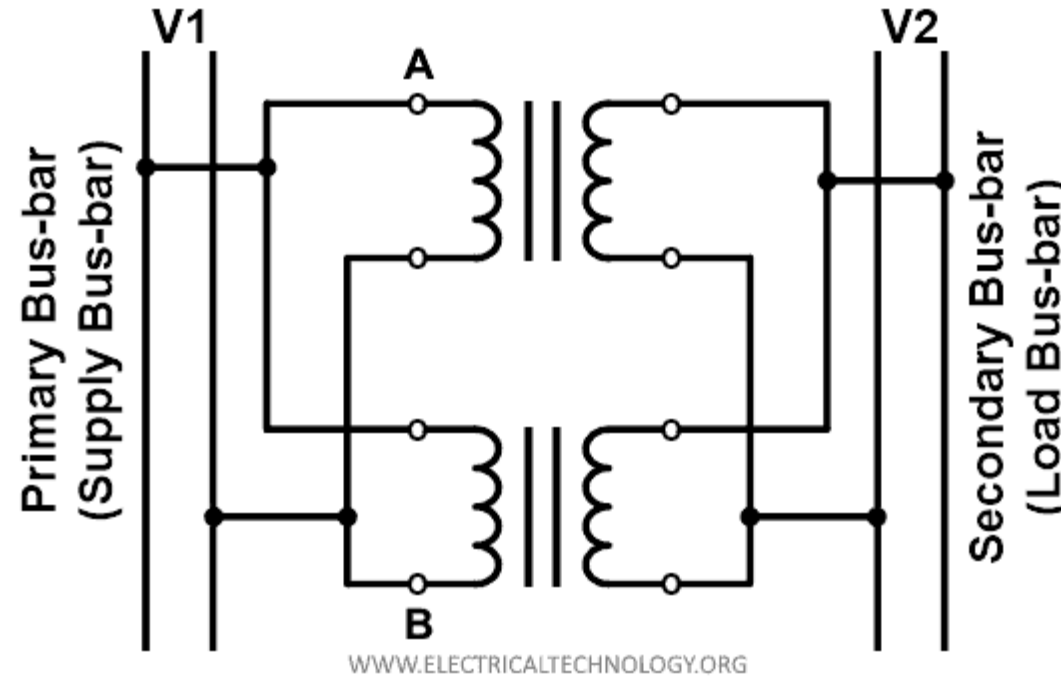


## Labelling of Transformer:

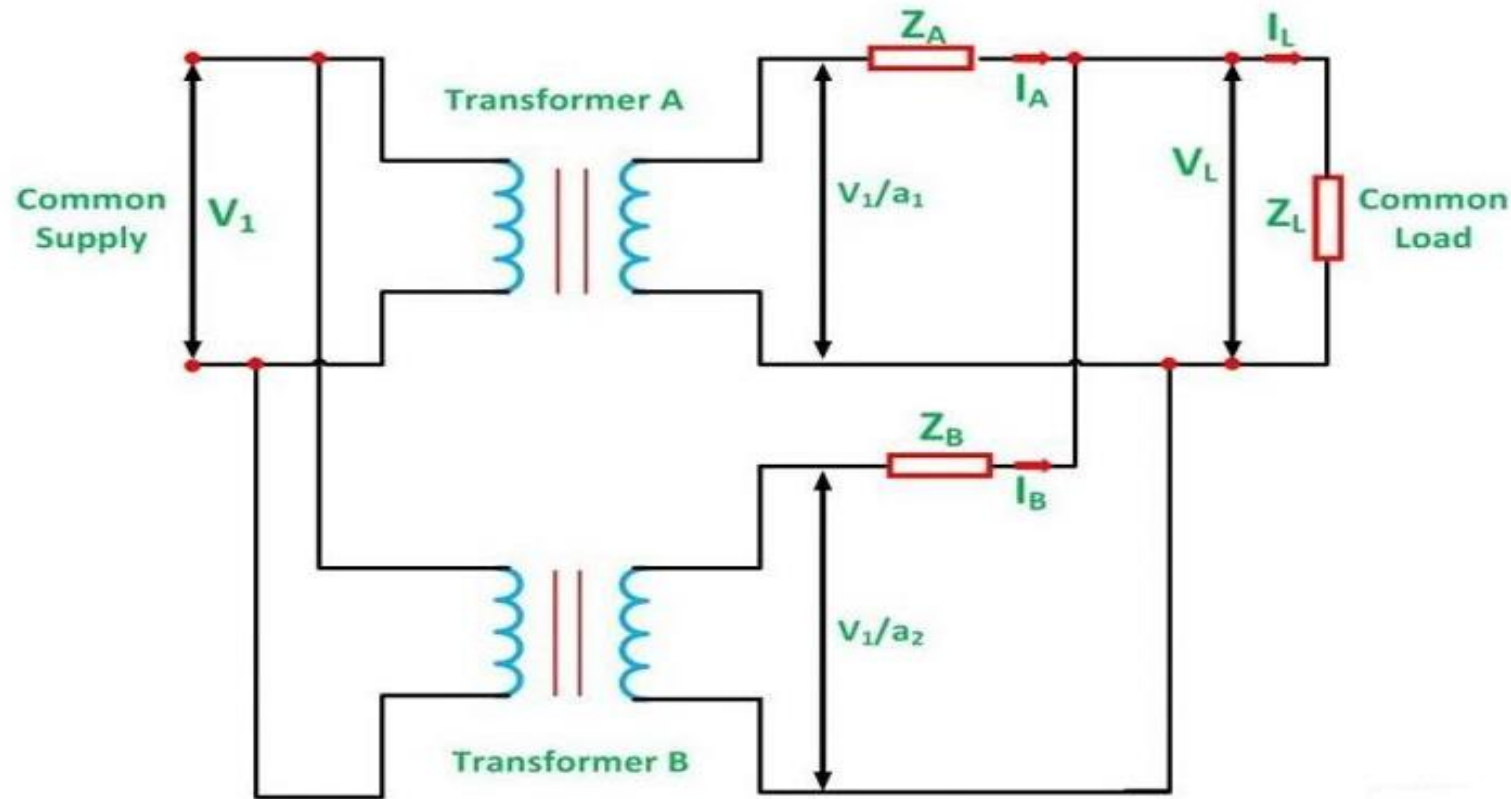


## Parallel Operation of Transformers:

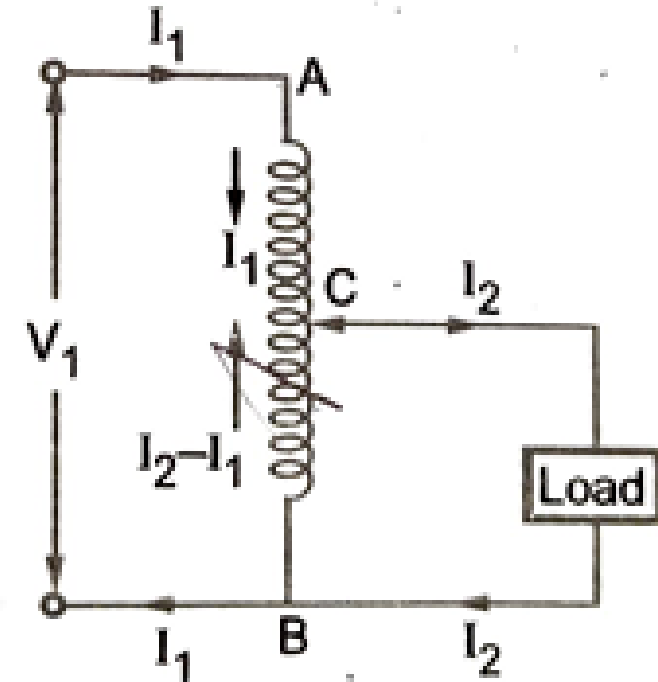
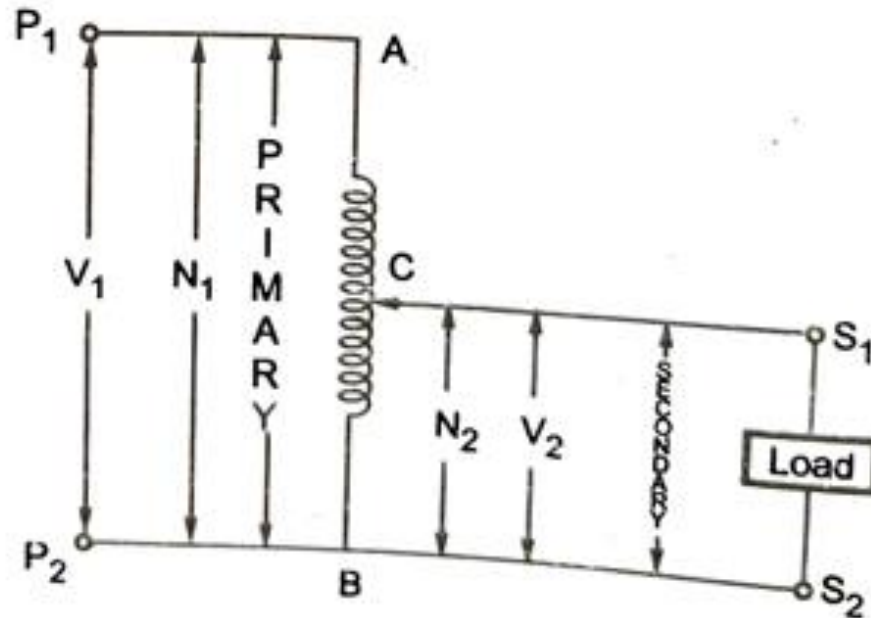
### Parallel Operation of 1- $\Phi$ Transformers



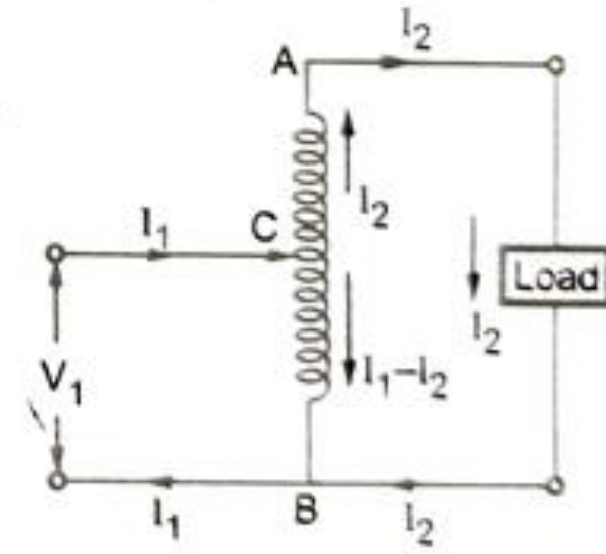
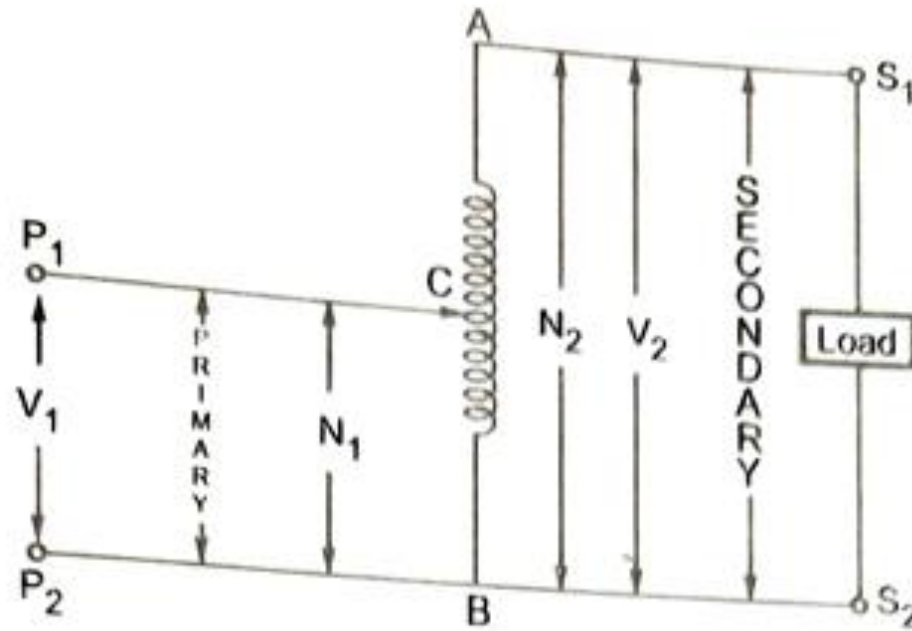
## Load sharing in case of similar and dissimilar transformers:



## Construction of Autotransformers:



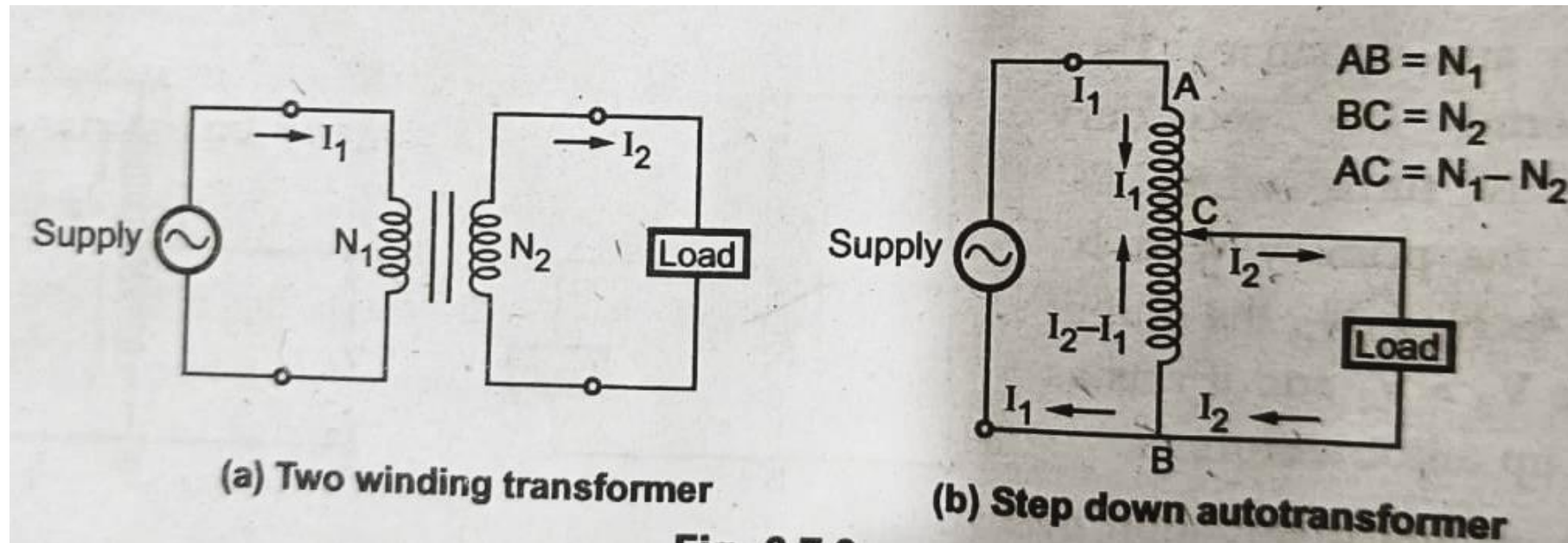
Step-down autotransformer



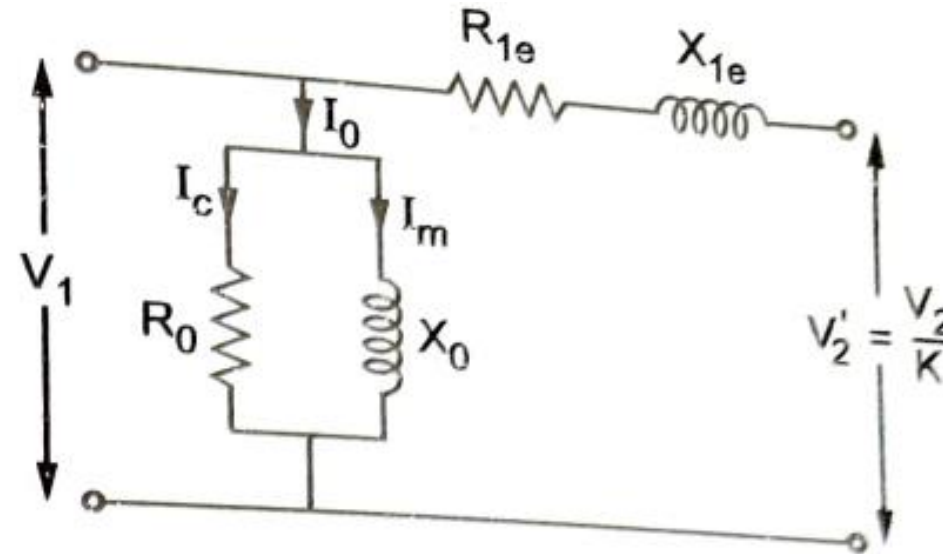
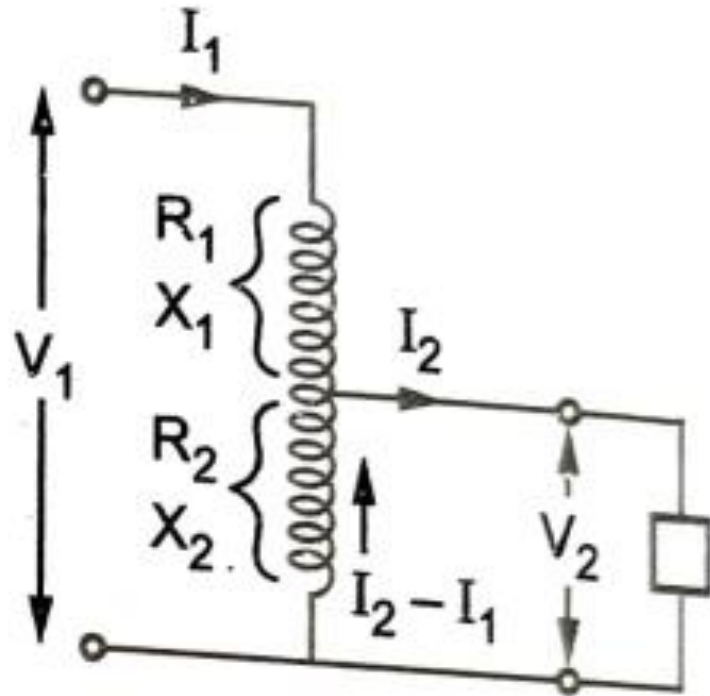
Step-up autotransformer



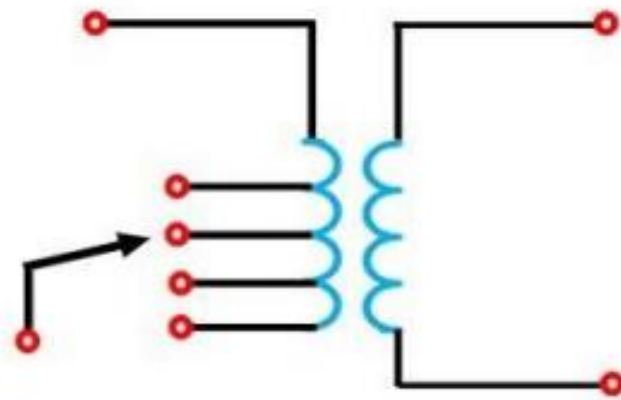
## Saving of Copper in Auto Transformer as Compared to Ordinary Two-Winding Transformer:



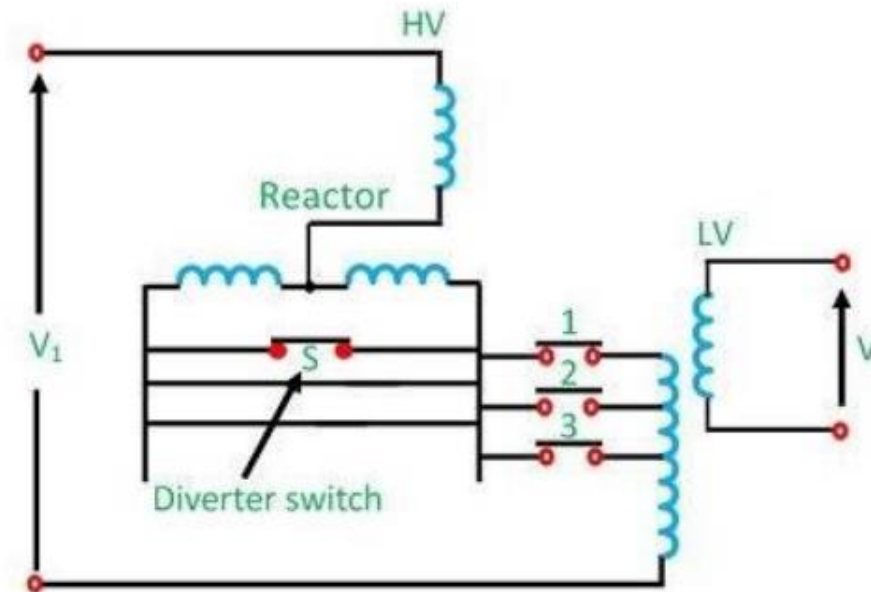
## Equivalent circuit of Autotransformer:



## Tap-changing Transformers:



Off-load tap-changing transformer



On-load tap changing using a reactor

