



Ministry of Higher Education

and Scientific Research

Al- Mustaqbal University College

Department of Medical Instrumentation Techniques Engineering

تكنولوجيا الكهرباء

Electrical Technology

Lecture 8

Lecture Name: TRANSFORMER

By

Dr. Jaber Ghaib Talib



Three-phase transformers

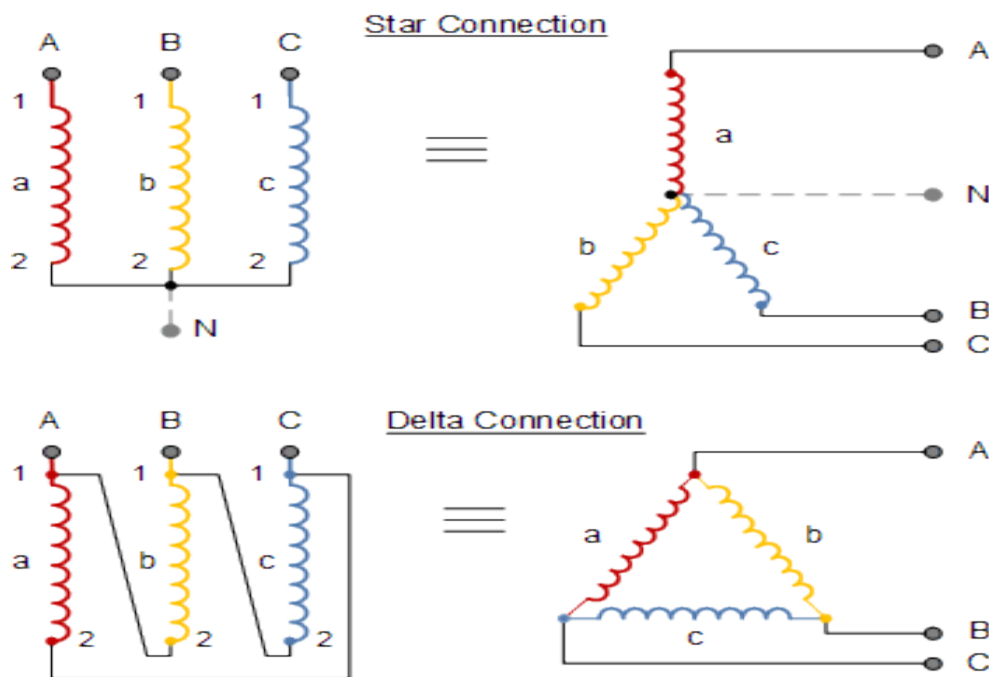
are used in three-phase circuits to step up and step down the voltage according to the needs in a power system.

You know that electric power is generated and transmitted using a three-phase system. The three-phase system has significant advantages over other polyphaser systems. In a three-phase circuit, the voltage is raised or lowered by means of three-phase transformers.

Three-phase transformers functions just like three single-phase transformers. But a single three-phase transformer occupies less volume and weighs less than three single-phase transformers designed for the same purpose.

The primary windings and secondary windings of the three-phase transformers may be independently connected in either way (Y) or delta (Δ) connection. As a result. Four types of three-phase transformers are in common use:

Transformer Star and Delta Configurations



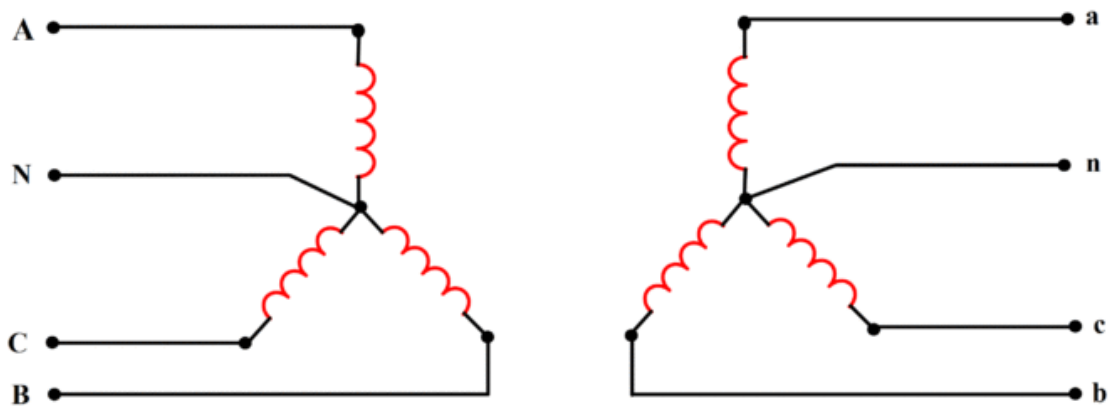
Y-Y, Y- Δ , Δ -Y, and Δ - Δ .



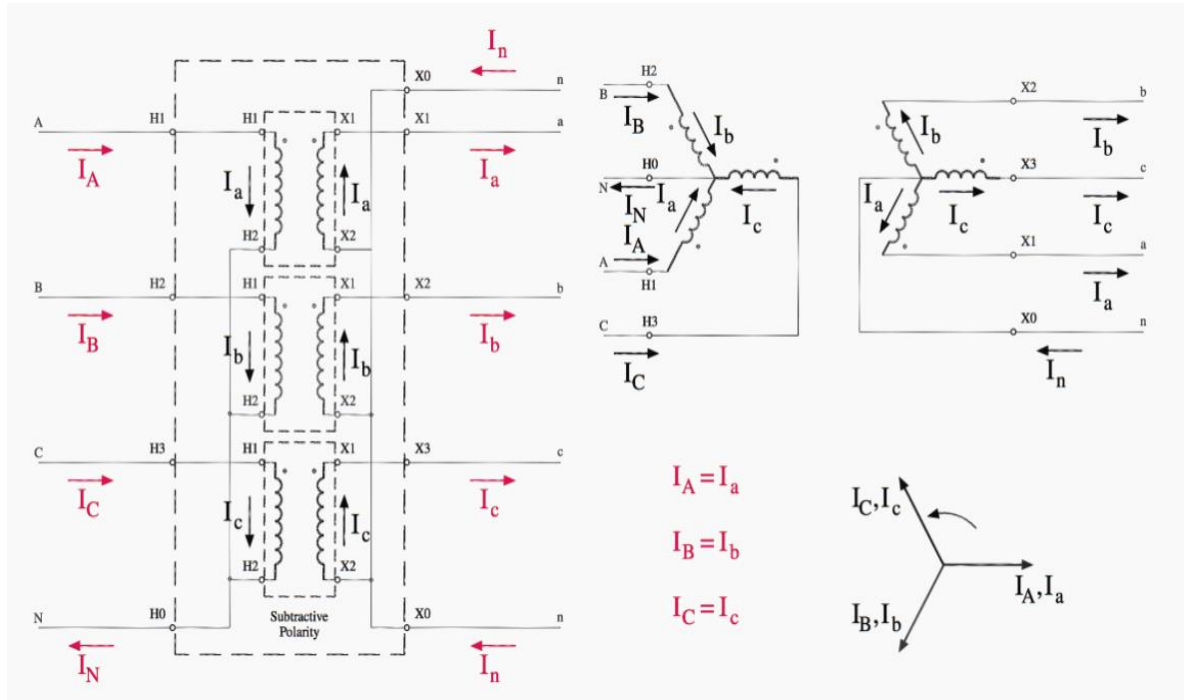
Three-phase Voltage and Current

Connection	Phase Voltage	Line Voltage	Phase Current	Line Current
Star	$V_P = V_L \div \sqrt{3}$	$V_L = \sqrt{3} \times V_P$	$I_P = I_L$	$I_L = I_P$
Delta	$V_P = V_L$	$V_L = V_P$	$I_P = I_L \div \sqrt{3}$	$I_L = \sqrt{3} \times I_P$

1- Y-Y



Y-Y Connection



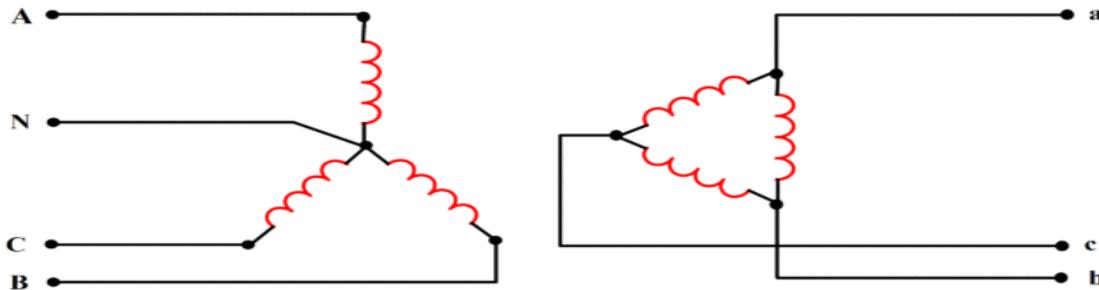
Advantages of Y-Y Connection

- Two voltage levels available
- Graded High voltage insulation
- Balanced connection when supplying 1- ϕ and 3- ϕ loads

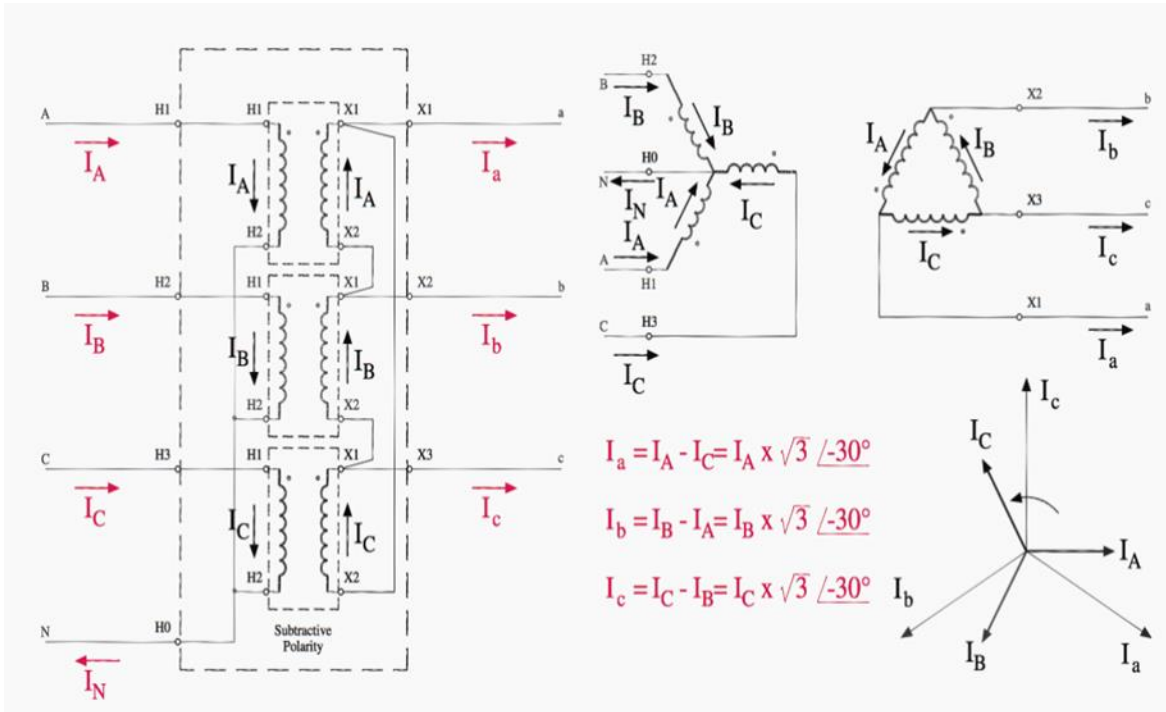
Disadvantages of Y-Y Connection

- Presence of 3rd harmonic component in ungrounded Y-Y connection.
- Thermal over-heating

2- Y- Δ



Y- Δ Connection



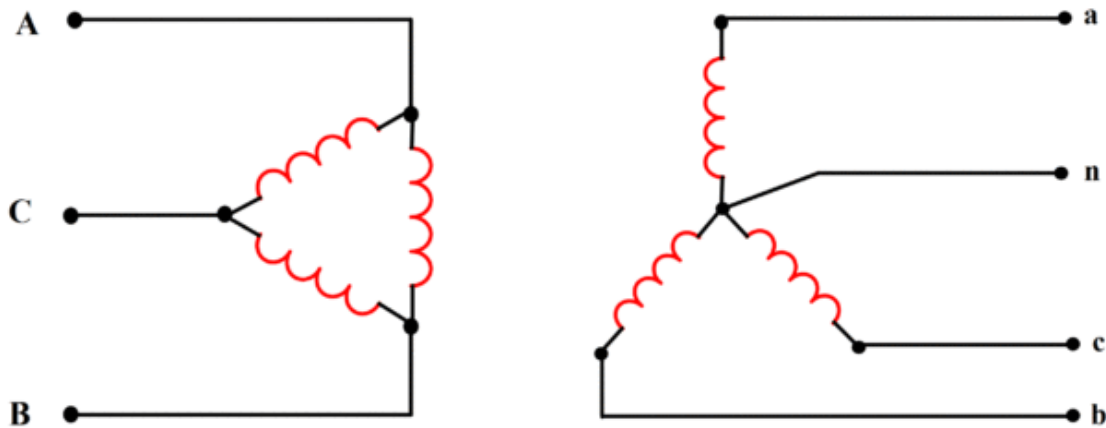
Advantages of Y-Δ Connection

- Neutral is available on primary side which can be earthed in order to avoid distortion.
- Two voltage levels (single and three phase) are available.
- Traps 3rd harmonic currents

Disadvantages of Y-Δ Connection

- Since primary and secondary are not in phase so cannot operate in parallel with other Y-Y or Δ-Δ transformers
- Full insulation is required on Δ side

3-D-Y



Δ -Y Connection

The Y- Δ

connection is commonly used in stepping down from a high voltage to a medium or low voltage level, as in distribution transformers. Conversely,

the Δ -Y

connection is used for stepping up to a high voltage, as in generation station transformer.

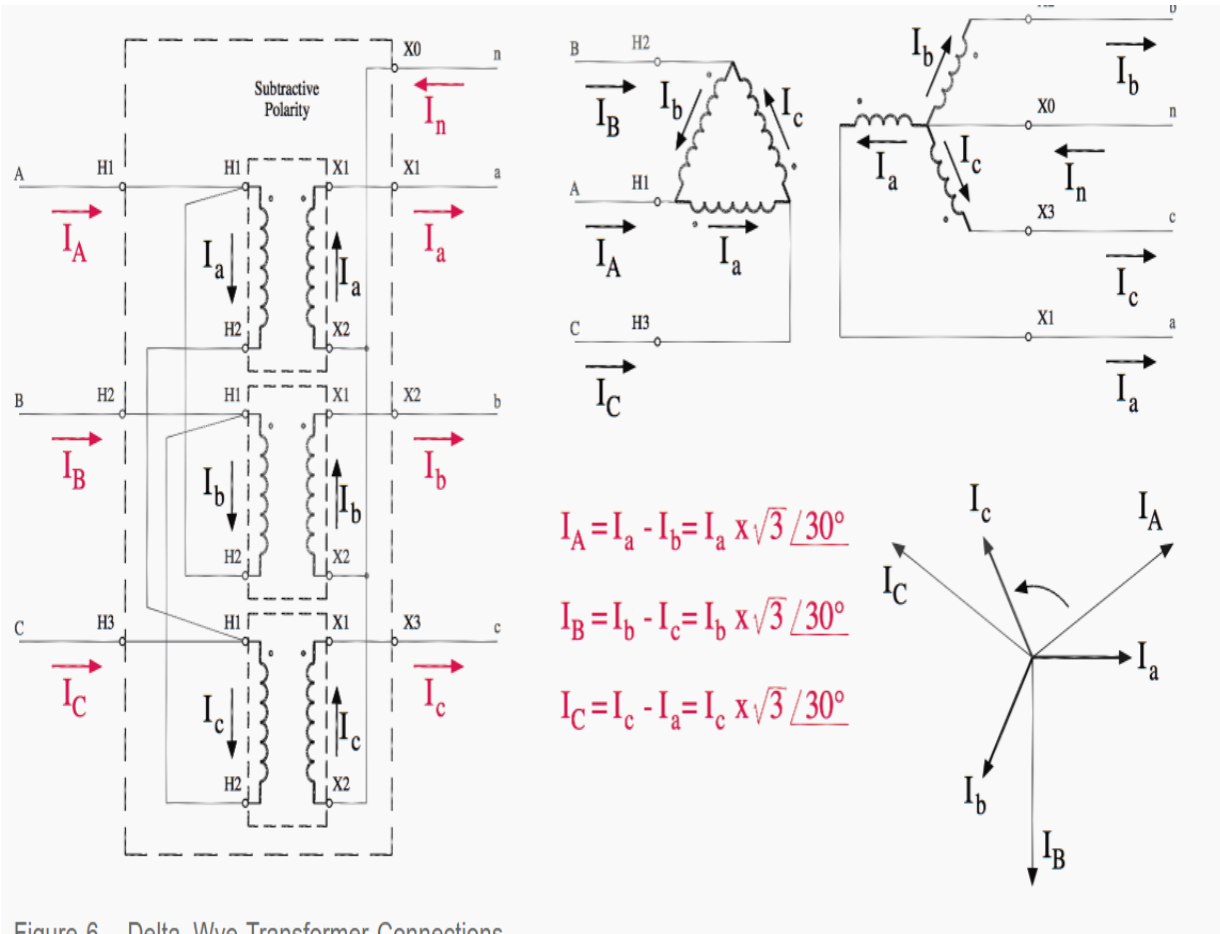
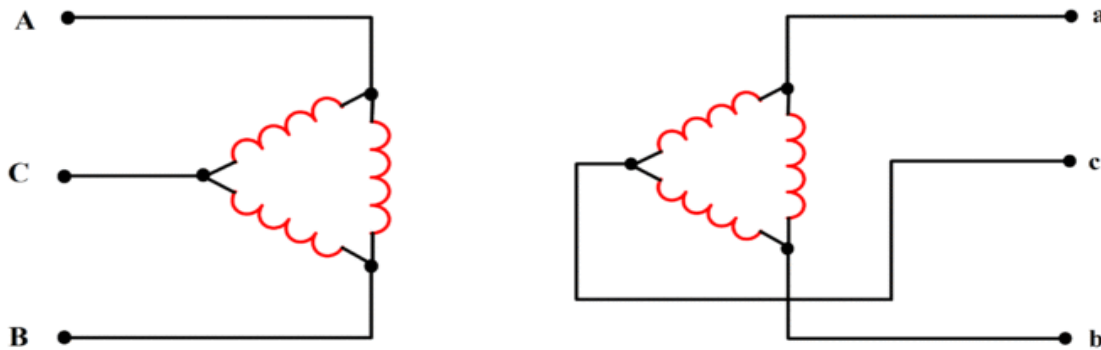


Figure 6 – Delta-Wye Transformer Connections

D-D



Δ-Δ Connection



Advantages of Delta-Delta Connection

- Ideal for three wire motor loads
- Can easily stand single line shorts without any interruption.
- Traps 3rd harmonics (circulating currents)

Disadvantages of Delta-Delta Connection

- Full insulation required on high voltage winding
- Since no neutral is available so its unbalanced connection when supplying to 1- ϕ and 3- ϕ loads

