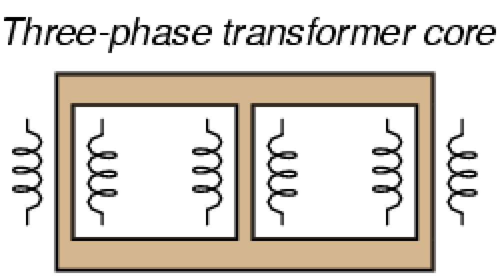
SECTION-B

3-ϕ TRANSFORMER

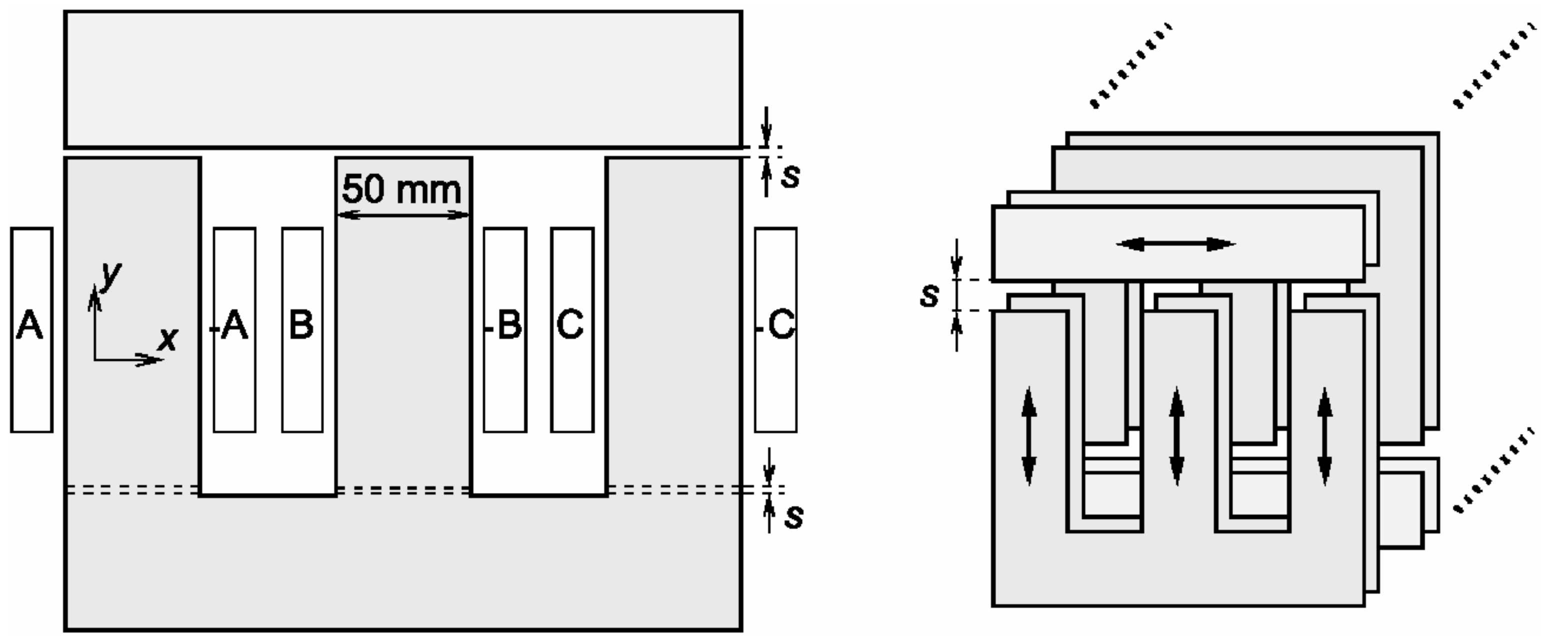
Three Phase Transformers

A three-phase transformer is made of three sets of primary and secondary windings, each set wound around one leg of an iron core assembly. Essentially it looks like three single-phase transformers sharing a joined core as in Figure below.



Three phase transformer core has three sets of windings.

Those sets of primary and secondary windings will be connected in either Δ or Y configurations to form a complete unit. The various combinations of ways that these windings can be connected together in will be the focus of this section.



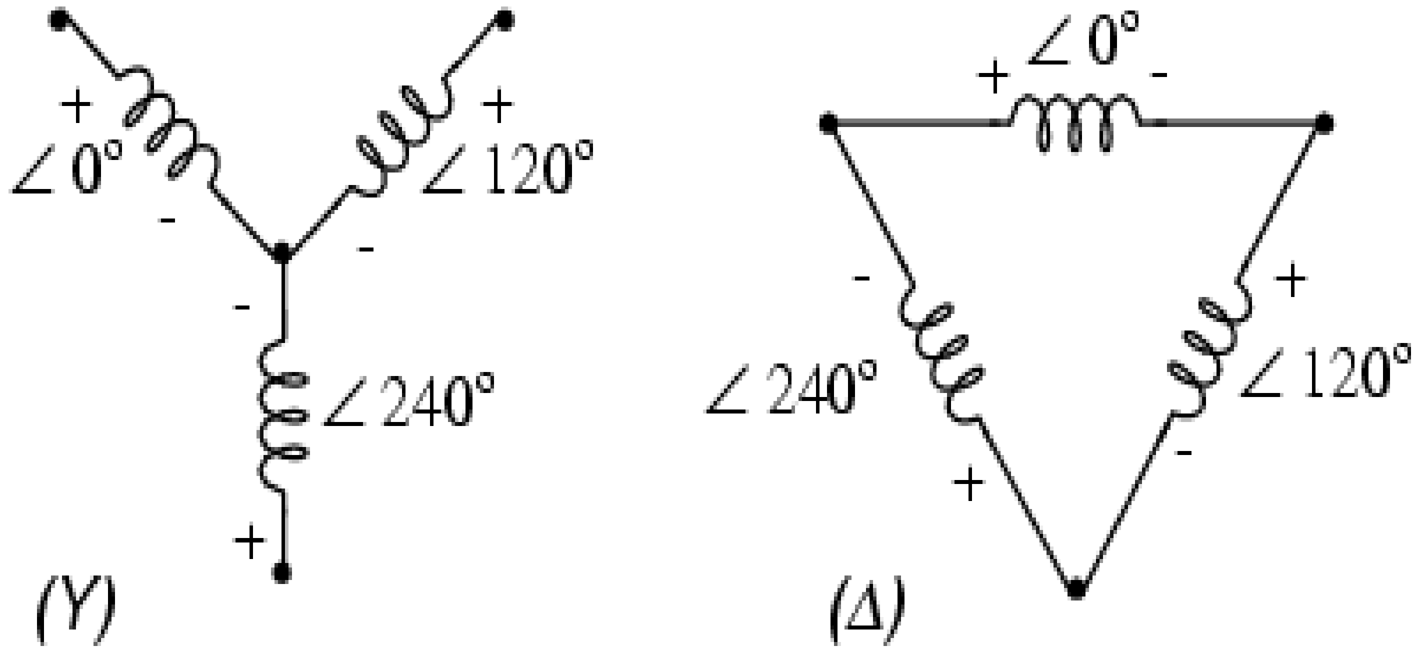
(a) cross-section of the core and the three primary windings

(b) alternate stacking of E- and I-sheets in pairs (rolling direction indicated)

Primary	-	Secondary
Y	-	Y
Y	-	Δ
Δ	-	Y
Δ	-	Δ

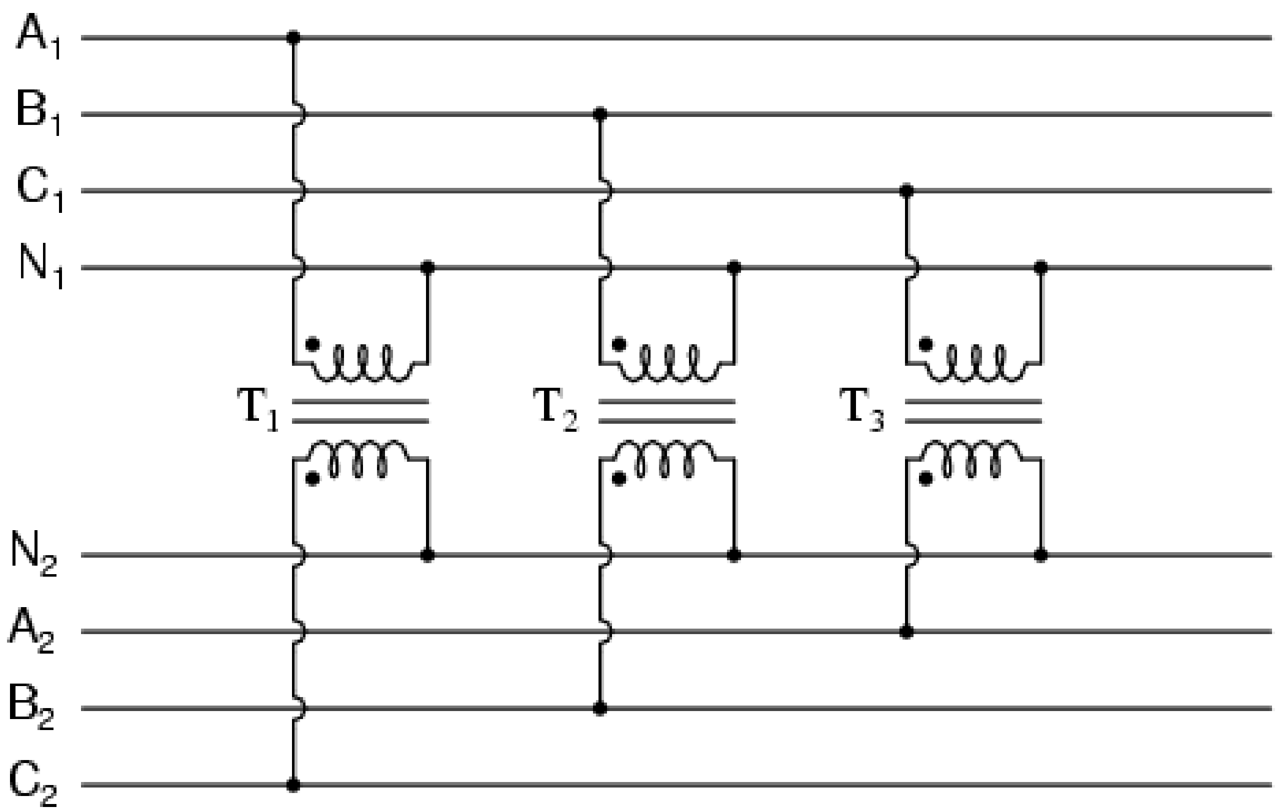
The reasons for choosing a Y or Δ configuration for transformer winding connections are the same as for any other three-phase application: Y connections provide the opportunity for multiple voltages, while Δ connections enjoy a higher level of reliability (if one winding fails open, the other two can still maintain full line voltages to the load).

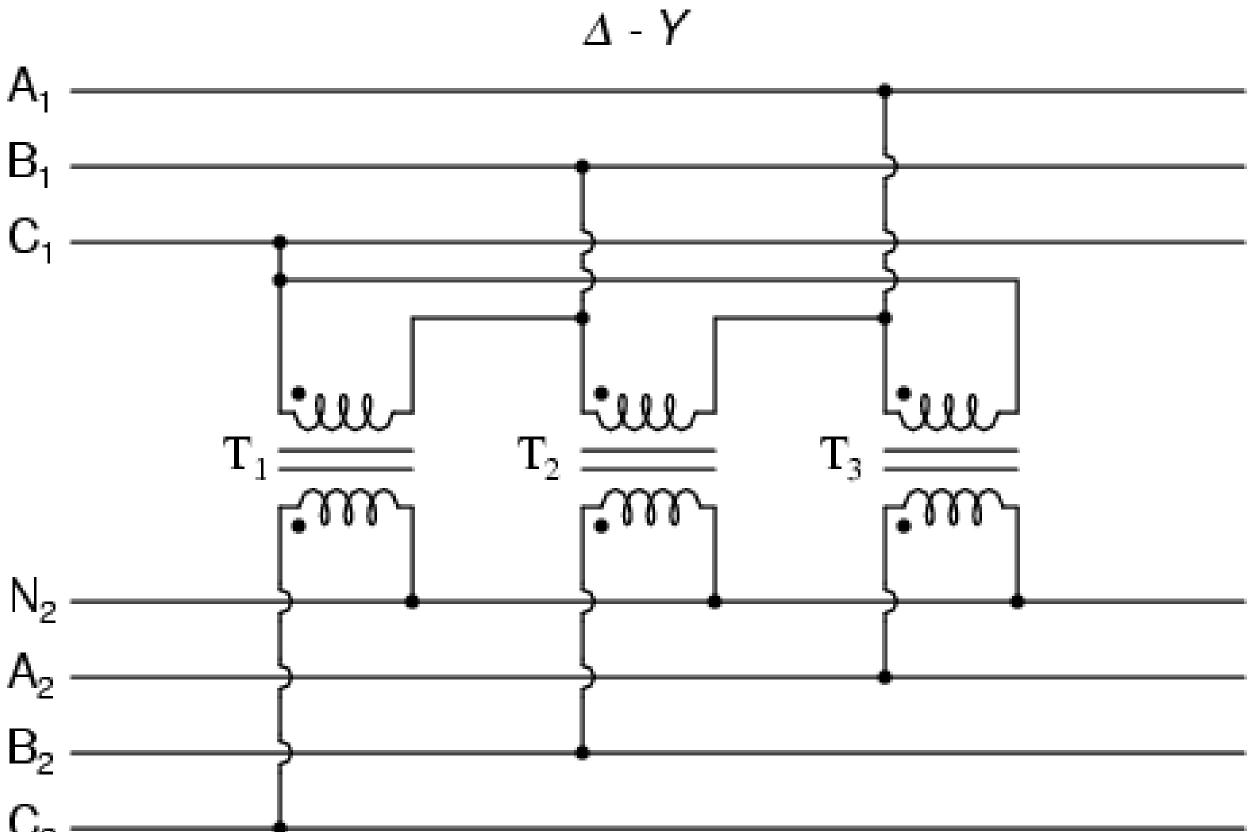
Probably the most important aspect of connecting three sets of primary and secondary windings together to form a three-phase transformer bank is paying attention to proper winding phasing (the dots used to denote “polarity” of windings). Remember the proper phase relationships between the phase windings of Δ and Y: (Figure below)



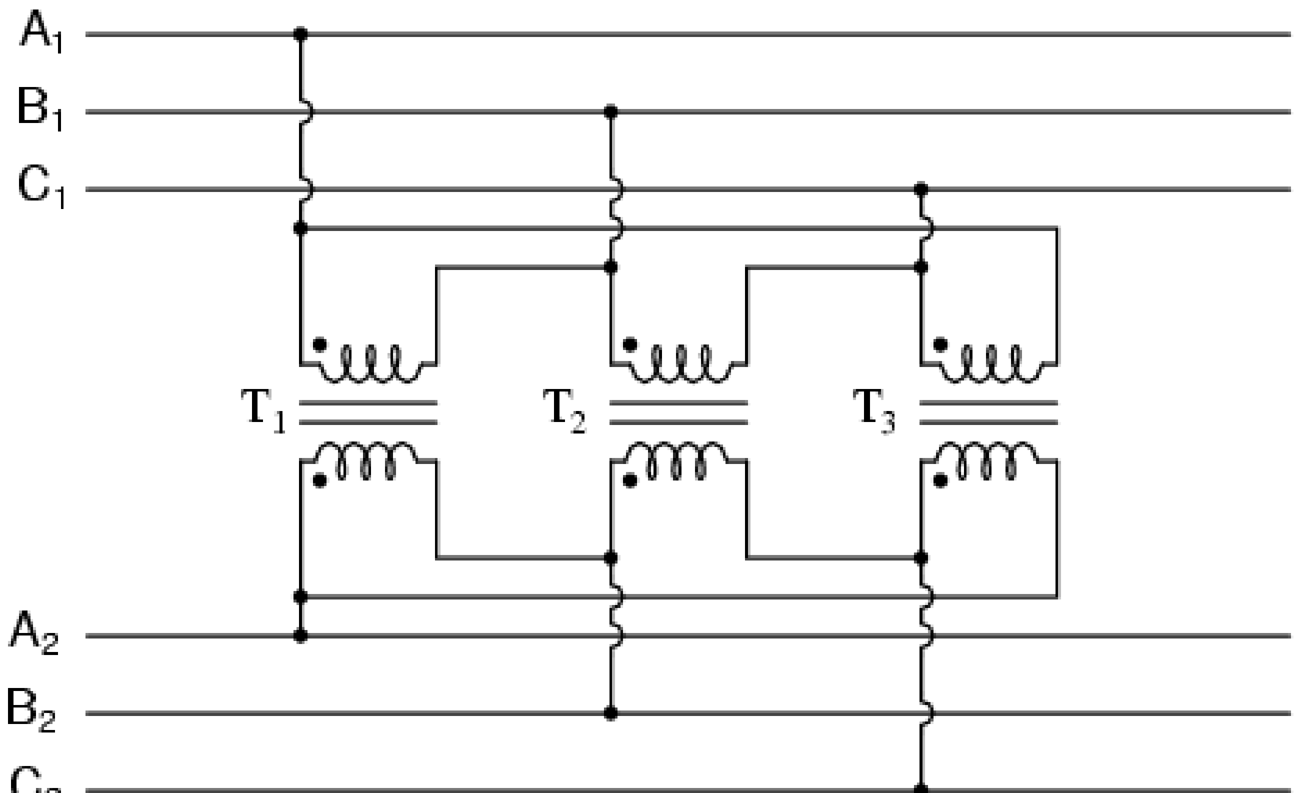
(Y) The center point of the "Y" must tie either all the "-" or all the "+" winding points together. (Δ) The winding polarities must stack together in a complementary manner (+ to -).

Y - Y

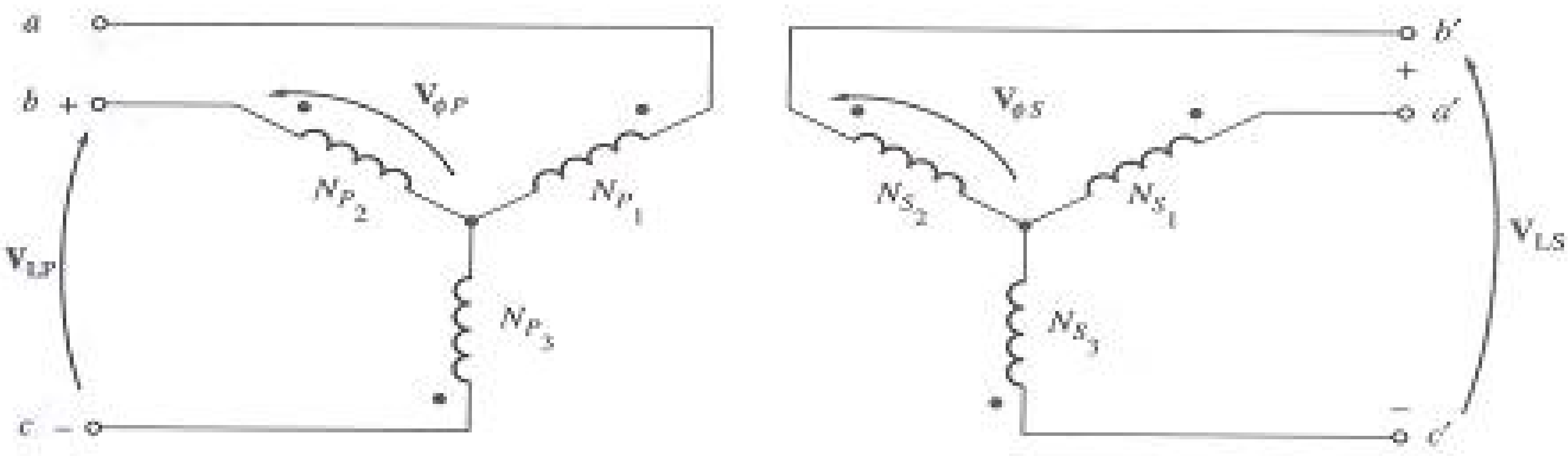



Δ - Y
A1
B1
C1
T1
T2
T3
N2
A2
B2
C2

Δ - Δ

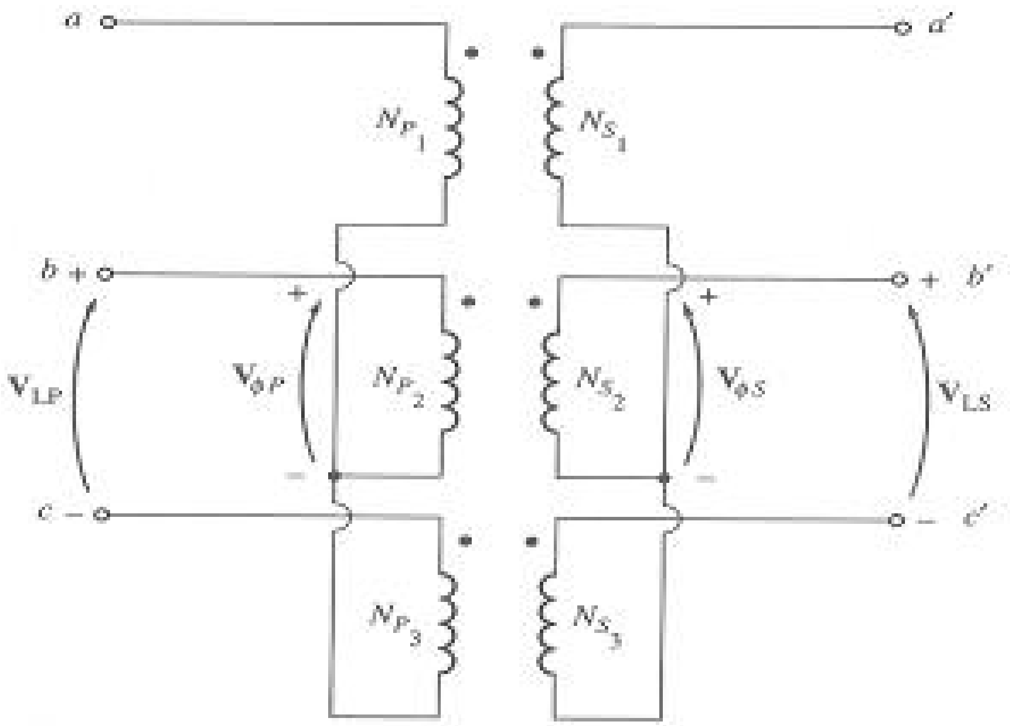


Connection Y-Y



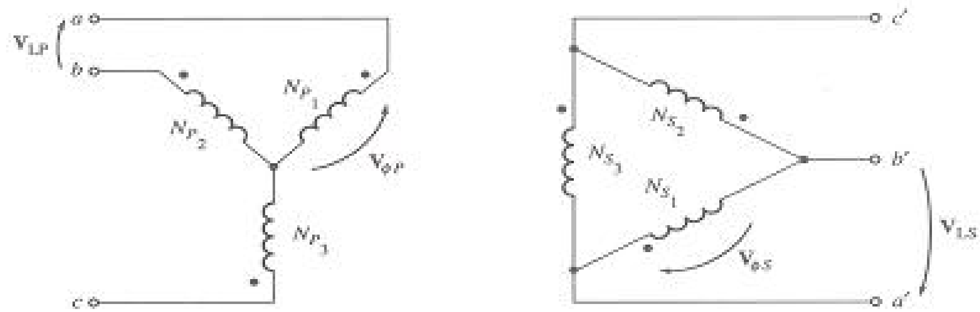
Three Phase transformer Y-Y connection

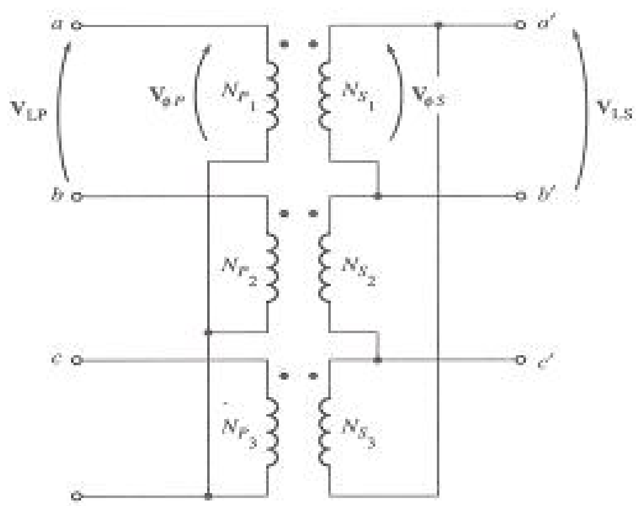
Transformer Connection Y-Y



$$\frac{V_{LP}}{V_{LS}} = \frac{\sqrt{3}V_{\phi P}}{\sqrt{3}V_{\phi S}} = a$$

Transformer Y-Δ Connection



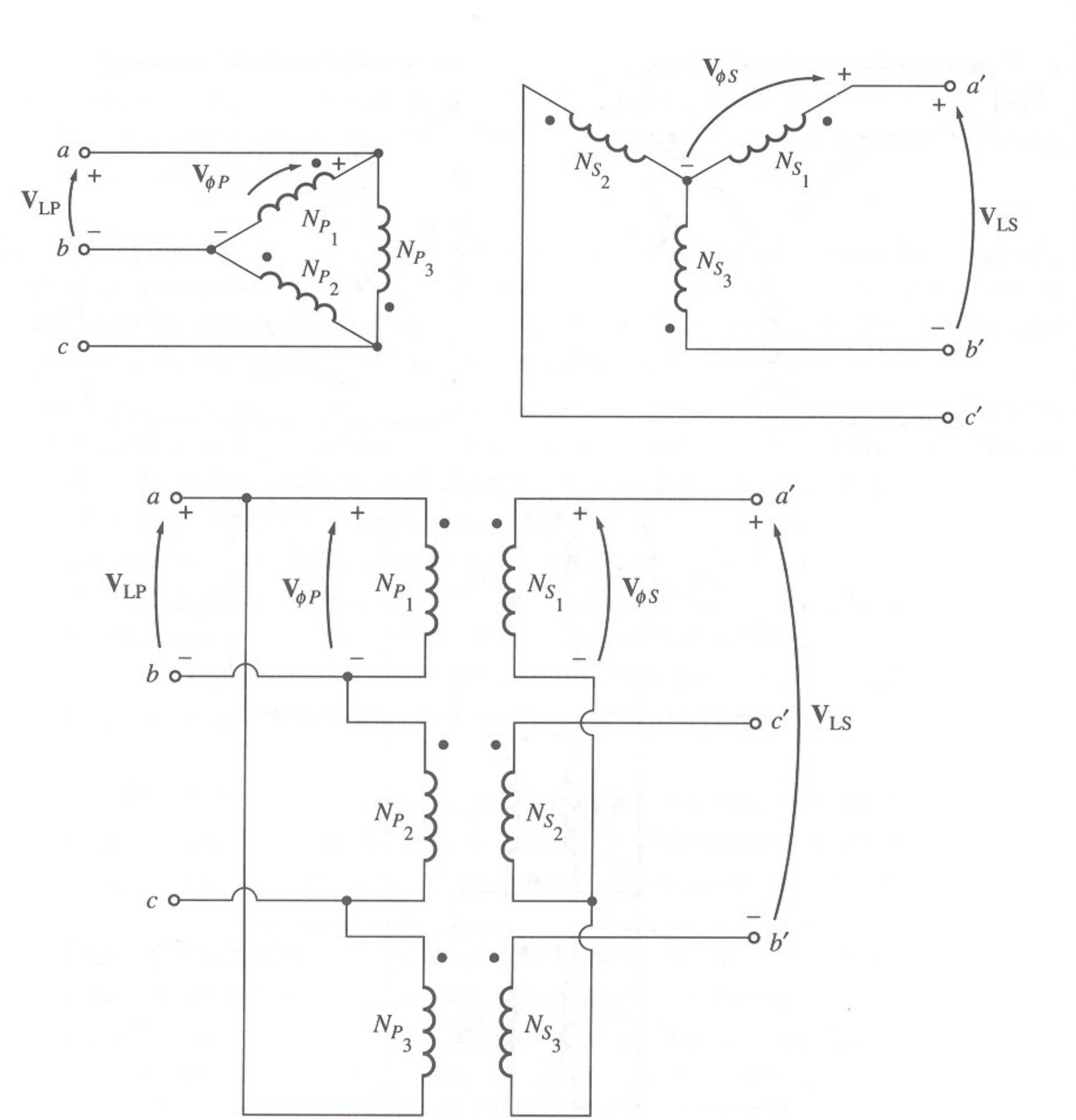


(b)

$$\frac{V_{LP}}{V_{LS}} = \frac{\sqrt{3}V_{\phi P}}{V_{\phi S}}$$

$$\frac{V_{LP}}{V_{LS}} = \sqrt{3}a$$

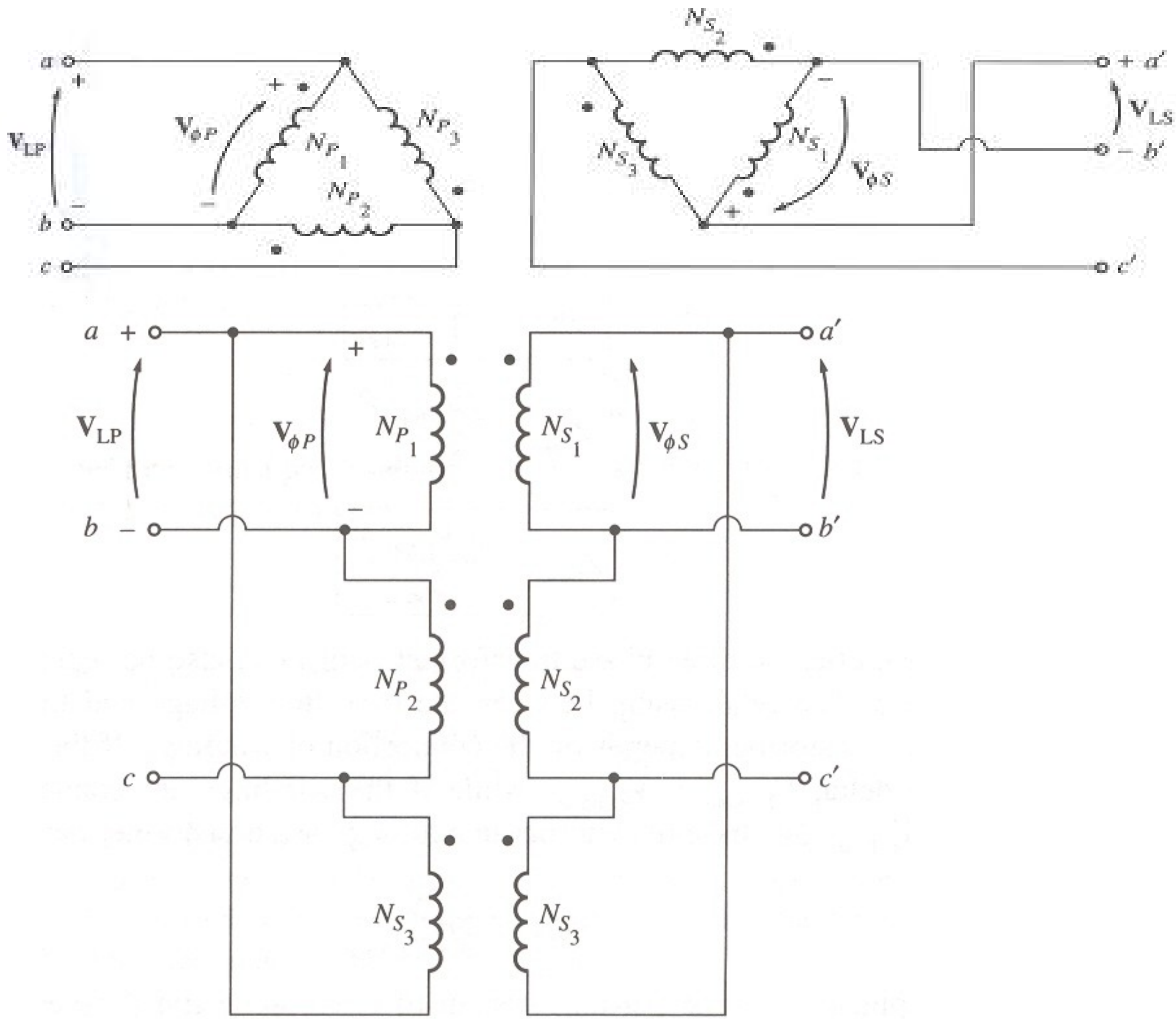
Transformer Δ-Y Connection



$$\frac{V_{LP}}{V_{LS}} = \frac{V_{\phi P}}{\sqrt{3} V_{\phi S}}$$

$$\frac{V_{LP}}{V_{LS}} = \frac{\sqrt{3}}{a}$$

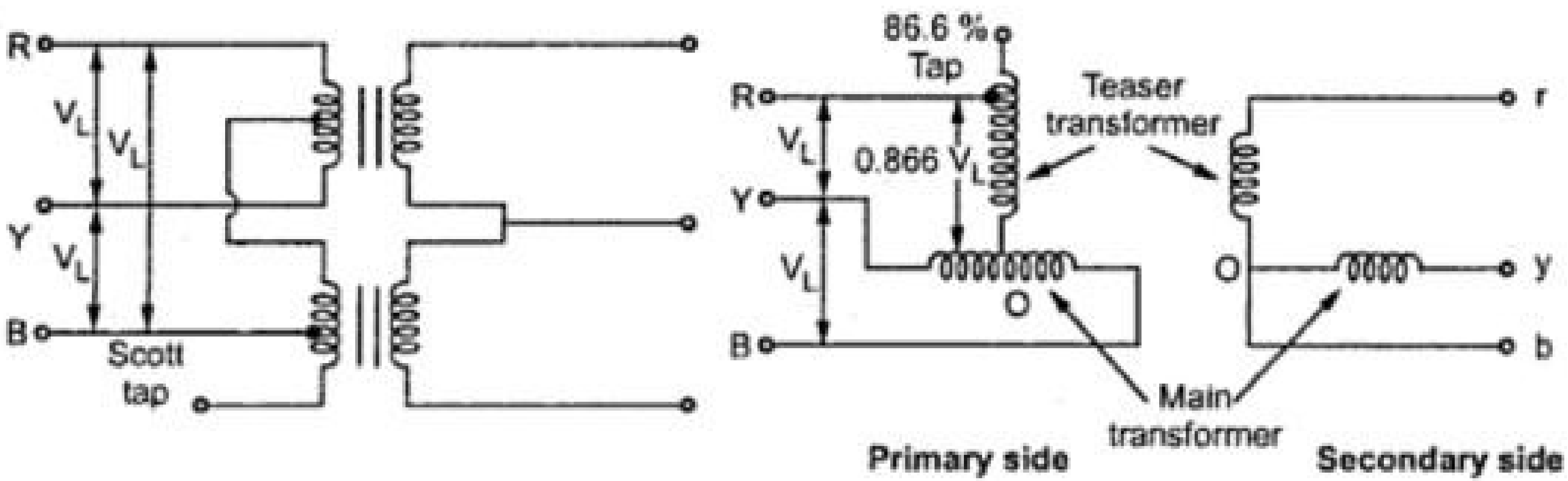
Transformer Δ-Δ Connection



$$\frac{V_{LP}}{V_{LS}} = \frac{V_{\phi P}}{V_{\phi S}} = a$$

SCOTT CONNECTION

With the help of Scott connection, proposed by C.F. Scott, it is possible to obtain 2phase supply which is required for furnaces or even three phase load can be driven from the available 2phase supply source.



Scott connection

SCOTT CONNECTION