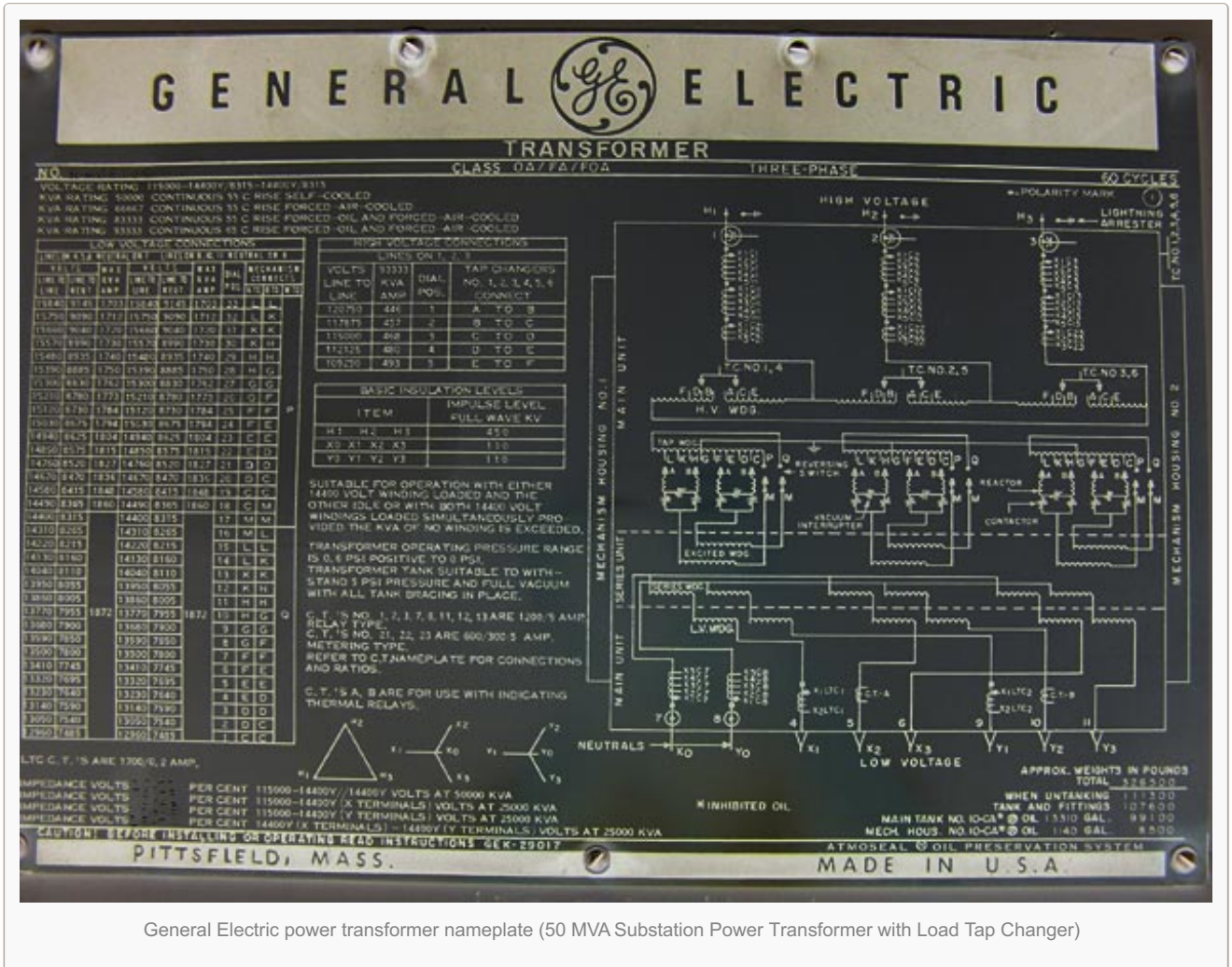


Star-Delta Transformer Connection Overview

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General Electric power transformer nameplate (50 MVA Substation Power Transformer with Load Tap Changer)

Star-Delta Connection Overview

In this type of [transformer connection](#), then primary is connected in star fashion while the secondary is connected in delta fashion as shown in the **Figure 1** below.

The voltages on the primary and secondary sides can be represented on the phasor diagram as shown in the **Figure 2** below.

Key points

1. As Primary in Star connected
2. Line voltage on Primary side = $\sqrt{3}$ X Phase voltage on Primary side. So
3. **Phase voltage** on Primary side = Line voltage on Primary side / $\sqrt{3}$
4. Now Transformation Ration (K) = Secondary Phase Voltage / Primary Phase Voltage
5. Secondary Phase Voltage = K X Primary Phase

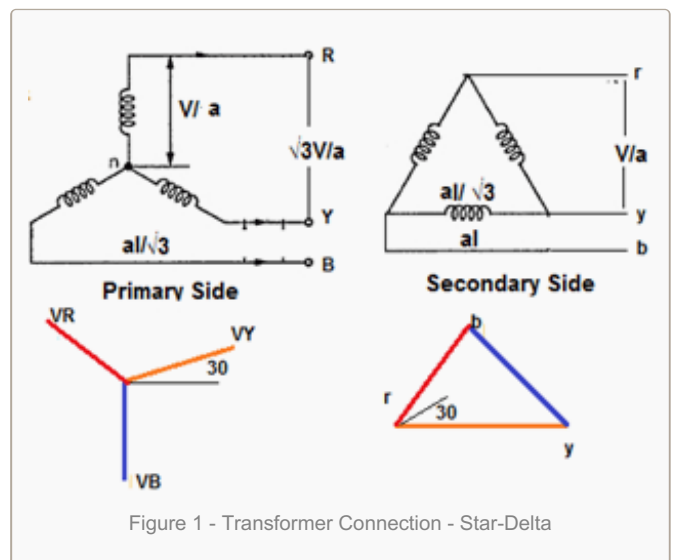
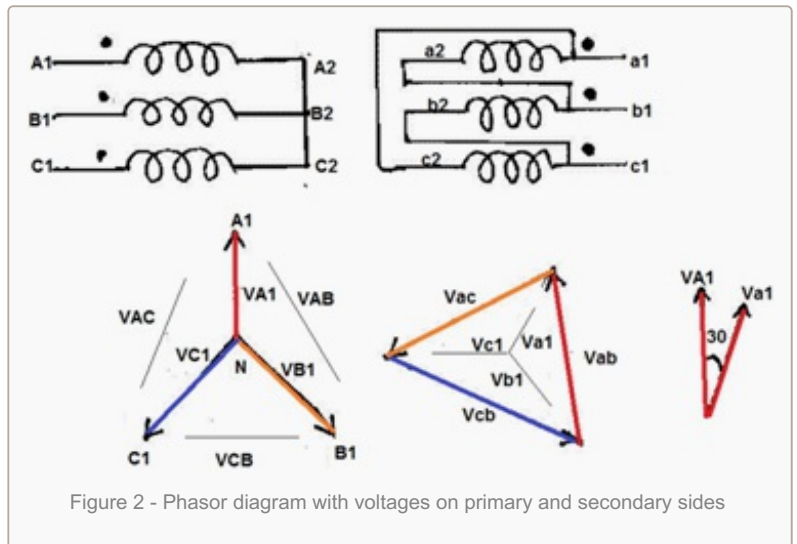


Figure 1 - Transformer Connection - Star-Delta

Voltage.

6. As Secondary in delta connected:
7. Line voltage on Secondary side = Phase voltage on Secondary side.
8. Secondary Phase Voltage = $K \times$ Primary Phase Voltage. $= K \times (\text{Line voltage on Primary side} / \sqrt{3})$
9. **Secondary Phase Voltage = $(K/\sqrt{3}) \times$ Line voltage on Primary side.**
10. **There is ± 30 Degree or -30 Degree Phase Shift between Secondary Phase Voltage to Primary Phase Voltage**

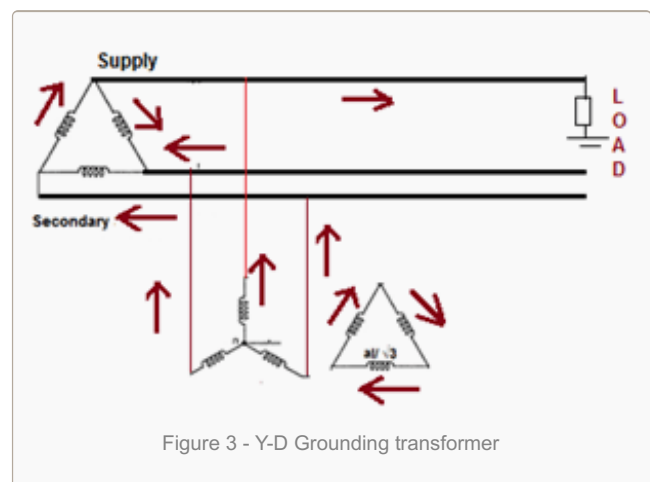


Advantages of Star Delta Connection

1. The primary side is star connected. Hence fewer numbers of turns are required. This makes the connection economical for large high voltage step down power transformers.
2. The neutral available on the primary can be earthed to avoid distortion.
3. The neutral point allows both types of loads (single phase or three phases) to be met.
4. Large unbalanced loads can be handled satisfactory.
5. The Y-D connection has no problem with third harmonic components due to circulating currents in D. It is also more stable to unbalanced loads since the D partially redistributes any imbalance that occurs.
6. The delta connected winding carries third harmonic current due to which potential of neutral point is stabilized. Some saving in cost of insulation is achieved if HV side is star connected. But in practice the HV side is normally connected in delta so that the three phase loads like motors and single phase loads like lighting loads can be supplied by LV side using three phase four wire system.
7. As Grounding Transformer: In Power System Mostly grounded Y- Δ transformer is used for no other purpose than to provide a good ground source in ungrounded Delta system. Take, for example, a distribution system supplied by Δ connected (i.e., ungrounded) power source.

If it is required to connect phase-to-ground loads to this system a grounding bank is connected to the system, as shown in **Figure 3** below:

8. This system a grounding bank is connected to the system, as shown in **Figure 3**. Note that the connected winding is not connected to any external circuit in **Figure 3**.
9. With a load current equal to 3 times i , each phase of the grounded Y winding provides the same current i , with the Δ -connected secondary winding of the grounding bank providing the ampere-turns required to cancel the ampere-turns of the primary winding. Note that the grounding bank does not supply any real power to the load; it is there merely to provide a ground path. All the power required by the load is supplied by two phases of the ungrounded supply.



Disadvantages of Star-Delta Connection

In this type of connection, the secondary voltage is not in phase with the primary. Hence it is not possible to operate this connection in parallel with star-star or delta-delta connected transformer.

One problem associated with this connection is that the secondary voltage is shifted by 30° with respect to the primary voltage. This can cause problems when paralleling 3-phase transformers since transformers secondary voltages must be in-phase to be paralleled. Therefore, we must pay attention to these shifts.

If secondary of this transformer should be paralleled with secondary of another transformer without phase shift, there would be a problem

Application

It is commonly employed for power supply transformers.

This type of connection is commonly employed at the substation end of the transmission line. The main use with this connection is to step down the voltage. The neutral available on the primary side is grounded. It can be seen that there is phase difference of 30° between primary and secondary line voltages.

Commonly used in a step-down transformer, Y connection on the HV side reduces insulation costs the neutral point on the HV side can be grounded, stable with respect to unbalanced loads. As for example, at the end of a transmission line. The neutral of the primary winding is earthed.

In this system, line voltage ratio is $1/\sqrt{3}$ Times of transformer turn-ratio and secondary voltage lags behind primary voltage by 30° . Also third harmonic currents flow in the to give a sinusoidal flux.

Source:

<http://electrical-engineering-portal.com/star-delta-transformer-connection-overview>