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Electrical Machines - I Sessional

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Lab Report 4 : Constructing of three phase transformer using three single phase transformers & observing line & phase voltage relation in primary and secondary windings.

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Constructing of three phase transformer using three single phase transformers & observing line & phase voltage relation in primary and secondary windings.

1 Introduction

Three phase transformer

To construct a three phase transformer, three single-phase transformers can be connected. Alternatively, a pre-assembled and balanced three-phase transformer consisting of three pairs of single-phase windings mounted onto a single laminated core can be used. This is also known as a 3-Φ transformer.

The primary and secondary windings of a transformer can be connected in different configuration to meet practically any requirement. In the case of three phase transformer windings, two forms of connection are: "Star" (wye) & "delta" (mesh).

The combinations of the three windings may be with the primary Δ-connected and the secondary Y-connected, or Y-Δ, Δ-Δ, Y-Y depending on the transformers use. When transformers are used to provide three or more phases they are generally referred to as a Polyphase Transformer.[1]
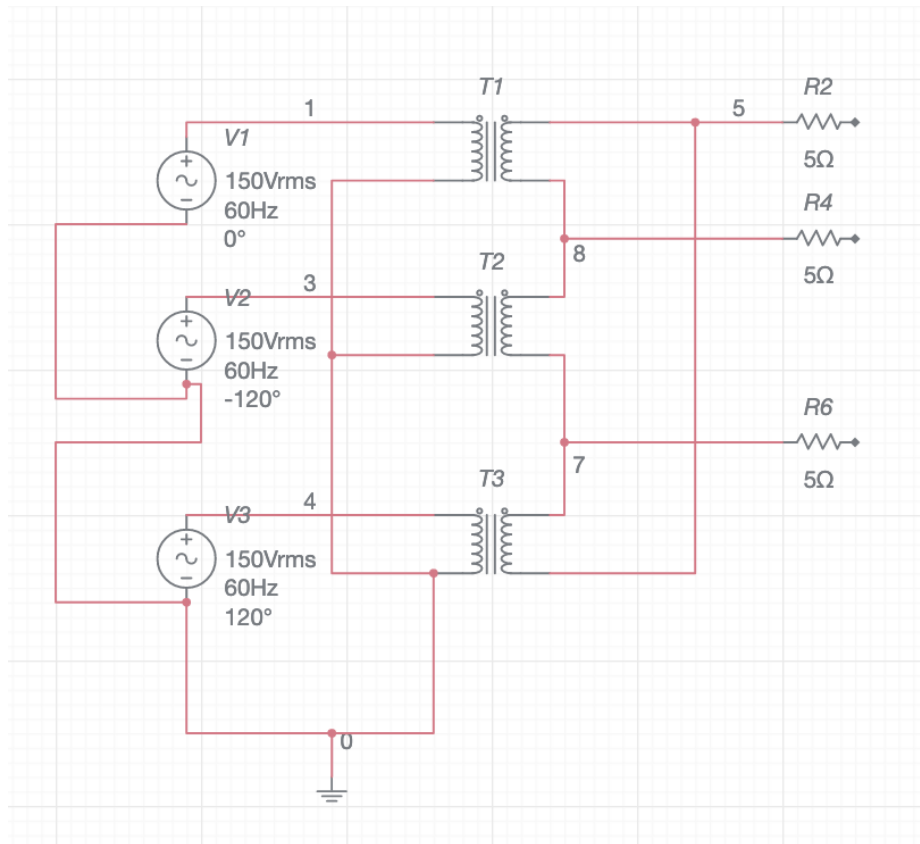
Circuit Diagrams

Figure 1: Circuit diagrams for Y-Δ three transformer connection.

2   Tools Used

- Single Phase Transformer (150V - 1A), 3 pieces
- Connecting wires
- Ammeter (0A - 5A)
- Voltmeter (0V - 120V)
- Wattmeter
- Three Phase AC supply (220V)
- Three phase Variac (0-250V)

3 Data & Calculation

3.1 Data Table:

Table 1: Y Connection

V_{an}	V_{bn}	V_{cn}	V_{AB}	V_{BC}	V_{CA}
100.8	100.7	101.5	175.8	176.8	177.4

Table 2: Δ Connection

V_{an}	V_{AB}
150.6	131.7

3.2 Calculation:

For Y-connection,
$$V_L = \sqrt{3}V_P$$

Line Voltage,
$$V_{an} = 100.8V$$

$\therefore$ Phase voltage,
$$V_{AB} = \sqrt{3} \times 100.8 = 174.59$$

Average Measured phase voltage,
$$V_{AB} = \frac{175.8 + 176.8 + 177.4}{3} = 176.67V$$

For Δ-connection,
$$V_L = V_P$$

Line voltage,
$$V_{an} = 100.7V$$

Measured phase voltage,
$$V_{AB} = 100.7V$$

4 Discussion

Just like three phase supply, in transformers, the relation persists. In wye connection, the line & phase voltages aren't the same but in delta connection, they are the same.

5 Conclusion

Since this experiment was done with AC supply, utmost caution was exercised to avoid any accident. Additionally, the line and phase current relation wasn't tested as it'd require precise and cautious connection. To avoid any dangers, only the voltage relation was done in this experiment.

References

[1] W. Storr, "Three Phase Transformer Connections and Basics," *Basic Electronics Tutorials*, Nov. 2023. [Online]. Available: https://www.electronics-tutorials.ws/transformer/three-phase-transformer.html