Heaven's Light is Our Guide

Rajshahi University of Engineering and Technology

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ECE 2208

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Electrical Machines - I Sessional

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Lab Report 3: Determining the regulation of a transformer when load is resistive.

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Determining the regulation of a transformer when load is resistive.

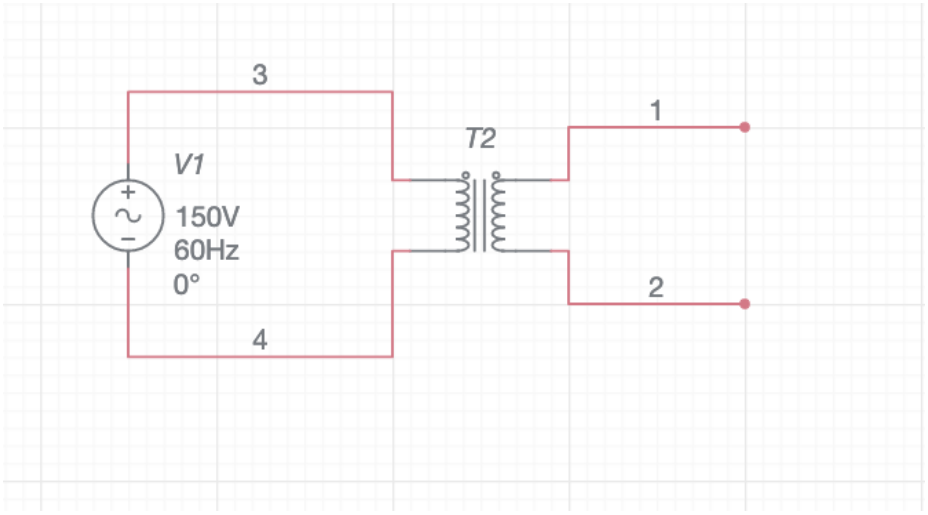
1 Introduction

Voltage regulation

Voltage regulation is the measure of how well a transformer can maintain a constant secondary voltage under varying load conditions, as the output secondary voltage may not be what we expect.

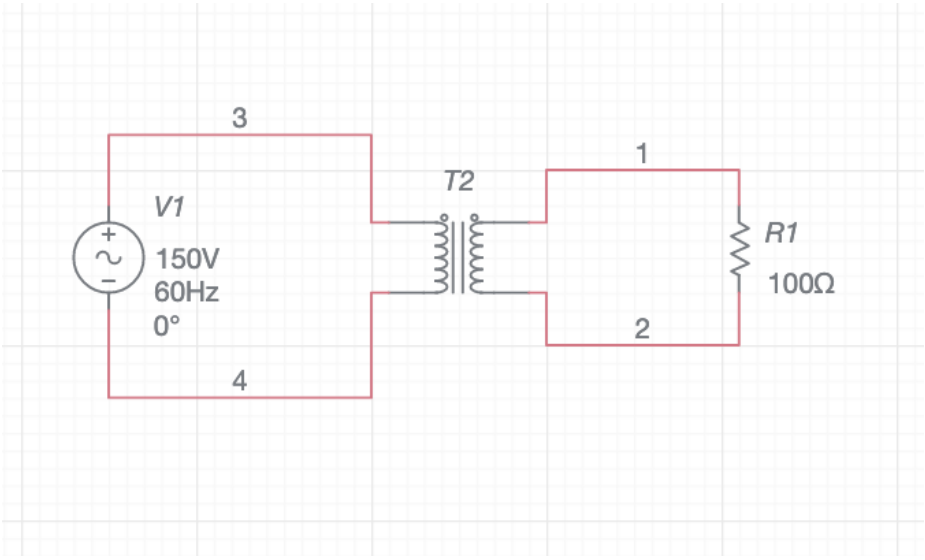
Voltage Regulation of single-phase transformers is the percentage (or per unit value) change in its secondary terminal voltage compared to its original no-load voltage under varying secondary load conditions.[1]

Circuit Diagrams



No load

Figure 1: Circuit diagram for Transformer voltage regulation test, for no-load condition.



Resistive load

Figure 2: Circuit diagram for Transformer voltage regulation test, for loaded condition.

2 Tools Used

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

3 Data & Calculation

3.1 Data Table:

Table 1: No Load

$\mathbf{V_P}$	$\mathbf{V_S}$	$\mathbf{I_P}$	$\mathbf{I_S}$	**W**
150.6	139.2	1.34	1.275	182.5

Table 2: Full Load

$\mathbf{V_P}$	$\mathbf{V_S}$	$\mathbf{I_P}$	$\mathbf{I_S}$	**W**
150.6	131.7	1.42	1.375	195

3.2 Calculation:

No Load Voltage,

$$V_{No-Load} = 139.2V$$

Full Load Voltage,

$$V_{Full-Load} = 131.7V$$

Voltage Regulation,

$$\begin{aligned} \%VR &= |\frac{\mathrm{V_{No\text{-}Load}} - \mathrm{V_{Full\text{-}Load}}}{\mathrm{V_{No\text{-}Load}}}| \times 100\% \\ &= |\frac{139.2 - 131.7}{131.7}| \times 100\% \\ &= 5.69\% \end{aligned}$$

3.3 Result

Voltage Regulation, $\%VR = 5.69\%$

4 Discussion

Voltage regulation controls how much the secondary terminal voltage inside the transformer varies due to changes in the connected load. If these losses are significant and the secondary voltage drops too low, the transformer's efficiency and performance are impacted.
When no load is attached to the transformer's secondary winding, there is no closed-loop situation, hence there is no output load current and the transformer behaves as a single winding with a high self-inductance.
Loading the secondary winding with a simple load causes a secondary current to flow, at any power factor(depending on the type of load, here resistive), through the internal winding of the transformer. Thus voltage drops due to the windings internal resistance and its leakage reactance causes the output terminal voltage to change.
So, whenever load is attached, full potential of the transformer can't be achieved, there will be some loss. Voltage regulation helps to determine that.

5 Conclusion

Since this experiment was done with AC supply, utmost caution was exercised to avoid any accident. To avoid electrocution, help from lab assistants was taken.

References

[1] W. Storr, "Transformer Voltage Regulation," *Basic Electronics Tutorials*, Jul. 2023. [Online]. Available: https://www.electronics-tutorials.ws/transformer/voltage-regulation.html