

# Power Circuit Theory - Lab Report 3

Alex Hiller - 11850637

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# Y-Neutral/Y-Neutral Transformer

## DC Resistance of the Windings

i++i

Explain the reasons for your position of the ammeter and the voltmeter.

i++i

$$V_1 = < ++ > \quad (1)$$

$$I_1 = V_2 = < ++ > \quad (2)$$

$$I_2 = < ++ > \quad (3)$$

$$R_1 = < ++ > \quad (4)$$

$$R_2 = < ++ > \quad (5)$$

## Measured Voltage and Current on the Primary Side of the Transformer

Primary Voltage:

$$|V'| = 4.53V \quad (6)$$

$$|I'| = 5.7A \quad (7)$$

## Calculate the Transformer's Parameters

$$Z_b = \frac{(V_{base})^2}{S_{base}} = \frac{(\sqrt{3} \times 240)^2}{4500} = < ++ > \Omega \quad (8)$$

$$R_0 = < ++ > (p.u.) \quad (9)$$

$$|Z_0| = \frac{|V_0|}{|I_0|} = \frac{|V'|}{|\frac{I'}{3}|} = < ++ > (p.u.) \quad (10)$$

$$X_0 = \sqrt{|Z_0|^2 - R_0^2} = < ++ > \quad (11)$$

## Measure the secondary neutral current with the Fluke clamp meter

$$|I''| = 10.02 A \text{ (rms)} \quad (12)$$

i++i

**Measure the voltage between the neutral points with DMM**

$$|V_{Nn}| = 3.9V \quad (13)$$

This measurement was oscillating a lot.

**Draw the zero sequence equivalent circuit of the transformer**

i++i

**Explain:**

i++i

# Y-Neutral to Y Transformer

**Predict  $|I_s|$**

+++

**Explain:**

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**If  $|I'| = 5.4\text{A}$ , expectations are that:**

$V'$  to be: +++

$Z_0$  to be: +++

The current in each primary winding to be: +++

Give explanations using Faraday's Law, Ampere's Law and the magnetic equivalent circuit. +++

**Measure voltage, current and power on the primary side of the transformer**

Primary Voltage:

$$|V'| = 16.95 \text{ V (rms)} \quad (14)$$

Primary Current:

$$|I'| = \frac{5.53}{3} = 1.843 \text{ A (rms)} \quad (15)$$

Primary Power:

$$P' = 21 \text{ W} \quad (16)$$

Secondary Winding Current:

$$|I_s| = 0.4 \text{ A (rms)} \quad (17)$$

**Calculate the transformer's parameters (referred to the primary)**

$$\frac{1}{3}R_0 = \frac{P'}{|I'|^2} = < ++ > \text{ (p.u.)} \quad (18)$$

Comparing  $R_0$  with that measured in part 1: +++

$$|Z_0| = \frac{|V_0|}{|I_0|} = \frac{|V|}{|\frac{I'}{3}|} = < ++ > \text{ (p.u.)} \quad (19)$$

$$X_0 = \sqrt{|Z_0|^2 - R_0^2} = < ++ > \text{ (p.u.)} \quad (20)$$

**Draw the zero sequence equivalent circuit of the transformer**

+++

**Explain**

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**Clamp meter measurements of each primary winding**

$$|I'_A| = 1.70 \text{ A} \quad (21)$$

$$|I'_B| = 1.74 \text{ A} \quad (22)$$

$$|I'_C| = 1.59 \text{ A} \quad (23)$$

**The measurements are slightly unequal this is because:**

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**With secondary terminals open-circuited and  $|I'| = 5.4 \text{ A}$**

**Primary voltage measured was:**

$$|V'| = 16.94 \text{ V (rms)} \quad (24)$$

**Calculated zero sequence impedance is:**

$$|Z_0| = < ++ > \text{ (p.u.)} \quad (25)$$

**Draw the zero sequence equivalent circuit of the transformer**

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**Explain**

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**Comparing the transformer's parameters with the zero sequence impedance**

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