Rajshahi University of Engineering & Technology

Department of Electrical & Computer Engineering

Lab Report

Experiment No: 02

Name of the experiment:

Study the relationship between phase current and line current of delta connected 3 phase balanced system.

Course Code	ECE 1202
Course Title	Circuits & Systems-II Sessional
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Experiment No. 02

Name of the Experiment: Study the relationship between phase current and line current of delta connected 3 phase balanced system.

Objective: To verify the relationship between phase current and line current in a balanced three-phase system connected in a delta (Δ) configuration.

Theory:

In a balanced three-phase delta-connected system, the phase currents are the currents flowing through each phase of the load, and the line currents are the currents flowing in each of the lines connecting the power source to the load.

For a delta-connected system:

- **Phase Current (I_P):** The current flowing through each phase of the load.

- **Line Current (I_L):** The current flowing through each line of the system.

The relationship between the line current and phase current in a delta-connected system is given by: $I_L = \sqrt{3} \, I_P$, $V_L = V_P$

Required Apparatus:

1. Ammeter
2. Multimeter
3. Source
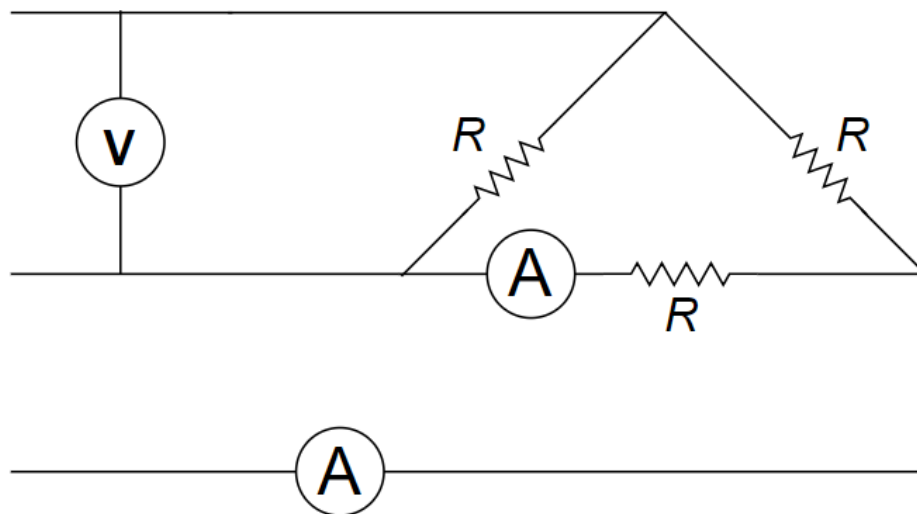4. Connecting Wires
5. Resistors

Circuit Diagram:

Fig 2.1 *delta-connected three-phase system*

Data Table:

Sl.	I_L	$I_{P (m)}$	$I_{P (c)}$	V_P	V_L	Error, $e = \left| \dfrac{I_{P_{(c)}} - I_{P_{(m)}}}{I_{P_{(c)}}} \right| \times 100\%$
1	2.83	1.66	1.63	50	50	1.84%
2	2.40	1.37	1.39	44	43	1.44%
3	1.78	1.04	1.03	31.95	31.6	0.97%

Data Table from Lab experiment:

Calculations & Results:

In delta connection, $I_L = \sqrt{3}\, I_P \ \Rightarrow \ I_P = \dfrac{I_L}{\sqrt{3}}$

For trial 1,

$$I_{P(c)} = \frac{I_L}{\sqrt{3}} = \frac{2.83}{\sqrt{3}} = 1.63 \ A$$

$$\text{error} = \left| \frac{I_{P_{(c)}} - I_{P_{(m)}}}{I_{P_{(c)}}} \right| \times 100\% = \left| \frac{1.63 - 1.66}{1.63} \right| \times 100\% = 1.84\%$$

For trial 2,

$$I_{P(c)} = \frac{I_L}{\sqrt{3}} = \frac{2.40}{\sqrt{3}} = 1.39 \ A$$

$$\text{error} = \left| \frac{I_{P_{(c)}} - I_{P_{(m)}}}{I_{P_{(c)}}} \right| \times 100\% = \left| \frac{1.39 - 1.37}{1.39} \right| \times 100\% = 1.44\%$$

For trial 3,

$$I_{P(c)} = \frac{I_L}{\sqrt{3}} = \frac{1.78}{\sqrt{3}} = 1.03\ A$$

$$\text{error} = \left| \frac{I_{P(c)} - I_{P(m)}}{I_{P(c)}} \right| \times 100\% = \left| \frac{1.03 - 1.04}{1.03} \right| \times 100\% = 0.97\%$$

$$\text{Average error} = \frac{1.84 + 1.44 + 0.97}{3} = 1.42\ \%$$

There are slight errors in the measurement of phase Currents due to factors such as instrument precision, connection stability, or minor variations in the load.

Discussion:

This experiment confirmed the theoretical relationship between phase and line currents in a delta-connected three-phase balanced system, where the line current was √3 times the phase current. This relationship is crucial for the analysis and design of balanced three-phase power systems.

Precautions:

1. All connections were securely fastened and insulated to prevent short circuits or electric shocks.

2. High accuracy and minimal errors were ensured by using properly calibrated instruments.

Reference:

1. Alexander, Charles K. and Matthew N. O. Sadiku, Fundamentals of Electric Circuits:

   a. Chapter 12

2. Wikipedia