Rajshahi University of Engineering and Technology

Course Title: Circuits & Systems –II Sessional

Course code: 1202
Exp. No: 02
Exp. Date: 04.06.2024
Submission Date: 09.09.2024

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Experiment Name: Study the Relationship Between Phase Current and Line Current of a Delta-Connected 3-Phase Balanced System.

Objectives: The objective of this experiment is to study the relationship between the phase current (Ip) and the line current (I_L) of a delta-connected 3-phase balanced system.

Theory: A balanced delta-delta system is one in which both the balance source and balanced load are delta connected. Delta or Mesh Connection (Δ) System is also known as Three Phase Three Wire System (3-Phase 3 Wire) and it is the most preferred system for AC power transmission while for distribution, Star connection is generally used.

In Delta (also denoted by Δ) system of interconnection, the starting ends of the three phases or coils are connected to the finishing ends of the coil. Or the starting end of the first coil is connected to the finishing end of the second coil and so on (for all three coils) and it looks like a closed mesh. in Delta Connection, the voltage between (any pair of) two lines is equal to the phase voltage of the phase winding which is connected between two lines. Since the delta configuration forms a closed loop, it does not require a neutral wire for balanced loads.
For a delta-connected 3-phase system:

$V_L = V_P$

The line current (I_L) is equal to the phase current (I_P) in a balanced Delta connection:

$I_L = \sqrt{3}\, I_P$

Required Apparatus:

- Three-phase AC power supply
- Resistive load
- Ammeter
- Connecting wires
- Multimeter

Circuit Diagram:

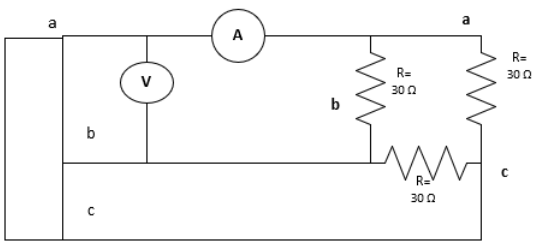
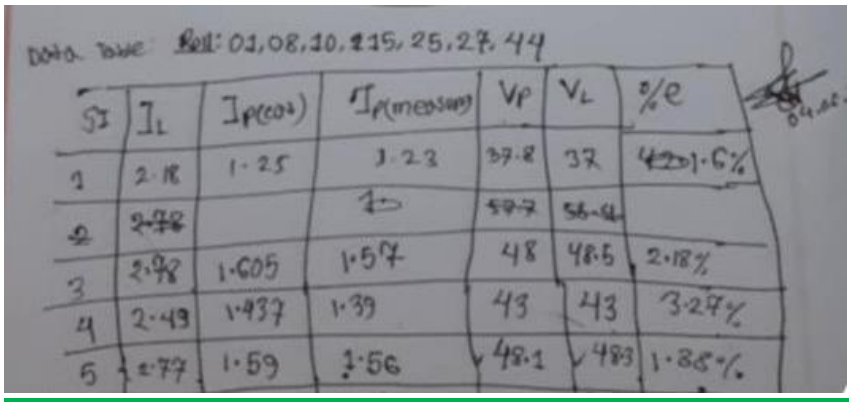


Fig. Three phase Delta-Delta connect balanced system.

Data Table:

SI No	I_L (A)	Ip (Calculated) (A)	Ip (Measured) (A)	V_P (V)	V_L (V)	% Error
1	2.18	1.25	1.23	37.8	37	1.6%
2	2.78	1.60	1.57	57.7	58.4	1.87%
3	2.43	1.40	1.39	48	48.6	0.71%
4	2.43	1.40	1.37	43	43.3	2.14%
5	2.47	1.43	1.41	43.1	47.3	1.40%
6	3.32	1.91	1.88	59	59.1	1.57%

Data Table from Lab Experiment:



Calculation:

For 1st calculation,

I_L=2.18 A, $I_P(Cal) = \frac{I_L}{\sqrt{3}}$ = 1.25 A, I_P(m) =1.23 A,

Error=$\left|\frac{\text{Ip (m)}}{\text{Ip (m)}} - I_{P(cal)}\right|$ = 1.6%

For 2nd calculation,

I_L=2.78 A, $I_P(Cal) = \frac{I_L}{\sqrt{3}}$ = 1.60 A, I_P(m) =1.57 A,

Error=$\left|\frac{\text{Ip (m)}}{\text{Ip (m)}} - I_{P(cal)}\right|$ = 1.87%

Discussion: In this experiment, we have measured the line currents and phase currents. Then we calculated the phase currents by using the formula of ($I_L = \sqrt{3}\ I_P$). The phase currents from calculated and measured are almost the same. But this result has some errors. This error is caused for not using multimeter properly. If we neglect the error, this result confirms that the relation between phase currents and line currents is ($I_L = \sqrt{3}\ I_P$). We have also measured the line voltage and the phase voltage. In theoretically, we know that the line and phase voltage are same in a balanced delta-delta connection. The result also proved that.

References

Delta Connection (Δ): 3 Phase Power, Voltage & Current Values. (n.d.). Retrieved from Electrical Technology: https://www.electricaltechnology.org/2014/09/delta-connection-power-voltage-current.html

Christopher, K., & Sadike, M. N. (n.d.). *Fundamentals of Electric Circuits.* New York: McGRAW-

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