

ANADOLU UNIVERSITY
DEPARTMENT OF
ELECTRICAL AND ELECTRONICS ENGINEERING

EEM 311 Principles of Energy Conversion Laboratory

Fall, 2014-2015

Experiment 1 : Three-phase Circuits



Purpose :

The purpose of this experiment is to study three-phase circuits, measure and analytically verify three-phase circuit parameters.

Procedure:

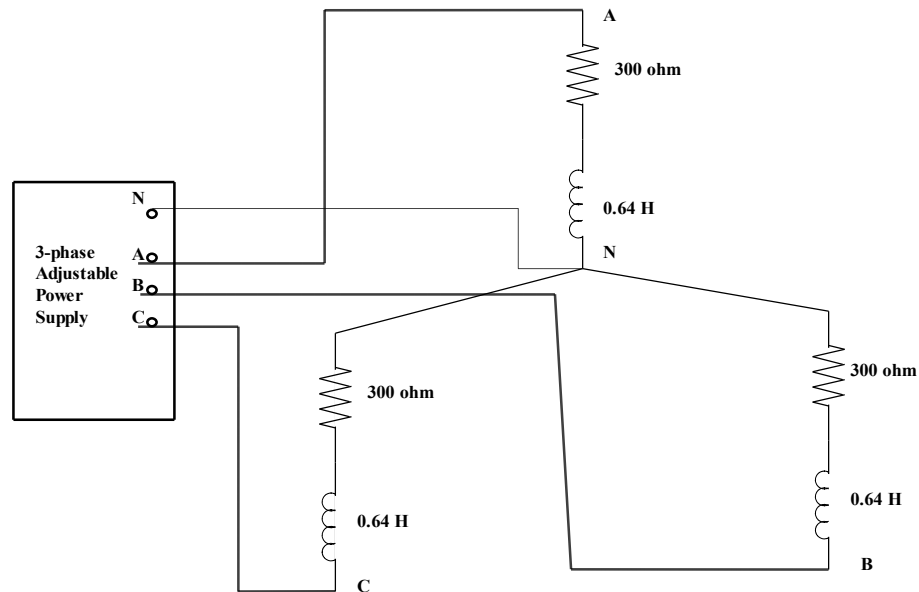


Figure 1.

Equipment List :

1	DL 1013M2	Power Supply
1	DL 1031	Digital Power Measuring Unit
1	DL 1017R	Resistive load bank
1	DL 1017L	Inductive load bank
1	Wavetek	Hand Multimeter (if needed)

Position	DL 1017R Resistive load bank	DL 1017L Inductive load bank
1	1050 Ω	4.46 H
2	750 Ω	3.19 H
3	435 Ω	1.84 H
4	300 Ω	1.27 H
5	213 Ω	0.90 H
6	150 Ω	0.64 H
7	123 Ω	0.52 H



Experimental Work :

Part A:

Experiment starts with a Y connected load which consists of a resistor and an inductor. On the resistive load bank you should set each resistor to position 4 at which each resistor becomes 300 ohms. Similarly, on the inductive load bank set each inductor to position 6 at which each inductor becomes 0.64 H.

- 1- Connect the load bank in Y.
- 2- Connect all required instrumentation to measure the 3-phase power, all line currents, and applied voltage.
- 3- Using the adjustable source, increase the applied voltage to 380V. At this voltage level, observe and record all instrumentation readings.

Line Voltages		Line Currents		Power	
V_{12}		I_1		W_{a10}	
V_{23}		I_2		W_{b10}	
V_{31}		I_3		$\sum W_{10}$	

Part B:

- 1- In this part of the experiment, connect the load in Δ . Also connect all instruments required to measure 3-phase power, all line currents and applied voltage.
- 2- Using adjustable source, increase the applied voltage to 220V. At this voltage level, observe and record all instrumentation readings.
- 3- Make necessary connections to measure the current of only one of the phase. Observe and record phase current that you measured.

Line Voltages		Line Currents		Power	
V_{12}		I_1		W_{a10}	
V_{23}		I_2		W_{b10}	
V_{31}		I_3		$\sum W_{10}$	

Part C:

In part C, again a Y connected load which consists of a resistor and an inductor will be used. But this time, the resistive load bank and the inductive load bank positions should be arranged differently for each group by the teaching assistant. Please note the position and the values of the load banks over the table that you record your data.

- 1- Connect the load bank in Y.
- 2- Connect all required instrumentation to measure the 3-phase power, all line currents, and applied voltage.



- 3- Using the adjustable source, increase the applied voltage to 380V. At this voltage level, observe and record all instrumentation readings.

DL 1017R Resistive load bank is at position ____ . ____ Ω

DL 1017L Inductive load bank is at position ____ . ____ H

Line Voltages		Line Currents		Power	
V_{12}		I_1		W_{a10}	
V_{23}		I_2		W_{b10}	
V_{31}		I_3		ΣW_{10}	

Questions:

- 1- In the part A of the experiment, you used 2-wattmeter method to measure the 3-phase power. Analytically verify that the power you measured is correct provided that the applied voltage and line currents are all measured in the laboratory.
- 2- From the data you obtained in Part A, calculate the load power factor using the relationship between the apparent power and active power.
- 3- In the part B of the experiment, you measured line currents and one of the phase current. Providing all line currents are the same, compare line current with the phase current you measured. What is the linear relation between them? Also analytically verify this relation.
- 4- From the data you obtained in Part B, calculate the load power factor using the relationship between the apparent power and active power.
- 5- In the part C of the experiment, again you used 2-wattmeter method to measure the 3-phase power. Analytically verify that the power you measured is correct provided that the applied voltage and line currents are all measured in the laboratory.
- 6- From the data you obtained in Part C, calculate the load power factor using the relationship between the apparent power and active power.

Remember: Each student has to prepare their own conclusion part including their solutions to the problems in the 'Questions' part of this document.

Report Preparation:

- 1- Your laboratory reports must be typed.
- 2- Briefly explain the purpose of the experiment and the procedure.
- 3- Provide measurement results in the form of tables or whenever needed, in the form of curves, etc.
- 4- If your lab handout includes some questions for you to answer in your reports, provide answers to those questions. If you use any references to answer those questions please refer them.
- 5- Each student must provide their individual conclusion part stating what they have learned from the lab assignment. A separate page for every student attached at the last of the report is preferred.

