EEE 270 (Electrical Drives & Instrumentation Sessional)

Experiment No. :- 01

Name of Experiment:

Verification of three phase voltage and current relations by balanced resistive load.

Group No. : 03

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Section : A1.

Department: CSE

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Date of Performance: 03-03-2020

Date of Submission: 10-03-2020

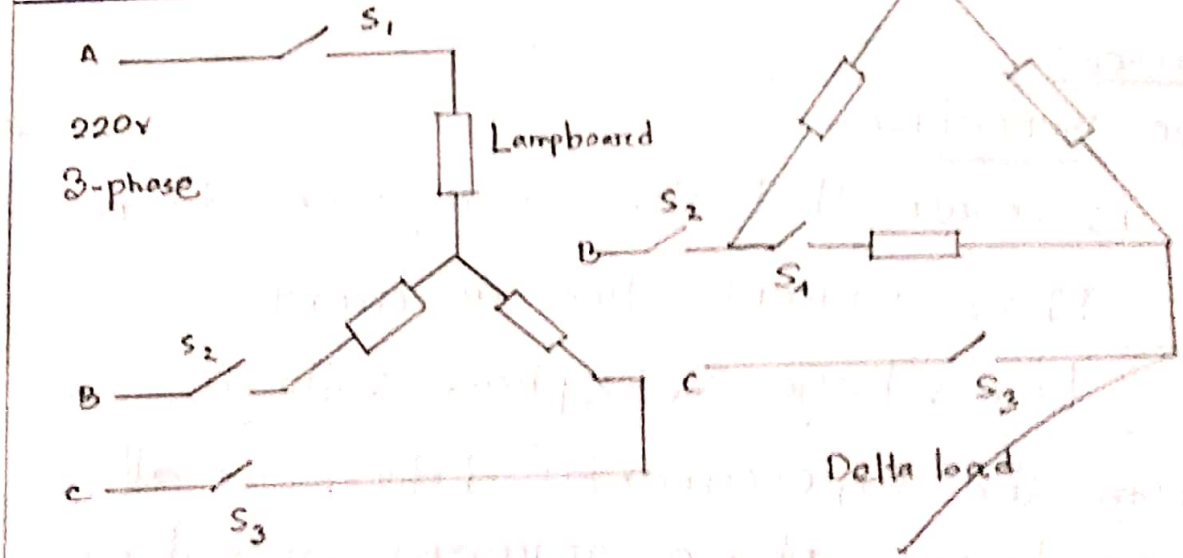
Objective

The experiment deal with the relationship between phase voltage and line voltage as well as line ~~vol~~ current and line phase current of two different types of connections - coye(Y) and delta(Δ) connections.

Equipments:

1. One AC voltmeter (0-150-300V)
2. One AC ammeter (0-5A)
3. Three lampboards (each containing at least 3 lamps) [All of them are identical]
4.

Circuit Diagram:



Experimental Data:

Connections	No. of Lamps	Line voltage(V)	Phase voltage(V)	Line Current(A)	Phase Current(A)
Wye	1.	227.5	133.8	0.3	0.3
	2.	228	134.4	0.5	0.5
	3.	229.7	135	0.7	0.7
Delta	1.	228.8	228.8	0.1	0.1
	2.	230.6	230.6	0.6	0.2
	3.	231.8	231.8	1.2	0.6

Report:

(Question & Answers)

① Show that the voltage and the current relations for wye and delta connections are verified

Answers:

Wye Connection –

It is known that for wye connection –

Phase current = line current

Line voltage = $\sqrt{3}$ × phase voltage

From the experimental data, for all three lamps phase current and line current are equal.

Again, using 1 lamp, the line voltage ~~is~~ and phase voltage are 227.5V and 133.8V respectively.

So, theoritically line voltage should be $\sqrt{3} \times 133.8V = 231.75V$ which may not be exactly same as the line voltage that is taken from the data. But it is pretty close. Same goes while using 2 and 3 lamps.

Hence both the voltage and current relationship for wye connection is satisfied.

Delta (Δ) Connection -

It is known that for delta connection -

Line voltage = phase voltage

line current = $\sqrt{3}$ x phase current

From the experimental data, it can be said that line and phase voltage are equal for delta connection. Hence it follows the ~~current~~ voltage relationship of delta connection

Now for delta connection using 3 lamps the value of phase current is 0.6A. So theoritically, the line current should be $0.6 \times \sqrt{3}\ A = 1.04\ A$

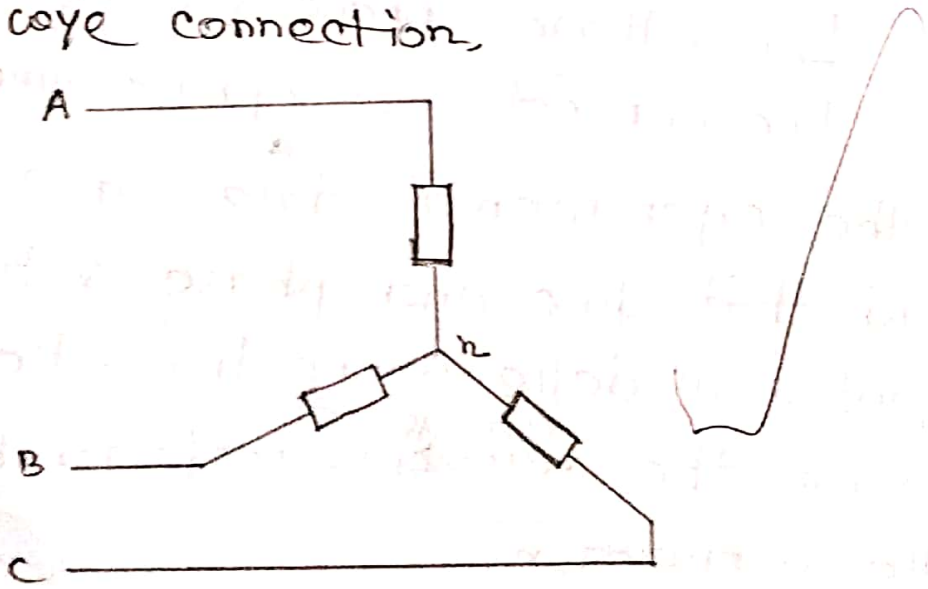
That value is slightly different from what is taken from the experimental data.

So, it follow the current relation-ship too.

(2) Draw the vector diagram for each set of reading for wye and delta connection and clearly lebel the voltage and the current vectors.

Answer:

For wye connection,



Here,

V_{nA}, V_{nB} and V_{nc} are phase voltages and V_{AB}, V_{BC} and V_{CA} are line voltages.

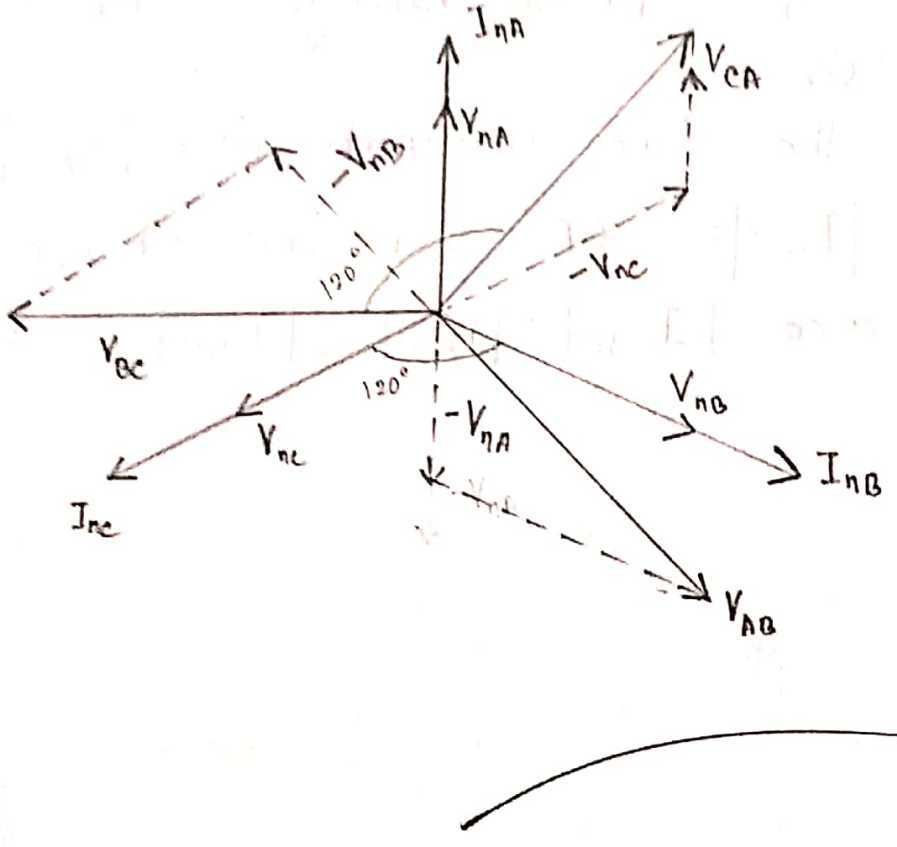
As balanced resistive load is used $|V_{nA}| = |V_{nB}| = |V_{nc}|$ and $|V_{AB}| = |V_{BC}| = |V_{CA}|$.

Now, for 3 lamps,

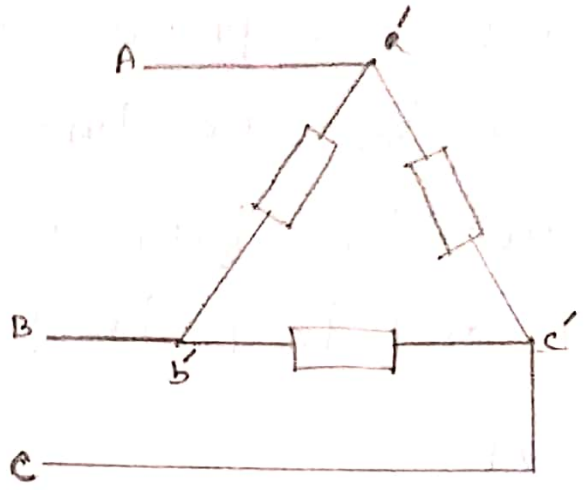
$$|V_{nA}| = |V_{nB}| = |V_{nc}| = 135V$$

and $|V_{AB}| = |V_{BC}| = |V_{CA}| = 229.7V$

Vector diagram:

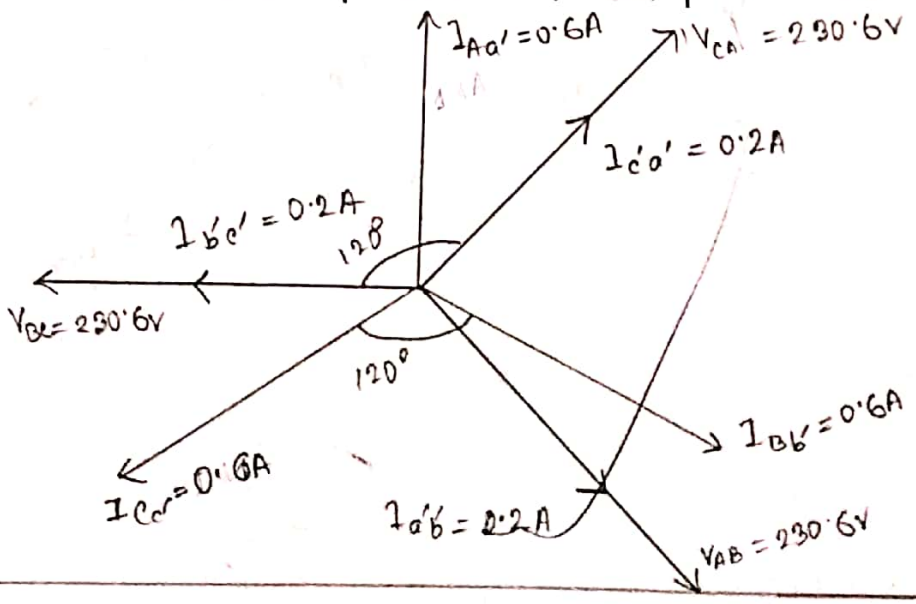


For delta connection,



Here, the phase voltages are $|V_{a'b'}|$, $|V_{b'c'}|$, $|V_{c'a'}|$. They are same as the line voltages $|V_{AB}|$, $|V_{BC}|$ and $|V_{CA}|$. For two lamps phase voltage = line voltage = 230·6V.

Again, the line currents are $|I_{Aa'}| = |I_{Bb'}| = |I_{Cc'}| = 0·6A$ and the phase currents are $|I_{a'b'}| = |I_{b'c'}| = |I_{c'a'}| = 0·2A$



Discussion:

A slight irregularity can be noticed between line voltage and phase voltage in wye connection. There is an error of approximately (3-4)v between these two voltages. For delta connection, this kind of irregularity is seen while determining the value of line current and phase current. Some reasons can be mentioned behind these irregularities -

(i) There may be a slight voltage drop along the wire and in the switch which is not included in the calculation.

(ii) The ammeter that was used wasn't perfect enough to give determine smallest values of current. In fact, it is one of the main

reasons for the errors in current

(iii) Lampboard was used as a balanced resistant. As a result, some power was lost an energy of heat and light. That, of course, leads to some error in calculating the value of voltages.

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	2.	228	134.4	~~0.1~~ 0.5	~~0.1~~ 0.5
	3.	229.7	135	~~0.3~~ 0.7	~~0.3~~ 0.7
Delta	1.	~~231.7~~ 228.8	228.8	0.1	0.1
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3/3/2020