

Practical No. 5: Connect three phase star connected balanced load and verify the relationship between line voltage and phase voltage, line current and phase current.

Practical Significance:

In practice, large power application like Transformer, Transmission line etc. use three phase systems. In a three phase circuit loads can be connected in balanced star and delta mode. Practical will help the students to acquire necessary skills.

Industry/Employer Expected Outcome(s)

Three-phase power is commonly used in factories and manufacturing plants to power large equipment such as compressors, pumps, conveyors, and motors, often use three-phase power to run large fans and pumps. It is necessary to formulate voltage and current relations for system parameters for testing, calculations and interpretations.

Course Level Learning Outcome(s)

Analyze A.C. circuits for single phase and polyphase supply.

Laboratory Learning Outcome(s)

LLO 1 Connect star connected three phase load.

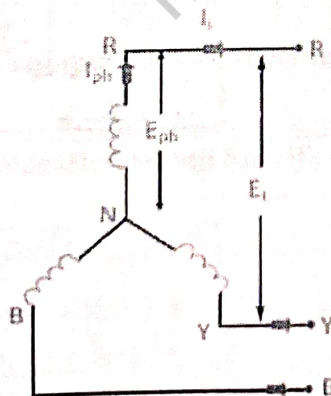
LLO 2 Verify relationship between line and phase quantities.

Relevant Affective Domain related outcome(s)

Follow safety electrical rules for safe practices.

Relevant Theoretical Background (With diagrams if required)

In the **Star Connection**, the similar ends (either start or finish) of the three windings are connected to a common point called star or neutral point. The three-line conductors run from the remaining three free terminals called **line conductors**.



Elements of Electrical Engineering (312315)

In star connection line voltage is root 3 times of phase voltage.

$$\text{Line voltage} = \sqrt{3} \times \text{Phase voltage}$$

$$E_L = \sqrt{3} E_{ph}$$

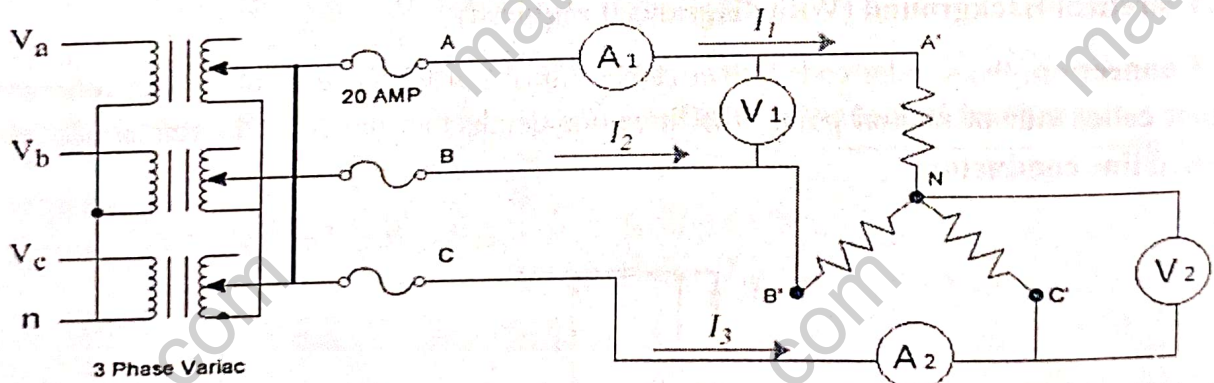
The same current flows through phase winding as well as in the line conductor as it is connected in series with the phase winding.

$$I_R = I_Y = I_B = I_L$$

Star connection is preferred for long distance power transmission because it is having the neutral point. When eq current will flow through all the three phases, then it is called as balanced current.

Usually, Star Connection is used in both transmission and distribution networks (with either single phase supply or three – phase. Delta Connection is generally used in distribution networks. Since insulation required is less, Star Connection can be used for long distances.

VII Actual Circuit diagram used in laboratory with equipment Specifications:



VIII Required Resources/apparatus/equipment with specification:

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Three Phase Variac	Suitable Three phase variac	1 No.
2	Three Phase load	Suitable range	1 No.
3	A.C. Ammeter	Suitable A.C. ammeter	2 No.
4	A.C. voltmeter	Suitable A.C. Voltmeter	2 No.

IX Precautions to be followed:

1. Avoid loose connections.
2. Don't touch wire with wet hands.
3. Ensure the output voltage of the Autotransformer should be zero.

X Procedure

1. Connect the circuit as shown in circuit diagram.
2. Confirm all the meters should be at zero position.
3. Set the rheostat at maximum position.
4. Set the autotransformer output voltage zero.
5. Switch ON the supply.
6. Record the reading of ammeters, voltmeters.
7. Take different readings at different input voltages.

XI Required Resources/apparatus/equipment with specification:

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Three phase variac	Suitable three phase variac	1 No
2	Three phase load	Suitable range	1 No
3	A.C. Ammeter	suitable AC ammeter	2 No
4	A.C. voltage meter	Suitable AC voltage.	2 No.

XII Actual Procedure Followed:

1. Connect the circuit as shown in circuit diagram.
2. Confirm all the meter should be zero position.
3. Set the rheostat at maximum position.
4. Set the autotransformer output voltage zero.
5. Switch on the supply.
6. Record the reading of ammeter voltage.
7. Take different readings at different input voltage.

XIII Observation and Calculation table.

Sr. No.	Line Voltage (volts)	Phase Voltage (Volts)	Line current (Amp)	Phase Current (Amp)	Ratio V_L/V_{ph}	Ratio I_L/I_{ph}
1	290	132	3	3	1	1
2	290	167	4	4	1	1
3	330	190	5	5	1	1

XIV Result(s)

From this practical observe that star connected balanced load I_L by I_{ph} is equal V_L .

XV Interpretation of results

The before star connection $I_L = I_{ph}$ — ①
and $V_L = 3 V_{ph}$

XVI Conclusion and recommendation

This practical state and connect three phase star connected balanced load verify the relationship between line voltage and phase voltage.

XVII Practical related questions (Provide space for answers)

1. Define balanced load.
2. State the application of star connection.
3. What will be the value of neutral current for three phase star connected balanced load?
4. State the methods to measure power in three phase circuit.

1. A balanced load is load in which magnitude of all impedances connected in the load equal and same type i.e. inductive, resistive or capacitive.

2. Star connection is used in transmission and distribution system for long distance power transfer as it provides a neutral point and allows operation at two different voltage levels.

3. The neutral current for a balanced load is zero because the phase currents are equal in magnitude but each other out.

4. →
→
• Two-watt meter method.
• Three-watt meter method.
• Direct power measured using energy meters.