Star and Delta: Line and Phase Voltage, Current and Power

Phase voltage, phase and line current and power of a balanced three-phase load connected in star or delta, from line voltage and impedance per phase.

Method: Balanced three-phase circuit relations (textbook)

Input parameters

Unit system: SI

Parameter	Value	Unit
Line voltage	415.00	V
Impedance per phase	10.000	Ω
Power factor of the load	0.80000	
Connection	Star (Y)	

Calculated results

Parameter	Value	Unit
Phase voltage	239.60	V
Phase current	23.960	A
Line current	23.960	A
Active power	13.778	kW
Apparent power	17.223	kVA

Notes for this case

- The same impedances take three times the line current and power in delta as in star: the basis of star–delta starting.

Formula and method

$$\text{Star}: \; V_{ph} = \frac{V_L}{\sqrt{3}}, \; I_L = I_{ph}; \quad \text{Delta}: \; V_{ph} = V_L, \; I_L = \sqrt{3}\, I_{ph}$$

$$P = 3 V_{ph} I_{ph} \cos\varphi = \sqrt{3}\, V_L I_L \cos\varphi$$

Variables

V_L	Line voltage	V
Z	Impedance per phase	Ω
$\cos\varphi$	Power factor of the load	-
conn	Connection	-
V_{ph}	Phase voltage	V
I_{ph}	Phase current	A
I_L	Line current	A
P	Active power	W
S	Apparent power	VA

Method and standards

Balanced star and delta relations.

Assumptions and limits

- Balanced load.
- The power factor is entered separately and is not checked against the impedance: for an impedance R + jX it should be R/Z.

References

- Balanced three-phase circuit relations (textbook)

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/electrical/motors/star-delta-line-phase

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.