Unbalanced Delta Load: Phase and Line Currents

Phase currents of an unbalanced delta-connected load with resistive and reactive branches on a balanced supply, the line currents and the total power.

Method: Phasor circuit analysis

Input parameters

Unit system: SI

Parameter	Value	Unit
Line voltage	415.00	V
Branch AB resistance	20.000	Ω
Branch AB reactance	10.000	Ω
Branch BC resistance	30.000	Ω
Branch BC reactance	0	Ω
Branch CA resistance	15.000	Ω
Branch CA reactance	-10.000	Ω

Calculated results

Parameter	Value	Unit
Line current A	41.579	A
Line current B	23.803	A
Line current C	26.082	A
Total active power	20.579	kW
Total reactive power	-1.8547	kvar

Notes for this case

• Branch currents I_ab = V_ab/Z_ab etc.; line currents by Kirchhoff at each corner, I_A = I_ab − I_ca. With unequal branches the line currents differ and are not √3 times any branch current. Positive reactance is inductive, negative capacitive.

Formula and method

$$I_{ab} = \frac{V_{ab}}{Z_{ab}}, \quad I_A = I_{ab} - I_{ca}, \quad S = \sum V_{xy} I_{xy}^{*}$$

Variables

V_{LL}	Line voltage	V
R_{ab}	Branch AB resistance	Ω
X_{ab}	Branch AB reactance	Ω
R_{bc}	Branch BC resistance	Ω
X_{bc}	Branch BC reactance	Ω
R_{ca}	Branch CA resistance	Ω
X_{ca}	Branch CA reactance	Ω
I_A	Line current A	A
I_B	Line current B	A
I_C	Line current C	A
P	Total active power	W
Q	Total reactive power	var

Method and standards

Delta load.

Assumptions and limits

- Balanced positive-sequence supply; linear branches.

References

Phasor circuit analysis

Report details

Report reference	FCC-SKQV-YJ5R (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

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

This calculator online

https://calc.firecad.com/electrical/circuits/unbalanced-delta-load-currents

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.