Neutral Current in an Unbalanced Three-Phase System

Neutral current of a three-phase four-wire system from the three phase currents at the same power factor, with the average current and the unbalance.

Method: Phasor sum of three currents 120° apart

Input parameters

Unit system: SI

Parameter	Value	Unit
Current in phase A	100.00	A
Current in phase B	80.000	A
Current in phase C	60.000	A

Calculated results

Parameter	Value	Unit
Neutral current	34.641	A
Average phase current	80.000	A
Current unbalance (largest deviation from the average)	25.000	%

Notes for this case

- Fundamental currents 120° apart at one power factor. Third-harmonic currents from electronic loads add in the neutral and are not included.

Formula and method

$$I_N = \sqrt{I_a^2 + I_b^2 + I_c^2 - I_a I_b - I_b I_c - I_c I_a}$$

Variables

I_a	Current in phase A	A
I_b	Current in phase B	A
I_c	Current in phase C	A
I_N	Neutral current	A
I_{avg}	Average phase current	A
$\mathcal{U}$	Current unbalance (largest deviation from the average)	-

Method and standards

Magnitude of the sum of three phasors 120° apart.

Assumptions and limits

- Same power factor in each phase (each current at the same angle to its phase voltage); fundamental only. Different power factors per phase change the phasor angles and so the neutral current: add the currents as phasors in that case.

References

- Phasor sum of three currents 120° apart

Report details

Report reference	FCC-A4HH-ZH4X (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/power/neutral-current-unbalanced

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.