Autotransformer Currents, Transformed Power and Copper Saving

Currents in the series and common windings of a single-phase autotransformer, the power transformed and conducted, and the copper saved against two windings.

Method: Autotransformer theory (M.G. Say, Performance and Design of AC Machines)

Input parameters

Unit system: SI

Parameter	Value	Unit
Higher voltage	440.00	V
Lower voltage	380.00	V
Throughput power (total for three phase)	50.000	kVA
Supply	Single phase	

Calculated results

Parameter	Value	Unit
Current on the higher-voltage side (series winding)	113.64	A
Current on the lower-voltage side	131.58	A
Current in the common winding $I_2 - I_1$	17.943	A
Power transformed by induction	6.8182	kVA
Power conducted directly	43.182	kVA
Copper saved against a two-winding transformer V_2 / V_1	86.364	%

Formula and method

$$I_1 = \frac{S}{k_3 V_1}, \quad I_2 = \frac{S}{k_3 V_2}, \quad I_c = I_2 - I_1, \quad k_3 = 1 \text{ (single phase)}, \ \sqrt{3} \text{ (three phase)}$$

$$S_t = S\left(1 - \frac{V_2}{V_1}\right), \quad S_c = S\,\frac{V_2}{V_1}$$

Variables

V_1	Higher voltage	V
V_2	Lower voltage	V
S	Throughput power (total for three phase)	VA
phases	Supply: single or three phase	-
k_3	1 for single phase, √3 for three phase	-
I_1	Current on the higher-voltage side (series winding)	A
I_2	Current on the lower-voltage side	A
I_c	Current in the common winding $I_2 - I_1$	A
S_t	Power transformed by induction	VA
S_c	Power conducted directly	VA
k	Copper saved against a two-winding transformer V_2 / V_1	-

Method and standards

Ideal autotransformer.

Assumptions and limits

- Ideal. For three phase choose the three-phase supply and enter the total kVA and the line voltages; the currents are line (winding) currents of a star-connected autotransformer.

References

• Autotransformer theory (M.G. Say, Performance and Design of AC Machines)

Report details

Report reference	FCC-62KZ-YPA9 (the same inputs always give the same reference)
Generated	17 November 2026, 19:44 UTC
Calculator	Autotransformer Currents, Transformed Power and Copper Saving
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	4 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/transformers/autotransformer-rating

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.