Motor Loading from Measured Input Power

Percentage loading of a three-phase motor from measured voltage, current and power factor against its rated output and efficiency, by the input power method.

Method: Input power method (Bureau of Energy Efficiency, Guide Book 3, ch. 2; US DOE Motor Challenge fact sheet)

Input parameters

Unit system: SI

Parameter	Value	Unit
Rated output of the motor	75.000	kW
Rated (full-load) efficiency	94.000	%
Measured line voltage	410.00	V
Measured line current	95.000	A
Measured power factor	0.82000	

Calculated results

Parameter	Value	Unit
Measured input power √3 V I cos φ	55.320	kW
Input power at full load P_r / η_r	79.787	kW
Motor loading	69.334	%
Estimated shaft output	52.001	kW

Notes for this case

- The rated efficiency is taken to hold at this load; below about 40 % load the real efficiency is lower and the loading is overstated.

Formula and method

$$P_{in} = \sqrt{3}\, V I \cos\varphi, \quad L = \frac{P_{in}}{P_r/\eta_r}$$

Variables

P_r	Rated output of the motor	W
η_r	Rated (full-load) efficiency	-
V	Measured line voltage	V
I	Measured line current	A
$\cos\varphi$	Measured power factor	-
P_{in}	Measured input power √3 V I cos φ	W
$P_{in,r}$	Input power at full load P_r / η_r	W
L	Motor loading	-
P_{out}	Estimated shaft output	W

Method and standards

Measured input against rated input.

Assumptions and limits

- Balanced supply; efficiency constant with load.

References

- Input power method (Bureau of Energy Efficiency, Guide Book 3, ch. 2; US DOE Motor Challenge fact sheet)

Report details

Report reference	FCC-Z0R4-HF7D (the same inputs always give the same reference)
Generated	17 November 2026, 19:49 UTC
Calculator	Motor Loading from Measured Input Power
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/motors/motor-loading-from-measurement

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.