Capacitor kvar for an Induction Motor

Capacitor rating to connect at an induction motor's terminals from its no-load current, kept below the magnetising kvar to avoid self-excitation.

Method: Motor-terminal capacitor practice (no-load magnetising kvar)

Input parameters

Unit system: SI

Parameter	Value	Unit
Line voltage	415.00	V
No-load current of the motor Measured with the motor running uncoupled, or from the maker's data; roughly 25–40 % of full-load current for 4-pole motors.	52.000	A
Share of the no-load magnetising kvar to supply Practice is 0.9 so the capacitor never supplies more than the magnetising kvar at no load.	90.000	%
Supply frequency	50.000	Hz

Calculated results

Parameter	Value	Unit
Capacitor rating (three-phase)	33.640	kvar
No-load magnetising kvar	37.378	kvar
Capacitor line current	46.800	A
Capacitance per phase, delta connected	207.25	µF

Notes for this case

- Take the nearest standard rating below the value. Do not fit motor-terminal capacitors to motors that can be driven by the load (cranes, hoists) or that use star-delta or reversing starters.

Formula and method

$$Q_0 = \sqrt{3}\,V I_0 \qquad Q_c = k Q_0 \qquad I_c = \frac{Q_c}{\sqrt{3}\,V} \qquad C_\Delta = \frac{Q_c}{3\omega V^2},\ \omega = 2\pi f$$

Variables

V	line voltage	V
I_0	no-load current	A
k	share of magnetising kvar	–
f	frequency	Hz
Q_c	capacitor rating	var
Q_0	no-load magnetising kvar	var
I_c	capacitor line current	A
C_Δ	Capacitance per phase, delta connected	F
ω	angular frequency	rad/s

Method and standards

The no-load current of an induction motor is almost all magnetising current; sizing the capacitor at about 90 % of it corrects most of the motor's reactive power without risk of self-excitation.

Assumptions and limits

- Direct-on-line motors only; not with variable-frequency drives.
- The 0.9 share is common practice, not a figure from a standard: enter your own share. The no-load current is taken as wholly magnetising; its small active part is neglected, which slightly oversizes Q_0.

References

• Motor-terminal capacitor practice (no-load magnetising kvar)

Report details

Report reference	FCC-BMDS-7P15 (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/capacitor-for-motor

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Reopens the calculator with the inputs of this report.