Generator Size for Starting a Large Motor

Generator kVA needed so a large motor starting on it keeps the transient voltage dip within a limit, from motor rating, starter and subtransient reactance.

Method: Voltage dip on a generator from motor starting kVA

Input parameters

Unit system: SI

Parameter	Value	Unit
Motor rated output	75.000	kW
Motor efficiency	93.000	%
Motor running power factor	86.000	%
Locked-rotor current / rated current	6.5000	
Starter kVA factor (DOL 1, star-delta 0.33, soft start about 0.5)	100.00	%
Generator subtransient reactance (per unit)	0.15000	
Allowed voltage dip	15.000	%
Planned running load (share of rating)	80.000	%

Calculated results

Parameter	Value	Unit
Motor running kVA	93.773	kVA
Motor starting kVA	609.53	kVA
Generator kVA for the dip limit	518.10	kVA
Generator kVA for running	117.22	kVA
Generator kVA needed	518.10	kVA

Notes for this case

• Dip ≈ X"_dS_s/(S_g + X"_dS_s), so S_g = X"_dS_s(1 − ΔV)/ΔV. This ignores the voltage regulator and engine response; makers' motor-starting curves give the final check. Reduced-voltage starters or VFDs cut the generator size sharply.

Formula and method

$$S_s = k_{LR} k_s \frac{P_m}{\eta pf}, \quad S_g = \max\left(X''_d S_s \frac{1-\Delta V}{\Delta V}, \frac{S_r}{\lambda} \right)$$

Variables

P_m	Motor rated output	W
η	Motor efficiency	-
pf	Motor running power factor	-
k_{LR}	Locked-rotor current / rated current	-
k_s	Starter kVA factor (DOL 1, star-delta 0.33, soft start about 0.5)	-
X''_d	Generator subtransient reactance (per unit)	-
ΔV_{max}	Allowed voltage dip	-
λ	Planned running load (share of rating)	-
S_r	Motor running kVA	VA
S_s	Motor starting kVA	VA
$S_{g,start}$	Generator kVA for the dip limit	VA

$S_{g,run}$	Generator kVA for running	VA
S_g	Generator kVA needed	VA

Method and standards

Motor-start dip.

Assumptions and limits

- Single motor start; regulator response ignored.

References

Voltage dip on a generator from motor starting kVA

Report details

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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/generator-size-for-motor-starting

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.