Motor Starting Voltage Dip Calculator (DOL)

Voltage dip at the bus when a large motor starts direct on line, from the transformer rating and impedance, the source fault level and the motor's starting kVA.

Method: kVA (impedance) method for motor starting

Input parameters

Unit system: SI

Parameter	Value	Unit
Transformer rating	1,600.0	kVA
Transformer impedance	6.0000	%
Upstream fault level at the transformer primary	250.00	MVA
Motor rated output	250.00	kW
Motor efficiency	95.000	%
Motor full-load power factor	88.000	%
Starting current, multiple of full-load current	6.0000	

Calculated results

Parameter	Value	Unit
Voltage dip at the bus	6.9301	%
Motor starting kVA	1,794.3	kVA
Short-circuit kVA at the bus	24.096	MVA

Formula and method

$$S_{sc} = \left(\frac{z_T}{S_T} + \frac{1}{S_{src}} \right)^{-1} \qquad S_{st} = k \, \frac{P_m}{\eta \cos \varphi} \qquad \Delta V = \frac{S_{st}}{S_{st} + S_{sc}}$$

Variables

S_T	transformer rating	VA
z_T	transformer impedance	–
S_{src}	source fault level	VA
P_m	motor rated output	W
η	motor efficiency	–
$\cos \varphi$	full-load power factor	–
k	starting current multiple	–
ΔV	voltage dip	–
S_{st}	motor starting kVA	VA
S_{sc}	short-circuit kVA at the bus	VA

Method and standards

Approximate kVA (impedance) method: the starting motor and the source impedance form a divider; angles are neglected, which slightly overstates the dip.

Assumptions and limits

- Infinite-bus approximation beyond the source fault level; resistances and angles neglected.
- The cable from the bus to the motor and any load already on the bus are not included: the dip at the motor terminals is larger than the bus dip shown.

References

- kVA (impedance) method for motor starting

Report details

Report reference	FCC-R3H0-WB64 (the same inputs always give the same reference)
Generated	17 November 2026, 19:46 UTC
Calculator	Motor Starting Voltage Dip Calculator (DOL)
Method last reviewed	11 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-starting-voltage-dip

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.