Busbar Short-Circuit Force Between Conductors

Electromagnetic force between parallel busbars or cables during a short circuit from the peak current and spacing, per metre and on a support span.

Method: Ampère's force law; F' = μ₀ i² / (2π a); three-phase centre conductor factor √3/2 (the basic relation of IEC 60865-1)

Input parameters

Unit system: SI

Parameter	Value	Unit
Peak short-circuit current	105.00	kA
Centre-to-centre spacing of the conductors	100.00	mm
Span between supports	0.60000	m
Arrangement	Three phase, side by side (centre conductor)	

Calculated results

Parameter	Value	Unit
Force per unit length	19.096	kN/m
Force on one span	11.458	kN

Notes for this case

- Long, thin, parallel conductors (spacing well above the bar size). Bar-shape factors, resonance and the stress in the bars and insulators are design checks to IEC 60865-1 and are not done here.

Formula and method

$$F' = \frac{\mu_0}{2\pi}\frac{i_p^2}{a}\left(\times\frac{\sqrt{3}}{2}\ \text{three phase}\right), \quad F = F'\,l$$

Variables

i_p	Peak short-circuit current	A
a	Centre-to-centre spacing of the conductors	m
l	Span between supports	m
type	Arrangement	-
F'	Force per unit length	N/m
F	Force on one span	N

Method and standards

Force between parallel current-carrying conductors.

Assumptions and limits

- Thin parallel conductors; static force.
- No conductor-shape factor (k_1s of IEC 60865-1) for rectangular bars close together: the result is the basic force between line currents.

References

- Ampère's force law
- F' = μ₀ i² / (2π a); three-phase centre conductor factor √3/2 (the basic relation of IEC 60865-1)

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/protection/busbar-short-circuit-force

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.