Capacitor Bank Parallel Resonance Order

Harmonic order and frequency at which a capacitor bank resonates with the supply inductance, from short-circuit level, kvar and transformer data.

Method: Parallel resonance h_r = √(S_sc/Q_C) (IEEE 519 application practice)

Input parameters

Unit system: SI

Parameter	Value	Unit
Short-circuit level at the bus	25.000	MVA
Capacitor bank	400.00	kvar
System frequency	50.000	Hz
Transformer rating (for the check)	1,600.0	kVA
Transformer impedance	6.0000	%

Calculated results

Parameter	Value	Unit
Resonant harmonic order	7.9057	
Resonant frequency	395.28	Hz
Order using transformer impedance only	8.1650	

Notes for this case

• The ±0.5-order band is a screening rule of thumb. With a stepped (automatic) bank the order changes as √(S_sc/Q_C) with each step: check every step against the harmonics present, not only the full bank.

Formula and method

$$h_r = \sqrt{\frac{S_{sc}}{Q_C}}, \quad f_r = h_r f, \quad h_{r,T} = \sqrt{\frac{S_T}{z_T Q_C}}$$

Variables

S_{sc}	Short-circuit level at the bus	VA
Q_C	Capacitor bank	var
f	System frequency	1/s
S_T	Transformer rating (for the check)	VA
z_T	Transformer impedance	-
h_r	Resonant harmonic order	-
f_r	Resonant frequency	1/s
$h_{r,T}$	Order using transformer impedance only	-

Method and standards

Parallel resonance.

Assumptions and limits

- Inductive supply; resistance neglected.
- Resonance within ±0.5 of the 3rd, 5th, 7th, 11th or 13th harmonic is flagged (a screening rule of thumb); for a stepped bank check each step.

References

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Report details

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Release checks	2 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-quality/harmonic-resonance-order

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.