Corona: Critical Disruptive Voltage (Peek)

Critical disruptive voltage for corona on an overhead line from conductor radius, phase spacing, air density and surface factor (Peek's formula).

Method: Peek's critical disruptive voltage ($V_c = g_0 m_0 \delta r \ln(D/r)$); as in Stevenson and Kothari–Nagrath

Input parameters

Unit system: SI

Parameter	Value	Unit
Conductor radius	12.500	mm
Phase spacing (or GMD)	5.0000	m
Surface irregularity factor	0.85000	
Air pressure	101.33	kPa
Air temperature	25.000	°C
Operating line voltage	220.00	kV

Calculated results

Parameter	Value	Unit
Air density factor	1.0000	
Critical disruptive line voltage	232.65	kV
Operating to critical voltage	0.94562	

Notes for this case

- Peek's formula with g_0 = 21.1 kV rms/cm (30 kV peak/cm) at 25 °C and 1 atm. Rain and fog lower V_c by about 20 %; visual corona starts somewhat above V_c.

Formula and method

$$V_{c,ph} = g_0 m_0 \delta r \ln\frac{D}{r}, \quad g_0 = 21.1\ \mathrm{kV_{rms}/cm}, \quad \delta = \frac{p}{p_0}\frac{T_0}{T}$$

Variables

r	Conductor radius	m
D	Phase spacing (or GMD)	m
m_0	Surface irregularity factor	-
p	Air pressure	Pa
T	Air temperature	K
V	Operating line voltage	V
δ	Air density factor	-
V_c	Critical disruptive line voltage	V
V/V_c	Operating to critical voltage	-

Method and standards

Peek's formula.

Assumptions and limits

- Smooth, fair-weather conditions with m_0.
- Single conductor per phase: bundled conductors (two or more sub-conductors) need the equivalent radius and are not covered by the inputs.
- Reference conditions p_0 = 101 325 Pa and T_0 = 298.15 K (25 °C) for δ; V_c,ph in kV rms with r in cm, multiplied by √3 for the line voltage.

References

- Peek's critical disruptive voltage ($V_c = g_o m_o \delta r \ln(D/r)$)
- as in Stevenson and Kothari–Nagrath

Report details

Report reference	FCC-MHAS-VT2X (the same inputs always give the same reference)
Generated	17 November 2026, 19:48 UTC
Calculator	Corona: Critical Disruptive Voltage (Peek)
Method last reviewed	13 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/corona-critical-voltage

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.