Deflagration Index K_G or K_St (Cubic Law)

Deflagration index from the maximum rate of pressure rise in a test vessel and its volume (K = (dP/dt)max·V^⅓), and the rate expected in another closed vessel.

Method: Perry's Chemical Engineers' Handbook; 9th ed. (McGraw-Hill, 2019); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Maximum rate of pressure rise in the test bar/s	600.00	
Test vessel volume	20.000	L
Volume of the vessel of interest	10.000	m^3

Calculated results

Parameter	Value	Unit
Deflagration index (bar·m/s)	162.87	
Expected max rate in V_2 (bar/s)	75.595	
Dust class St by K_St (dusts only; 1: ≤200, 2: ≤300, 3: >300)	1.0000	

Notes for this case

- The cubic law needs geometrically similar vessels and the same turbulence. Vent sizing follows NFPA 68 or EN 14491, not this calculator. Screening estimate only, not a safety study or a basis for protective design.
- St classes apply to dusts only; for a gas K is K_G and the class has no meaning. Class St 0 (no explosion) is found by test, not from a K above zero.

Formula and method

$$K = \left(\frac{dP}{dt}\right)_{max} V^{1/3}, \quad \left(\frac{dP}{dt}\right)_2 = \frac{K}{V_2^{1/3}}$$

Variables

$(dP/dt)_{max}$	Maximum rate of pressure rise in the test	-
V	Test vessel volume	m^3
V_2	Volume of the vessel of interest	m^3
K	Deflagration index (bar·m/s)	-
$(dP/dt)_2$	Expected max rate in V_2 (bar/s)	-
St	Dust class St by K_St (dusts only; 1: ≤200, 2: ≤300, 3: >300)	-

Method and standards

Cubic law.

Assumptions and limits

- Similar geometry and turbulence.
- The St class is for dusts; it is shown for any K but has no meaning for a gas K_G. St 0 (no explosion) comes from a test that shows no explosion, so it never results from a positive rate here.

References

- Perry's Chemical Engineers' Handbook
- 9th ed. (McGraw-Hill, 2019)
- sec. 23 (deflagration index K_G, K_St = (dP/dt)max V^⅓; dust explosion classes)

Report details

Report reference	FCC-EB6S-YY3Y (the same inputs always give the same reference)
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Calculator	Deflagration Index K_G or K_St (Cubic Law)
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/chemical/process-safety/deflagration-index-cubic-law

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.