Lined Duct Attenuation (Sabine's Formula)

Sound attenuation per metre and over a length of an acoustically lined rectangular or round duct from lining absorption coefficient, perimeter and free area.

Method: Sabine's lined duct formula

Input parameters

Unit system: SI

Parameter	Value	Unit
Duct shape	Rectangular (lined all round)	
Free width (or diameter)	400.00	mm
Free height (rectangular)	300.00	mm
Lining absorption coefficient at the band	60.000	%
Lined length	4.0000	m

Calculated results

Parameter	Value	Unit
Perimeter-to-area ratio	11.667	1/m
Attenuation per metre	5.9917	
Attenuation over the length	23.967	

Notes for this case

• Sabine: ΔL′ = 1.05α^1.4·P/S dB per unit length (P/S in the same length unit). Good at mid frequencies for ducts below about 0.6 m; above the frequency where the wavelength is smaller than the duct (beaming) attenuation drops sharply, and flanking and regenerated noise cap the total (here at 40 dB). Use measured insertion loss for silencers.

Formula and method

$$\Delta L' = 1.05\alpha^{1.4}\frac{P}{S}, \quad \Delta L = \Delta L' L$$

Variables

shape	Duct shape	-
w	Free width (or diameter)	m
h	Free height (rectangular)	m
α	Lining absorption coefficient at the band	-
L	Lined length	m
P/S	Perimeter-to-area ratio	1/m
$\Delta L'$	Attenuation per metre	-
ΔL	Attenuation over the length	-

Method and standards

Lined duct.

Assumptions and limits

- Mid-frequency bands; no flow regenerated noise; fully lined perimeter.

References

Sabine's lined duct formula

Report details

Report reference	FCC-YRC6-TA68 (the same inputs always give the same reference)
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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/hvac/ducts/lined-duct-attenuation

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.