Panel Sound Transmission Loss by the Mass Law and Coincidence

Sound transmission loss of a single panel at a frequency by the normal- and field-incidence mass law, with the panel's surface mass and coincidence frequency.

Method: Mass law and coincidence of single panels

Input parameters

Unit system: SI

Parameter	Value	Unit
Panel material density	7,850.0	kg/m³
Panel thickness	2.0000	mm
Elastic modulus	200.00	GPa
Poisson's ratio	0.30000	
Frequency	500.00	Hz
Speed of sound in air	343.00	m/s

Calculated results

Parameter	Value	Unit
Surface mass	15.700	kg/m²
Normal-incidence mass law	35.897	
Field-incidence mass law	30.897	
Coincidence frequency	6,129.3	Hz

Notes for this case

• Mass law: TL_0 = 20log(m″f) − 42 dB at normal incidence, about 5 dB less for a diffuse field; each doubling of mass or frequency adds 6 dB. Near and above the coincidence frequency f_c = (c²/2π)√(m″/B) the panel's bending waves match the sound and TL dips; damping decides how deep. Valid well above the panel's lowest resonances.

Formula and method

$$TL_0 = 20\log_{10}(m''f) - 42, \quad TL_f \approx TL_0 - 5, \quad f_c = \frac{c^2}{2\pi}\sqrt{\frac{m''}{B}}, \quad B = \frac{Et^3}{12(1-\nu^2)}$$

Variables

ρ	Panel material density	kg/m³
t	Panel thickness	m
E	Elastic modulus	Pa
ν	Poisson's ratio	-
f	Frequency	1/s
c	Speed of sound in air	m/s
m''	Surface mass	kg/m²
TL_0	Normal-incidence mass law	-
TL_f	Field-incidence mass law	-
f_c	Coincidence frequency	1/s

Method and standards

Mass law.

Assumptions and limits

- Single homogeneous panel; mass-controlled range.

References

Mass law and coincidence of single panels

Report details

Report reference	FCC-ZD3P-3WW4 (the same inputs always give the same reference)
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Calculator	Panel Sound Transmission Loss by the Mass Law and Coincidence
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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/instrumentation/vibration-noise/mass-law-transmission-loss

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.