Sound Power Level from Sound Pressure Level and Distance

Sound power level of a source from a measured sound pressure level at a distance with a directivity factor, and the level at another distance (free field).

Method: L_W = L_p + 10 log(4πr²/Q) (free-field point source)

Input parameters

Unit system: SI

Parameter	Value	Unit
Measured sound pressure level (dB)	85.000	
Measurement distance	1.0000	m
Directivity factor	2: on a floor (hemisphere)	
Distance for prediction	10.000	m

Calculated results

Parameter	Value	Unit
Sound power level (dB re 1 pW)	92.982	
Sound power	1.9869e-06	kW
Sound pressure level at r_2 (dB)	65.000	

Notes for this case

- Free-field, far from the source; in rooms the reverberant field adds to these values.

Formula and method

$$L_W = L_p + 10\log_{10}\frac{4\pi r^2}{Q}, \quad W = 10^{-12}\cdot 10^{L_W/10}, \quad L_{p2} = L_W - 10\log_{10}\frac{4\pi r_2^2}{Q}$$

Variables

L_p	Measured sound pressure level (dB)	-
r	Measurement distance	m
Q	Directivity factor	-
r_2	Distance for prediction	m
L_W	Sound power level (dB re 1 pW)	-
W	Sound power	W
L_{p2}	Sound pressure level at r_2 (dB)	-

Method and standards

Free-field acoustics.

Assumptions and limits

- Point source, free field, uniform directivity: one measurement point stands for the whole surface. Survey methods (ISO 3744, ISO 3746) average several positions over a measurement surface; use them for declared values.
- Measure in the far field: at 1 m from a large machine you may be in the near field, where the level does not fall as 1/r². The distance is not checked against the source size.

References

- L_W = L_p + 10 log(4πr²/Q) (free-field point source)

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/instrumentation/vibration-noise/sound-power-from-pressure

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.