



# HVAC fundamentals

## Sound definition

A sound source emits a sound power, which is expressed in Watts (W). The sound power radiates away from the source, causing small fluctuations in the air pressure through the room. Sound power cannot be measured directly, but the small fluctuations in the air pressure can be, expressed in Pascals (Pa).

### The decibel (dB)

Sound power levels and sound pressure levels are stated using the decibel unit (dB). The decibel is a logarithmic unit that indicates the ratio of the two quantities; a measured value and a reference value. As the range of sound power and sound pressure can be so large a logarithmic scale provides a convenient way to display the data.

$$\text{Decibel equation: } \text{dB} = 10 \log \left( \frac{P_1}{P_2} \right)$$

### Sound pressure level

Sound pressure level (SPL) is a logarithmic pressure of the effective sound pressure of a sound relative to a reference value.

Where  $p$  is the absolute level of the sound pressure and the reference pressure  $20 \mu\text{Pa}$  (approximation of the faintest sound that can be heard by a human ear). Abbreviation SPL is often used to represent sound pressure level, and the notational  $L_p$  is normally used in equations.

Sound pressure level equation:

### Sound pressure level (SPL)

$$L_p = 10 \log \frac{p^2}{(20\mu\text{Pa})^2}$$

### Sound power level

Sound power level (PWL) is a measurement of the total noise radiated by the source in all directions.

Where  $P$  is the absolute level of sound power and the sound power reference is  $10^{-12} \text{ W}$ . It is essential the power level values always follow the notation "dB re  $10^{-12} \text{ W}$ ". Abbreviation PWL is often used to represent sound power level, and the notational  $L_w$  is normally used in equations.

Sound power level equation:

### Sound power level (PWL)

$$L_w = 10 \log \frac{P^2}{10^{-12} \text{ W}}$$

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