

Glossary of Common Acoustic Terms

Absorption - In acoustics, the changing of sound energy to heat.

Absorption coefficient - the fraction of sound energy that is absorbed at any surface. It has the value between 0 and 1 and varies with the frequency and angle of incidence of the sound.

Acoustics - The science of sound.

Acoustic treatment - The application of design principles in architectural acoustics to isolate noise or vibration and to correct acoustical faults in spaces by addition of absorption, reflectors or other devices.

Ambient noise - Background or general noise level characteristic of a space, often used in comparison with a specific noise source overlay. The metric most often used in the United Kingdom is the sound pressure level in dB(A) exceeded for 90% of the time, i.e. L90, although L95, or even L99 are used as the measure of background in some regions.

Anechoic chamber - A room designed to suppress internal sound reflections. Used for acoustical measurements.

Attenuate - To reduce the level of an acoustical signal.

Audio spectrum - The range of acoustical signal perceived by the human ear, usually taken as 20 Hz to 20 kHz. However, for Health and Safety work, 31,5Hz to 8kHz is usually quoted as the spectrum or range of interest.

Auditory system - The human hearing system made up of the external ear, the middle ear, the inner ear, the nerve pathways and the brain.

A-weighting - The frequency-response of a sound level meter that makes its reading conform to a notional human response. It is now properly called A-frequency-weighting and is defined in various International standards such as IEC 60651 and IEC 61672, as well as in various national standards such as ANSI S1.4. A-frequency-weighting is mandated all over the world for hearing damage risk measurements.

Bass - The lower range of audible frequencies.

Bel - A scale unit used in the comparison of the magnitudes of powers. The number of bel expressing the relative magnitudes of two powers is the logarithm to the base 10 of the ratio of the powers. See also decibel.

Coincidence - This occurs when the wavelength of the incident sound wave projected onto a partition or panel matches the bending wavelength of the partition or panel.

Critical frequency - Lowest frequency when coincidence occurs. Critical frequency is raised for thinner and less stiff surfaces in the sound path.

dB(A) A sound level meter reading with an A-weighting network. It was originally set as simulating the human ear response at a loudness level of 40 phons, but today, it is simply a standardised metric.

Damping - The process where by the amplitude of an oscillation of a system is diminished due to thermodynamically or other irreversible processes.

decibel (dB) - One-tenth of a bel.

Diaphragm - Any surface that vibrates in response to sound or is vibrated to emit sound, such as in microphones and loudspeakers. Also applied to wall and floor surfaces vibrating in response to sound or in transmitting sound.

Diffraction - Ability of a sound wave to pass round a screen or barrier. Lower frequency sounds can diffract around obstacles more easily because of their longer wavelength.

Diffusion - Complexity of reflecting surfaces causing an even dispersion of sound in a room, with no directionality of sound waves.

Dose - The permitted amount of noise, in Exposure, multiplied by time (Pa²hr) that a person is exposed to and can be expressed in many ways. Dose limits are set by governments to limit the exposure of workers to noise and there are many ways of describing this exposure. The reality is that all 'dose' systems allow a maximum Sound Exposure each day or week, but few use simple Sound Exposure as their metric. In Europe, the normal maximum permitted exposure, is 85dB for 8 hours. 'Per cent' dose is a number laid down by politicians in a particular political region and is simply the ratio of the actual dose divided by the maximum permitted, multiplied by 100. This means 100% dose is NOT the same in all countries. "% dose" is easy to understand, but makes life difficult if the maximum exposure limit is changed, as all existing instruments have to be re-scaled or scrapped. To get round this problem, 'dosimeters' were renamed as 'Personal Sound Exposure Meters' (PSEM) and are described in IEC 61252

Echo - Reflected sound discernible as separate from the initial sound, by virtue of the longreflected sound path.

Equal loudness contour- A contour representing a constant loudness for all audible frequencies.

Equivalent continuous sound level (Leq) - The sound pressure level of a steady sound that has, over a given period, the same energy as the fluctuating sound in question.

Flanking - Ability of acoustic energy to by-pass a sound barrier at the edges. Good air-borne sound insulation through a floor construction, for example, may be flanked by sound transmission down the walls or ducts.

Flutter echo - Rapid echo pattern between parallel walls which can be discerned.

Focusing - Acoustic energy can be reflected from concave surfaces into a concentrated focus.

Frequency - Frequency is the number of whole cycles of vibration per second. Note: Frequency may be expressed in hertz (Hz), kilohertz (kHz) or megahertz (MHz).

Hearing loss - The decrease of individuals' hearing levels below the specified standard of normal hearing when this can be ascribed to a specific cause such as advancing age, conductive deafness, perceptible defects or noise exposure.

Hearing threshold level - A measured threshold of hearing, expressed in decibels relative to a specified standard of normal hearing.

Hertz - The unit of frequency; symbol Hz. It is the same as cycles per second.

Cycle - Of a periodic quantity: the sequence of changes which takes place during the period of a recurring variable quantity.

dB - The symbol for the decibel.

Helmholtz resonator - A reactive, tuned, sound absorber. A bottle is such as resonator. It can employ a perforated cover over a cavity.

Level - the ratio, expressed in decibels, of the magnitude of the quantity to a specified reference magnitude.

Loudness - An observer's auditory impression of the strength of a sound. Note: It cannot be measured with a sound level meter; a special Loudness meter is needed.

Loudness level - The loudness level of a sound is measured by the sound pressure level of a standard pure tone of specified frequency that is assessed by normal observers as being equally loud.

Masking - The effect whereby the threshold of audibility of a sound is raised by the presence of another (masking) sound. Masking is most effective when the masking sound is of lower frequency than the sound to be masked. Masking using white noise is sometimes used as an aid to communication in offices.

Membrane absorber - A component assembly whereby a solid thin panel is spaced away from a solid backing but by virtue of panel flexibility vibrates on the trapped layer of air. The frequency at which maximum absorption occurs depends on the spacing panel to backing and the superficial weight of the panel.

Mode - A room resonance. Axial modes are associated with pairs of parallel walls. Tangential modes involve four room surfaces and oblique modes all six surfaces. Their effect is greatest at low frequencies and for small rooms.

Natural frequency - The frequency of a free vibration.

Noise - Sound which is undesired by the recipient. Undesired electrical disturbances in a transmission channel or device may also be termed 'noise', in which case the qualification 'electrical' should be included unless it is self-evident.

Noise criteria - Standard spectrum curves by which a given measured noise may be described by a single NC number.

Noise rating curves - An agreed set of empirical curves relating octave-band sound pressure level to the centre frequency of the octave bands, each of which is characterized by a 'noise rating' (NR), which is numerically equal to the sound pressure level at the intersection with the ordinate at 1000 Hz. The 'noise rating' of a given noise is found by plotting the octave-band spectrum on the same diagram and selecting the highest noise rating curve to which the spectrum is tangent.

Octave - The interval between two frequencies having a ratio of 2:1.

Peak Sound Level - (symbol L_{peak}) This is not the same as Maximum Sound Level. Peak Sound Level is recording the peak of the original pressure wave. This is commonly associated with C or Z frequency weighting, but has no time weighting. If the noise being measured is impulsive such as a hammer being used then the Peak level may easily be 20 dB higher than the maximum sound level, this is due to the time weighting being applied to the max sound level. To give some scale. The time constant for 'I' (Impulse) response is 35millisec. The maximum permitted acquisition time of Peak is 100 microseconds. Clearly a very short pulse will read very differently on Peak and 'MAX I'.

Perceived noise level - The perceived noise level of a sound is measured by the sound pressure level of a reference sound which is assessed by normal observers as being equally noisy. The reference sound consists of a random noise between one-third and one octave wide centred on 1000 Hz.

Permanent threshold shift - The component of threshold shift which shows no progressive reduction with the passage of time when the apparent cause has been removed.

phon - The unit of loudness level when the standard pure tone is produced by a sensibly plane sinusoidal progressive sound wave coming from directly in front of the observer and having a frequency of 1000 Hz.

Pink noise - A noise signal whose spectrum level decreases at 3 dB per octave rate. This gives the noise equal energy per octave.

Pitch -Pitch is the frequency of a sound as perceived by human hearing.

Plenum - An absorbent-lined cavity through which conditioned air is routed to reduce noise.

Porous absorber- Sound absorbing finish where the sound energy falling on it is dissipated by viscous losses within the pores of the material.

Pure tone - A pure tone is a sinusoidal sound of only one frequency, such as that generated by a tuning fork, electronic signal generator or an acoustic calibrator.

Random noise - A noise signal, commonly used in measurements, which has constantly shifting amplitude, phase and frequency and a uniform spectral distribution of energy.

Reflection - Sound energy returned after impact on a surface, rather than being absorbed as heat energy within the surface.

Refraction - The bending of sound waves travelling through layered media with different sound velocities. It is especially important in considering its effect at the edges of barriers.

Resonance - The natural vibration of an area of material at a particular frequency as a result of excitation by a sound at that frequency.

Reverberation - The effect whereby a sound builds up in a space or at a point in a space because of multiple reflections from surrounding enclosing walls, floors and ceiling.

Reverberation chamber - A room with hard boundaries used for measuring sound absorption coefficients.

Reverberant field- A sound field resulting from the superposition of many waves due to repeated reflections at the boundaries.

Reverberant sound - The sound in an enclosure excluding that which is received directly from the source without reflection.

Reverberation time - The time required for the mean square sound pressure of a given frequency in an enclosure, initially in a steady state, to decrease after the source is stopped, to one-millionth of its initial value (i.e. the time for 60 dB decay). It is normally calculated by measuring a drop of 20dB and tripling the time (20dB method), or by measuring a drop of 30 dB and doubling this.

Richness - A property of sound in an auditorium where there are many repetitions and reflections within a short period.

Sabine - The unit of sound absorption.

Sine wave - A single frequency periodic wave having simple harmonic motion.

Sound - Physically it is a fluctuation in pressure, a particle displacement in an elastic medium like air around the static pressure. This is called objective sound. Physiologically it is an auditory sensation produced in the ear and brain by variations in the pressure of air. This is subjective sound.

Sound absorption - Damping of a sound wave on passing into a medium wholly or partially. The property possessed by materials, objects or media of absorbing sound energy.

Sound absorption coefficient - Of a surface or material at a given frequency and under specified conditions : the complement of the sound energy reflection coefficient under those conditions, i.e., it is equal to 1 minus the sound energy reflection coefficient of the surface or material.

Sound insulation - Means taken to reduce the transmission of sound, usually by enclosure. Of a partition: the property that opposes the transmission of sound from one side to the other.

Sound intensity - Sound intensity (I) is the sound power distributed over unit area. Unit is watts per square meter.

Sound level - A-frequency-weighted value of the sound pressure level as determined by a sound level meter.

Sound level meter - An instrument designed to measure a frequency-weighted value of the sound pressure level. It consists of a microphone, amplifier and indicating instrument having a declared performance in respect of directivity, frequency response, rectification characteristic, and ballistic response.

Sound power - Sound power (P) is the rate at which sound energy is produced at the sound source. Unit is watt (W).

Sound power level (PWL) - The sound power level of a source, in decibels, is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power. In cases of doubt, the reference sound power should be explicitly stated. Note: In the absence of any statement to the contrary, the reference sound power in air is taken to be 10^{-12} W (= 1 pW).

Sound pressure - Sound pressure (p) is the average variation in atmospheric pressure caused by the sound. Unit is pascal (Pa) Note: The term sound pressure may be qualified by the terms 'instantaneous', 'maximum', 'peak' or RMS, etc. The Root Mean Square (RMS) sound pressure is frequently understood by the unqualified term sound pressure.

Sound pressure level (SPL) - The sound pressure level of a sound, in decibels, is equal to 20 times the logarithm to the base 10 of the ratio of the RMS sound pressure to the reference sound pressure. In case of doubt, the reference sound pressure should be stated. In the absence of any statement to the contrary, the reference sound pressure in air is taken to be 2×10^{-5} N/m², or 0,0002 Pa.

Sound propagation - The wave process whereby sound energy is transferred from one part of a medium to another.

Sound transmission - The transfer of sound energy from one medium to another.

Sound reduction index - Difference in dB measured between the amount of energy flowing towards the wall in the source room and the total amount of energy entering the receiving room.

Sound spectrum - Sounds can be analysed to reveal their frequency content. This can be achieved by dividing the frequencies into octave bands and the sound pressure levels measured in those bands.

Sound transmission class - Single-figure rating used mainly in the USA for comparing partitions for general building design purposes. Sound transmission losses in sixteen test bands from 125 to 4K Hz are compared with a reference contour.

Sound transmission coefficient - The ratio which the sound energy of a given frequency transmitted through and beyond a surface or partition bears to that incident upon it.

Sound wave - A disturbance whereby energy is transmitted in a medium by virtue of the inertial, elastic and other dynamic properties of the medium. Usually the passage of a wave involves only temporary departure of the state of the medium from its equilibrium state.

Standing wave - A resonance condition in an enclosed space in which sound waves travelling in one direction interact with those travelling in the opposite direction, resulting in a stable condition.

Temporary threshold shift, or TTS - The deviation, in decibels, of a measured hearing level from one previously established. After a period where the subject is not exposed to high sound levels TTS will disappear.

Velocity - Velocity is the distance moved per second in a fixed direction.

Wave - A regular variation of an electrical signal or acoustical pressure.

Wavelength - Wavelength is the distance between any two repeating points on a wave.

Weighting - Adjustment of response in the frequency or time domains of a sound level meter to achieve a desired measurement.

White noise - Random noise having uniform distribution of energy with frequency.