Glossary of common Acoustic Terms

Absorption
In acoustics, the changing of sound energy to heat. The sound wave impinges on a surface where it changes to heat and thus is not reflected back.

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

Acoustics
The science of sound.

Acoustic treatment
Used in architectural acoustics to isolate noise or vibration and to correct acoustical faults in spaces by addition of absorption devices, reflectors or other devices, sometimes including electronic systems.

Ambient noise
Background or general noise level characteristic of a location, often used in comparison with a specific noise source. The metric most often used in the United Kingdom to describe this 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. Because there are so few reflections, any sound will come from one indirection only, it is used in microphone directivity measurements.

ANSI
The American National Standards Institute. They set USA standards, that in acoustics are usually VERY different to the International (IEC) standards and are often incompatible. The ANSI sound level meter standard is ANSI S1.4-1983 (R2006). ANSI standards can be bought on-line from http://webstore.ansi.org

Attenuate
To reduce the level of an acoustical signal.

Audio spectrum
The range of acoustical signal perceived by the human ear, conventionally 20Hz to 20kHz, but many other ranges may be quoted. However, for Health and Safety work, 31,5Hz to 8kHz is usually quoted as the spectrum or range of interest.

Average Sound Level
See Equivalent continuous sound level.

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 (correctly A-frequency-weighting).
The frequency-response of a sound level meter that makes its reading conform to a notional human response. It is defined in various International standards such as the obsolete IEC 60651 and the current IEC 61672, as well as in various national standards such as ANSI S1.4. (USA). A-frequency-weighting is mandated all over the world for

hearing damage risk measurements. Any approved sound level meter meeting IEC 61672 is mandated to incorporate at least an A-weighting filter.

Bass
The lower range of audible frequencies. The term come from music.

Bel
A unit used as a descriptor 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. It is named after Alexander Graham Bell (1847-1922), Scots-born scientist. Because the bel is so large the decibel (bel x 0,1) is more commonly used.

Coincidence
This occurs when the wavelength of the incident sound wave projected onto a surface matches the bending wavelength of that surface.

Class (of a sound level meter)
IEC 61672 divides sound level meters into 2 classes or performance categories, where Class 1 sound level meter is often called 'precision'. They were called 'Types' in earlier standards, such as IEC 60651 and 60804. Class 1 & 2 meters essentially have the same design goals, but a Class 2 sound level meter has wider tolerances and is thus slightly less accurate, but for most applications, the difference is very small.

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

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

dB(A) (often just referred to as dBA, or decibels A weighted)
The "metric" that a sound level meter gives when on A-frequency-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 whereby the amplitude of an oscillation of a system is diminished due to thermodynamically or other irreversible processes. In acoustics, it is often done by absorbent material.

decibel (symbol dB)
One-tenth of a bel. Mathematically, the decibel and bel are strictly not units, as they are simply a ratio between two quantities and as such have no dimension.

Diaphragm
Any surface that vibrates in response to sound or is vibrated to emit sound, especially in microphones and loudspeakers. Some people also apply it 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. In effect, the edge of the barrier acts like a new sound source

Diffusion
When reflecting surface or surfaces cause a dispersion of sound in a room, with no directionality of sound waves.

Dose
The permitted amount of noise, in Sound 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 new 'Exposure Limit Value' sets a legal limit of 87dB(A) over 8 hours. This is the maximum permissible noise level exposure to enter the

operatives ear (including the use of hearnig protetion). “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 heard as separate from the initial sound, by virtue of the longer reflected sound path.

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

Equivalent continuous sound level (common abbreviation Leq)
If noise levels are rapidly changing then the average level can be a useful tool and it is usually called the “Equivalent Continuous Level”. However, it is properly known as time-average sound level (symbol LAT) but mainly only pedants use this, most people use the more common LAeqT. Formally, it is defined as twenty times the logarithm to the base ten of the ratio of a root-mean-square sound pressure during a stated time interval to the reference sound pressure, sound pressure being obtained with a standard frequency weighting and is expressed in decibels (dB). Being an average level, Leq can go up and down but the longer it is measured, the more stable it gets, as it measures all the noise from the beginning of the measurement.

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.

Focusing
Acoustic energy can be reflected from concave surfaces into a concentrated focus. The effect is the same as focussing light.

Frequency
Frequency is the number of whole cycles of vibration per second. Note: Frequency may be expressed in hertz (Hz), kilohertz (kHz) of megahertz (MHz). Originally, it was simply described as “cycles per second” or cps.

Hearing loss
The decrease of a person’s hearing levels below the specified standard of normal hearing.

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. Named after the German physicist Heinrich Hertz.

Helmholtz resonator
A reactive, tuned, sound absorber. A bottle is such a resonator. Many good sound calibrators incorporate a Helmholtz resonator, to increase their equivalent volume. Named after Hermann von Helmholtz a German physicist.

IEC
The International Electro-technical Commission. They set and agree the world standards for many things, in particular for acoustics. The Standards are written by working groups, made up of academics, commercial companies and government laboratories and agreed by a plenary meeting of all interested countries. While the USA is a full member of IEC, in acoustics they usually do not take much regard to them. IEC standards describe the instrument’s performance NOT its method of use. IEC acoustic standards are all of the form IEC 6xxxx. IE standards can be bought 0n-line from www.iec.ch/

ISO
The International Organization for Standardisation. They are a similar organisation to IEC, but ISO set standards for measurements methods NOT for the instrument. They are available from www.iso.org/

Level
the ratio, expressed in decibels, of the magnitude of the quantity to be measured to the reference magnitude.

Leq (Equivalent continuous sound level)
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See Leq meters from Pulsar here.

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 where the threshold of audibility of a sound is raised by the presence of another (masking) sound or sounds. 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 mainly 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 Floor
The self-generated noise of a sound level meter, usually due to the microphone or pre-amplifier. This is therefore the level below which the meter cannot read.

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 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 1Hz. 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. The term comes from music.

Peak Sound Level - (symbol Lpeak) It is expressed in decibels.
This is not the same as Maximum Sound Level, but they are often confused.

Peak Sound Level is the highest peak of the original pressure wave. This is commonly associated with C or Z frequency weighting (originally Flat), but has itself no time weighting. If the noise being measured is impulsive such as a hammer, then the Peak level may easily be 20dB higher than the maximum sound level, because of the time weighting being applied to the sound level. It is formally defined as twenty times the logarithm to the base ten of the ratio of a peak sound pressure to the reference sound pressure, peak sound pressure being obtained with a standard frequency weighting

To give some idea of scale. The time constant for "I" (Impulse) response is 35millisec. The maximum permitted acquisition time of Peak is 100 microseconds (0,1 millisec) . 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 1000Hz.

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. In effect permanent deafness

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 3dB per octave rate. This gives the noise equal energy per octave and is used to test many acoustic devices.

Pitch
Pitch is the frequency of a sound as perceived by human hearing. It is mainly musicians who use 'Pitch'. Engineers use 'Frequency'.

Plenum
A cavity usually absorbent-lined 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 and converted to heat.

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. (White, pink and blue noise are all random noises)

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 or an object at a particular frequency as a result of excitation by a sound at that frequency. It is resonance that causes glasses to shatter with noise.

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 and continues when the exciting source is removed.

Reverberation chamber
A room with hard surfaces used for measuring sound absorption coefficients. None of the surfaces are parallel.

Reverberant field
A sound field resulting from the superposition of many waves due to repeated reflections at the boundaries. This is the field produced in a reverberant chamber.

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 60dB decay). It is normally calculated by measuring a drop of 20dB and tripling the time (20dB method), or by measuring a drop of 30dB 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. Named after Wallace Clement Sabine, an American physicist.

Sine wave
A single frequency periodic wave having simple harmonic motion and is described by frequency and amplitude. Formally it is a mathematical curve that describes a smooth repetitive oscillation.

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 calibrator
A sound source that normally gives a 1kHz tone at 94dB (1Pa) to correct any level error of the sound level meter. It has an IEC standard IEC 60942. Because of the differing microphone characteristics, a sound calibrator from manufacturer 'A' should NOT be used on a meter from manufacturer 'B' unless both manufacturers can provide any needed correction. Example of a sound calibrator.

Sound Exposure
The time integral of the square of sound pressure over a stated time interval or event. The units are pascal-squared seconds Pa2s and the symbol is EA.

Sound Exposure level
Ten times the logarithm to the base ten of the ratio of a sound exposure to the reference sound exposure, reference sound exposure being the product of the square of the reference sound pressure and the reference time interval of 1s. Sound exposure level is expressed in decibels (dB) and the symbol is LAE. It is often referred to as SEL.

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. The unit is watts per square meter.

Sound level
The 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 & time-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. It is fully described and specified in IEC 61672 Part 1. There are three kinds of sound measuring instruments:

(1) a conventional sound level meter that measures exponential time‑weighted sound level;

(2) an integrating‑averaging sound level meter that measures time‑average sound level; and

(3) an integrating sound level meter that measures sound exposure level.

Sound power - Sound power (P) is the rate at which sound energy is produced at the sound source. The 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 10-12W (= 1 pW).

Sound pressure
Sound pressure (p) is the average variation in atmospheric pressure caused by the sound. The 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 x 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, or simply one location to another.

Sound reduction index
Difference in decibel 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 or third-octave bands or even smaller 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 4KHz 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 been 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, just as the waves in the sea.

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 decibel, of a measured hearing level in a person 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. It is related to the frequency and velocity by $v = f\lambda$

Weighting
Adjustment of response in the frequency or time domains of a sound level meter to achieve a desired measurement. The formal definitions of frequency and time weightings are:-

frequency weighting is the difference between the level of the signal indicated on the display device and the corresponding level of a constant-amplitude steady-state sinusoidal input signal, specified as a function of frequency

time weighting is the exponential function of time, with a specified time constant, that weights the square of the instantaneous sound pressure. Two time weightings are defined in IEC 61672 S having a time constant of 1s and F having a ime constant of 0,125s. I time weighting (35m) is no longer in the body of the standard and its use is not recommended

White noise
Random noise having uniform distribution of energy with frequency. It is used to test certain devices as well as a masking noise.