

Appendix 12.1

Glossary of Specialist Acoustic Terminology

Contents

12.1.1	Decibel (dB)	1
12.1.2	dB(A)	1
12.1.3	Equivalent continuous sound level	1
12.1.4	Frequency	1
12.1.5	Maximum noise level	2
12.1.6	Sound power level	2
12.1.7	Sound pressure level	2
12.1.8	Statistical noise levels	2
12.1.9	Typical levels	3
12.1.10	Vibration	3
12.1.11	Vibration dose value (VDV)	3

12.1.1 Decibel (dB)

The ratio of sound pressures which we can hear is approximately $10^6:1$ (one million:one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound pressure level' (L_p) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

12.1.2 dB(A)

The unit used to define a weighted sound pressure level, which correlates well with the subjective response to sound. The 'A' weighting follows the frequency response of the human ear, which is less sensitive to low and very high frequencies than it is to those in the range 500Hz to 4kHz.

In some statistical descriptors the 'A' weighting forms part of a subscript, such as L_{A10} , L_{A90} , and L_{Aeq} .

12.1.3 Equivalent continuous sound level

An index for assessment for overall noise exposure is the equivalent continuous sound level, L_{eq} . This is a notional steady level which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Therefore, fluctuating levels can be described in terms of a single figure level.

12.1.4 Frequency

Frequency is the rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the hertz (Hz), which is identical to cycles per second. A 1000Hz is often denoted as 1kHz, eg 2kHz = 2000Hz. Human hearing ranges approximately from 20Hz to 20kHz. For design purposes the octave bands between 63Hz to 8kHz are generally used. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For more detailed analysis, each octave band may be split into three one-third octave bands or in some cases, narrow frequency bands.

12.1.5 Maximum noise level

The maximum noise level identified during a measurement period. Experimental data has shown that the human ear does not generally register the full loudness of transient sound events of less than 125ms duration and fast time weighting (F) has an exponential time constant of 125ms which reflects the ear's response. Slow time weighting (S) has an exponential time constant of 1s and is used to allow more accurate estimation of the average sound level on a visual display.

The maximum level measured with fast time weighting is denoted as $L_{Amax,F}$. The maximum level measured with slow time weighting is denoted $L_{Amax,S}$.

12.1.6 Sound power level

The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source. The sound power level is an intrinsic characteristic of a source (analogous to its volume or mass), which is not affected by the environment within which the source is located.

12.1.7 Sound pressure level

The sound power emitted by a source results in pressure fluctuations in the air, which are heard as sound.

The sound pressure level (L_p) is ten times the logarithm of the ratio of the measured sound pressure (detected by a microphone) to the reference level of 2×10^{-5} Pa (the threshold of hearing).

Thus L_p (dB) = $10 \log (P/P_{ref})^2$ where P_{ref} , the lowest pressure detectable by the ear, is 0.00002 pascals (ie 2×10^{-5} Pa).

The threshold of hearing is 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dB_{pA} and a change of 3dB is only just detectable. A change of 10dB is subjectively twice, or half, as loud.

12.1.8 Statistical noise levels

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index which allows for this variation. The L_{10} is the level exceeded for 10% of the time period under consideration, and can be used for the assessment of road traffic noise (note that L_{Aeq} is used in BS 8233 for assessing traffic noise). The L_{90} , the level exceeded for 90% of the time, has been adopted to represent the background noise level. The L_1 , the level exceeded for 1% of the time, is usually a good indicator of the maximum levels recorded during the sample period. A weighted statistical noise levels are denoted L_{A10} , $dB L_{A90}$ etc. The reference time period (T) is normally included, e.g. $dB L_{A10,5min}$ or $dB L_{A90,8hr}$.

12.1.9 Typical levels

Some typical dB(A) noise levels are given below:

Table 6A.1: Typical noise levels and examples

Noise Level, dB(A)	Example
130	Threshold of pain
120	Jet aircraft take-off at 100m
110	Chain saw at 1m
100	Inside disco
90	Heavy lorries at 5m
80	Kerbside of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heater at 1m
40	Living room
30	Theatre
20	Remote countryside on still night
10	Sound insulated test chamber

12.1.10 Vibration

Vibration may be expressed in terms of displacement, velocity and acceleration. Velocity and acceleration are most commonly used when assessing human comfort or structureborne noise issues.

Vibration magnitude may be quantified as a peak value, or as a root mean squared (rms) value. The rms value is of benefit because it takes into account both time history variation and energy content. The rms value is equal to 0.707 times the peak value.

The peak value, expressed as the peak particle velocity (PPV) is commonly used for construction vibration and is the parameter best correlated with building damage. PPV can also be related to the perceptible to people of vibration.

Generally humans are more sensitive to changes in vibration amplitude than they are to changes in the duration of the exposure to vibration.

12.1.11 Vibration dose value (VDV)

This is a complex metric that has been identified as being the best objective measure of human disturbance from intermittent/transient vibration. The VDV is the fourth root of the time integral of the fourth power of the weighted acceleration. VDV are measured in units of $\text{ms}^{-1.75}$. The frequency weightings are defined in BS 6472-1: 2008 and in BS 6841: 1987.

The VDV doubles in magnitude with a doubling of vibration amplitude. However, a 16-fold increase in the duration of exposure to the vibration is required to double the VDV (without any change in amplitude).