

# A BRIEF GUIDE TO NOISE CONTROL TERMS

**DECIBEL (dB)** Decibels are the basic unit of measure of sound levels. Because of the large range of sound energy that people can hear and because the response of the ear is more logarithmic than linear, decibels use a logarithmic scale to represent either sound pressure levels or sound power levels. This is why 50 dB + 50 dB does actually equal 53 dB.

**SPL or  $L_p$**  SPL or  $L_p$  stands for sound pressure level. Sound pressure is what the ear or a microphone responds to, and the sound pressure level is a measure of the intensity of the sound pressure at a given point referenced to 20 micropascals. The sound pressure level from any source depends on the position relative to the source, so sound pressure level data always needs a distance and sometimes a direction from the source to be meaningful.

**PWL or  $L_w$**  PWL or  $L_w$  stands for sound power level. The sound power is the total sound energy radiated by a noise source. The sound power level is the logarithmic ratio of the sound power of the source in watts relative to the reference sound-power level of  $10^{-12}$  Watts. Before 1963, the reference power was  $10^{-13}$  Watts. Occasionally, some data still shows up referenced to  $10^{-13}$  Watts, which is something to watch for since it makes a 10 dB difference in sound power level.

**HERTZ (Hz)** Hertz means cycles per second, which is the measure of the frequency of the noise. Any noise source will produce sound energy over a wide range of frequencies, but whether the energy is concentrated in the lower or higher frequencies corresponds to what we consider a "rumble" or a "whine". Noise with a lot of energy at a single frequency or in a very narrow frequency band is considered tonal. Tonal noise is very noticeable and often more annoying than broadband noise (noise over a broad frequency range).

**OCTAVE BAND** Sound levels are normally reported in 9 octave bands which cover most of the audible frequency range, about 20 Hz to 16,000 Hz. The standard octave bands are denoted by the center frequency in each band ranging from 31 to 8000 Hz. Octave band sound level data is very important for source identification or if noise control treatment must be designed. Also important, but sometimes omitted, is the 31 Hz octave data. High, untreated levels in the 31 Hz octave can correlate to rattling windows and other annoyances.

**dB<sub>A</sub>** dBA denotes an A-weighted sound level. The ear has differing sensitivities to different frequencies of sound, and the A-weighting scale was developed to correspond to the relative frequency response of the human ear. The ear is relatively insensitive to low frequency sounds compared to mid- and high frequencies as is reflected in the A-weighting corrections shown below. The A-weighted sound level has proven to be a good indicator of community annoyance to noise and is therefore often used in design criteria and community noise standards.

<u>31</u>	<u>63</u>	<u>125</u>	<u>250</u>	<u>500</u>	<u>1000</u>	<u>2000</u>	<u>4000</u>	<u>8000</u>	<u>Hz</u>
-39	-26	-16	-9	-3	0	+1	+1	-1	<b>dB</b>

**L<sub>eq</sub>** L<sub>eq</sub> is the energy equivalent sound level. It is the sound level of a steady-state source that has the same ("equivalent") total energy as the time-varying sound measured over a specific period of time. L<sub>eq</sub> is a single-valued level that expresses the time-average (total energy of a varying or fluctuating sound level and is an A-weighted level.

L<sub>dn</sub> is the day-night sound level, which is calculated from the following equation:

$$L_{dn} = 10 \text{ Log } 1/24 [15 \times 10^{(L_d/10)} + 9 \times 10^{((L_n+10)/10)}]$$

**L<sub>dn</sub>** L<sub>d</sub> is the L<sub>eq</sub> for the 15 daytime hours between 7 AM and 10 PM and L<sub>n</sub> is the L<sub>eq</sub> for the 9 nighttime hours between 10 PM and 7 AM. This equation adds a 10 dB penalty to the nighttime L<sub>eq</sub> to account for the fact that noise is more disturbing at residential locations during the typically quieter nighttime hours. Most federal agencies including the Environmental Protection Agency, Housing and Urban Development and Federal Energy Regulatory Commission use the L<sub>dn</sub> measure for their criteria; in general, an L<sub>dn</sub> of 55 dBA is considered acceptable for residential areas.

**L<sub>%</sub>** The L<sub>%</sub> denotes the percentile sound level, which is the A-weighted sound level that is exceeded for that percentage of time during the measurement period. The usual percentages measured are 1, 10, 50, 90 and 99. The L<sub>10</sub>, or the level exceeded 10% of the time, is typically used as a measure of traffic noise because it represents the intermittent sources. The L<sub>50</sub> is the median sound level and is generally slightly lower than the L<sub>eq</sub> for the period. The L<sub>90</sub> is generally considered the residual or ambient sound level, and is representative of the consistent minimum background sound level for the area. The percentile sound levels are used less frequently since the introduction of the L<sub>eq</sub> and L<sub>dn</sub> measures.