

Human Perception of Sound

The threshold of perception of the human ear is approximately three decibels and a five-decibel change is considered to be clearly noticeable to the ear. This is primarily due to the logarithmic measuring metric typically associated with decibels. As the table below demonstrates, a 10-decibel change would be perceived to be twice as loud.

Perceived Change in Decibel Levels

| Change in sound level | Perceived change to the human ear |
|-----------------------|-----------------------------------|
| ± 1dB | Not perceptible |
| ± 3dB | Threshold of perception |
| ± 5dB | Clearly noticeable |
| ±10dB | Twice (or half) as Loud |
| ± 20dB | Fourfold (4x) change |

Distance Attenuation Estimations

When the distance is doubled from a Line source the sound level decreases three decibels.

Example - if a sound level is: 70 decibels at 15 meters it will be
67 decibels at 30 meters, and
64 decibels at 60 meters.

When the distance is doubled from a Point source, the sound level decreases six decibels.

Example - if a sound level is: 95 decibels at 15 meters it will be
89 decibels at 30 meters, and
84 decibels at 60 meters.

Simplified Understanding of Decibel Scales

The following is a simplified explanation on how to understand Decibel (dB) ratings and how the number (i.e. 50dB) relates to a common noise we can associate with, in our environment.

On the decibel scale, the smallest audible sound (near total silence) is 0dB. A sound 10 times more powerful is 10dB. A sound 100 times more powerful than near total silence is 20dB. A sound 1,000 times more powerful than near total silence is 30dB.

Any sound above 85dB can cause hearing loss, and the loss is related both to power of the sound as well as the length of exposure.

You know that you are listening to an 85dB sound if you have to raise your voice to be heard by somebody else.

Eight hours of 90dB sound can cause damage to your ears; any exposure to 140dB sound causes immediate damage (and causes actual pain).

Decibel Levels of Common Noise Sources

Many different properties affect the noise level of a specific source type. For example, three lawn mowers may have three different noise levels because of differences in each specific piece of equipment. Noise level also depends on the distance from the noise source and the attenuation of the surrounding environment.

Here are some examples of common sounds and their decibel ratings:

| Decibel Levels of Common Sounds | |
|---------------------------------|----------------------------|
| 140dB | Jet engine at 5 meters |
| 130dB | Jet aircraft at 100 meters |
| 120dB | Rock concert |
| 110dB | Pneumatic chipper |
| 90dB | Chainsaw |
| 80dB | Heavy truck traffic |
| 70dB | Business office |
| 60dB | Conversational speech |
| 50dB | Lbrary |
| 40dB | Bedroom |
| 30dB | Secluded woods |
| 20dB | Whisper |

Rules of Thumb

When a sound increases by 10 Decibels, the subjective response is a doubling od loudness.

Example: 60 decibels to 70 decibels = twice as loud

Perceived change in loudness:

- + 1dB - UNNOTICEABLE
- + 3dB - BARELY NOTICEABLE
- + 5 dB - QUITE NOTICEABLE
- + 10dB - SOUND IS TWICE AS LOUD
- + 20dB - SOUND IS FOUR TIMES AS LOUD

When the distance is doubled from a "point" source the sound level decreases by six decibels.

Example: 15 meters = 60 decibels
 30 meters = 54 decibels
 60 meters = 48 decibels