

## Noise – how it is measured ...

### Did you know that...

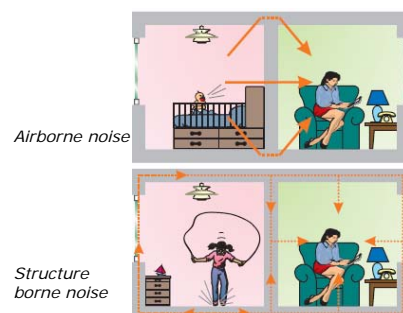
... noise is not a physical term?

Noise is sound which disturbs or is a danger to the health of humans. It is therefore in the medicinal-psychological category. What a human finds as disturbing also depends on the surroundings and situation.

Our hearing recognises sounds as information. Continuous noises are therefore not often consciously recognised. It is only when the level of sound changes its tone or pitch that we really hear it. The quicker the pitch changes or the more impeding the tone is, the likelier it is that the sound will be determined as noise.

... sound is transmitted through air and materials ?

Sound arises through vibrations in solid materials, liquids or gases (air). Depending on the direction of transmission one speaks of airborne or structure borne noise. Normally more than one direction is involved.



... sound moves in air like ripples on water ?

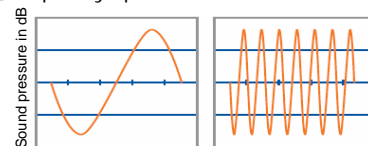
The stronger the pressure differences - the higher the wave - is called sound pressure. It can be extremely different - from a light ticking of a clock to the blast of an explosion. Sound level is measured in Decibels (dB).

The number of waves (or vibrations) per second is called frequency and is measured in Hertz (Hz). A sound is made up of a number of tones in differing frequencies.

Deep tones = low frequencies = fewer vibrations per second;

High tones = high frequencies = many vibration per second.

The typical assembly of deep, middle and high tones make up the „frequency spectrum“ of the sound.



... you cannot hear nothing ?

Of course, you say. And therefore the scale of measuring sound pressure has been defined that way: the dB-scale begins at the threshold of sound of 0 dB. The pain-threshold of hearing is arrived at approx. 140 dB.

#### Note:

No sound level can ever exceed 194 dB - sound pressure then becomes atmospheric pressure.

#### Some typical sound levels

Sound source	Distance	Sound level
Rustling leaf	1 m	10 dB
Ticking clock	1 m	20 dB
Light music	1 m	40 dB
Normal speech	1 m	50-60dB
Car	7 m	80 dB
Heavy truck	7 m	90 dB
Pneumatic hammer	7 m	90-100 dB
Jet aircraft	20 m	120-130 dB

## ... and how it is heard

...80 is not the same as 80 ?

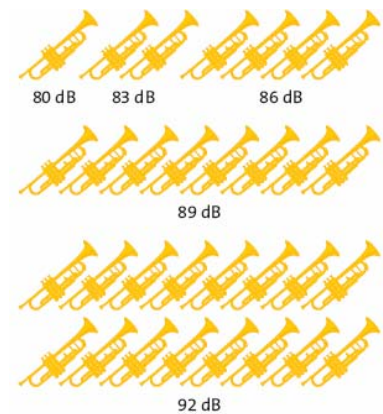
The human ear is not only sensitive to sound pressure. It is more sensitive to high pitched than low pitched sounds. This has something to do with the size of the sound waves – which need to be imagined in meters and centimeters. The higher the frequency, the shorter the waves. That is why high frequency sounds pass easier through holes than low-frequency sounds (they are more impeding) – and therefore „fit“ easier into the diameter of the ear.

A high tone with 80 dB sound pressure therefore seems to be louder than a deep tone also with 80 dB. The so-called A-weighted sound pressure – given as dB(A) takes this into account: it weighs the sound level in accordance with the frequency-dependence of sound reception. In measurement, a part of the sound energy in the lower frequencies is filtered out in order that this sound level can be adapted to physiological reception.

...two times 80 is not 160, rather 83 ?

If we were to measure sound pressure in the standard units of Pascal (Pa), we would have to deal with values in their millions – as the human hearing range is this wide. In order to make the values simpler to oversee, the dB scale is not linear but logarithmic. This means that if a loudspeaker was giving off a sound level of 80 dB and a second loudspeaker with the same sound energy was added a sound level of 83 dB would be reached – and not 160.

**Sound level – calculate in decibels**



**Rule of thumb:**

The increase or decrease in sound level of 10 dB is recognised as a doubling or halving of sound level (logarithmic value). One therefore needs approx. ten to twelve sound sources (90 dB) to have the impression of hearing twice as loud as one.

This also equals our recognition: two loudspeakers do not seem twice as loud as one, rather only as a little louder.

**Note:**

A difference of 1 dB can be recognised by young people with healthy ears.

...you can hear tones from 16 Hz to 20,000 Hz ?

Also as a young person. As you grow older this range shrinks dramatically.

What lies above this frequency is called ultra-sound and below 16 Hz is called infra-sound.

For acoustics in buildings, the frequencies between 100 to 4,000 Hz are decisive: the range within which one hears best.