Committing to the future

2011

Measuring Instruments For Indoor Air Quality, Light And Sound

CH_4

C_3H_8

CO

CO_2

Lux

dB

kHz

°C

%RH

m/s

hPa

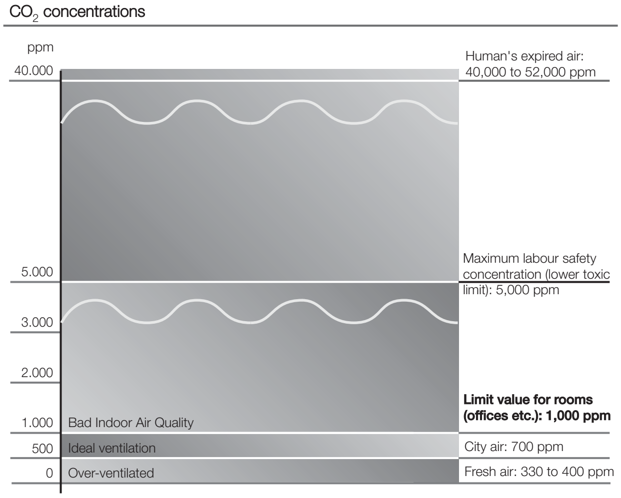
V

CO_2 measurement engineering

Why CO_2 measurement?
CO_2 concentration is used as an indicator when assessing indoor air quality. If the CO_2 concentration in indoor air is too high (limit value: 1000 ppm), the air feels „stuffy and stale“.

Bad air quality in rooms (e.g. offices) can lead to tiredness, lack of concentration and illness (Sick Building Syndrome SBS) and is caused, in many cases, by insufficient ventilation.

The CO_2 concentration in demand controlled ventilating (DCV) systems is used to regulate the supply of fresh air. Stationary CO_2 transmitters are used and should be checked on a regular basis using hand-held measuring instruments.



The parameter light

Approximately 80% of all sensations are experienced by the eye. Light is required for this purpose.
Approximately 25% of human energy is needed for the sight process.

Spectral response of the eye
Light is made up of very high electromagnetic oscillation between 380 and 770 nm. They are experienced by the eye as light.

Light intensities
Humans are day-active creatures, i.e. we are used to a light intensity such as that which is available during the day. Values lie between approx. 5000 Lux on a dull winter’s day and approx. 100 000 Lux on a sunny summer’s day.

The light intensity of artifical lights is ususally between 100 and 1000 Lux.

Effects
Fatigue on account of too little light occurs more in the organism as a whole than in the eye itself. For this reason, insufficient or bad lighting conditions cannot be identified as the cause of accidents or fatigue.

According to documentation available approx. 30% of all accidents result directly or indirectly from inadequate lighting. In the interest of accident prevention it is imperative that steps are taken to monitor the situation.

Different light intensities are recommended by standards bodies, depending on the task. Light intensities of approx. 100 to 250 Lux are sufficient for simple tasks. A minimum of 1000 Lux is required for precision work.

Light intensity Unit: Lux (lx) Light intensity is the ratio of the light flux on an area to the area.	**Light flux:** Unit: lumen (lm) Light flux is the total radiation power emitted from a light source and photometrically assessed.

$$\text{Light intensity (lx)} = \frac{\text{Light flux (lm)}}{\text{Area (m}^2\text{)}} \qquad E = \frac{\Phi}{A}$$

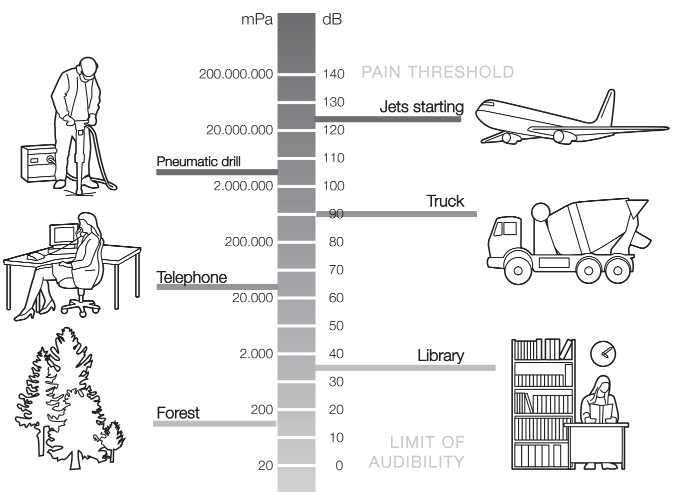
The parameter sound

Sound waves are fluctuations in air pressure
If they are audible to the human ear we talk about audible sound. The fluctuations in pressure occurring with audible sound are extremely low. At a normal pressure of 1013 mbar even changes in the µPa range can stimulate the human ear. A suitable pressure sensor with the appropriate sensitivity is the microphone.

Sound level meters have been designed for measurements in the free field. There is also a free field if the level falls by 6 dB per duplication of the distance from the source. This is the case in most rooms.

Example:
– Office with carpet, curtains and partitions = Free field !
– Cellar with concrete walls, without furniture, highly reverberant = Reverberant field !

Measuring tips
Measuring conditions are ideal if there are absolutely no interfering objects in the sound field. This would be the case, for example, on top of a mountain. Because there are no walls or ceilings on which sound can be reflected, free dispersion is guaranteed (free field). In a closed room there is usually a wall opposite the noise source. This can cause reflections which distort the measured result (reverberant field).



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