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10 Golden Rules for Dust Control

Rule 6: Adequately ventilate the workshops

Despite the possibility of enclosing systems or of extracting the dust directly at the point of origin, it is sometimes not possible to entirely prevent the release of dust. Especially the particularly treacherous respirable dust is not visible to the naked eye and can remain for hours in the air after the end of the work process. Adequate ventilation of the workshops (general ventilation) is therefore essential. The uncleaned air is thereby displaced or diluted by a targeted air supply. Fundamentally, a distinction is made between **natural** and **mechanical ventilation**.

Natural ventilation

Natural ventilation replaces the room air by differences in pressure. The driving forces are wind or temperature differences in the exterior of the building. Natural ventilation is regulated by windows, doors or specific supply and discharge air openings. On the wind-facing site (windward) of buildings excess pressure is formed, on all other exterior surfaces of the building there is a negative pressure. Therefore, the result, depending on the arrangement of openings or leakages of the building, is an inflow of outside air on the side with excess pressure and an outflow of ambient air on the side with negative pressure. Also in this case, the principle applies: without supply air there is no exhaust air! For the air that is discharged from a room, a corresponding amount of air must flow in as replacement, otherwise even the largest exhaust air openings remain ineffective. The supply air must of course not be taken from work areas with dust exposure.

Unexpected effects can severely impair natural ventilation. As a result of heated air and due to resulting thermal updraught, unexpected flows and pressure differences are generated within the room. As a result of strong winds or extreme temperatures, the flow of natural ventilation can come to a standstill or even change its direction.

Opening windows as required (window ventilation) is the simplest and most well-known ventilation principle. This solution is suitable for work

- of a small scope,
- with small quantities,
- with substances that possess a low hazard potential.

In the process the occurrence of draughts, cooling down and undefined air flows in the room are to be observed.

A more targeted ventilation can be accomplished using specific supply and discharge air openings. These must be arranged in such a way that the air flow captures the hazardous substances as completely as possible and leads them away via the shortest route. In the planning, all heat sources, all sources of hazardous substances and their individual movement are to be taken into account. Attention should be paid that the air flow is supported by the existing thermal processes, by, for example, arranging the exhaust air openings as high as possible and the supply air openings as low as possible. The dimensioning is to be undertaken in such a way that an adequate replacement of air can occur even under unfavourable conditions. The cross-section of the ventilation openings should be adjustable, for example using adjustable slats and shutters or using fans and flaps in windows, doors, wall openings, shafts, louvres, domes, lanterns or deflectors.

Interference of the existing air flows, for example by moving people or vehicles but also as a result of the opening of doors and gates or as a result of exterior wall temperatures changing with the seasons, is to be taken into account.

In the event of high noise levels within the work rooms, noise protection measures are to be provided for the supply and discharge air openings.

Mechanical ventilation using heating, ventilation and air conditioning systems (HVAC systems)

An optimum adaptation to the specific application, in particular in the event of high level requirements, is achieved using mechanical ventilation. Compared with natural ventilation it is associated with considerable investment and operating costs, it is however independent of the weather. In addition the air flow can be adapted to the spatial conditions and the concentration of hazardous substances. Interfering draughts are thus avoided to the greatest extent. The supply air can be cleaned and conditioned with regards to temperature and moisture, recovery of the heat from the exhaust air is possible. Using dosed high or negative pressure, spreading of the dusts into other work rooms is avoided.

In each case the ventilation system must be able to reliably discharge the released dusts. After adequate cleaning the exhaust air can be fed back into the room as recirculated air. It should thus reach virtually fresh air quality (see rule 4), the corresponding occupational exposure limits are to be reliably complied with.

Separation of dust

For the separation of dust the following methods are used:

- cross-flow separation (gravity, centrifugal force and electrical field),
- inertial separator (utilising the inertia effects incl. impact effects),
- filtering effect of porous materials and
- wet separator.

Most frequently, filtration materials, predominantly fibre filters (fabric, fibre layers) or porous solids (ceramics), are used. In the event of higher dust contents, dedusting filters are used. In the process, the filter cake is detached (dedusted) by shaking, pulsating or by pressurised air surges.

A smart variation of workshop ventilation is the creation of spatially separated areas in which the employees carry out certain activities. This also includes, for instance, mechanically-ventilated driver's cabins of cranes or vehicles or control rooms. As a result of being sealed towards the exterior or as a result of over-pressure in the cabin, an overflow of dust particles from the surrounding air is avoided. Normally, the supplied air is cleaned by means of suitable particle filters.

The air exchange rates that are sometimes quoted can serve at most as a rough indication for the design of ventilation systems. For the selection and correct layout, the following aspects are to be assessed by way of preference:

- construction and spatial dimensions of production equipment and production halls,
- required air quality in the work areas (occupational exposure limits – OELs),
- thermal conditions in the work area,
- dispersion of heat and supply air flows,
- arrangement of equipment for air distribution.

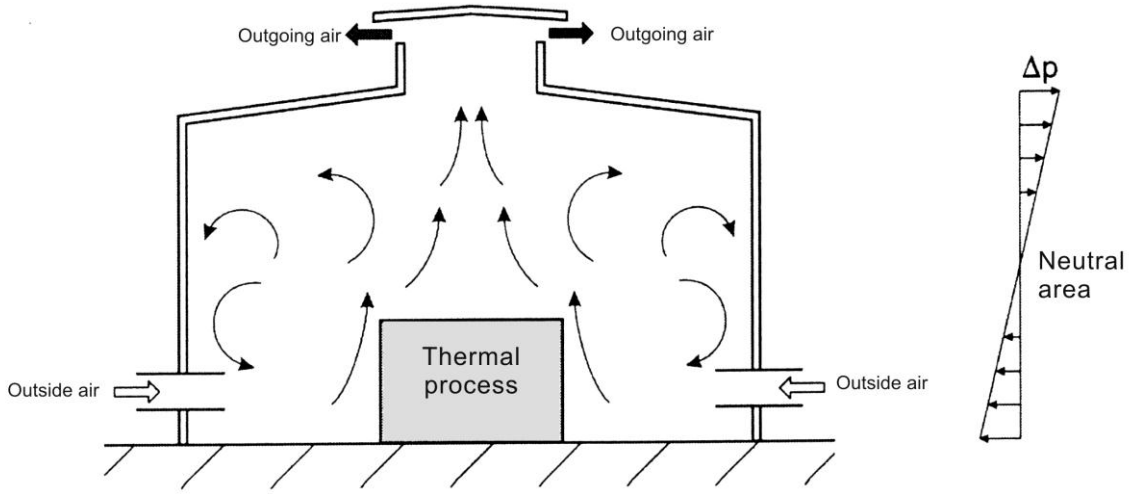

Figure 1: Principle of natural ventilation in accordance with EN 12792

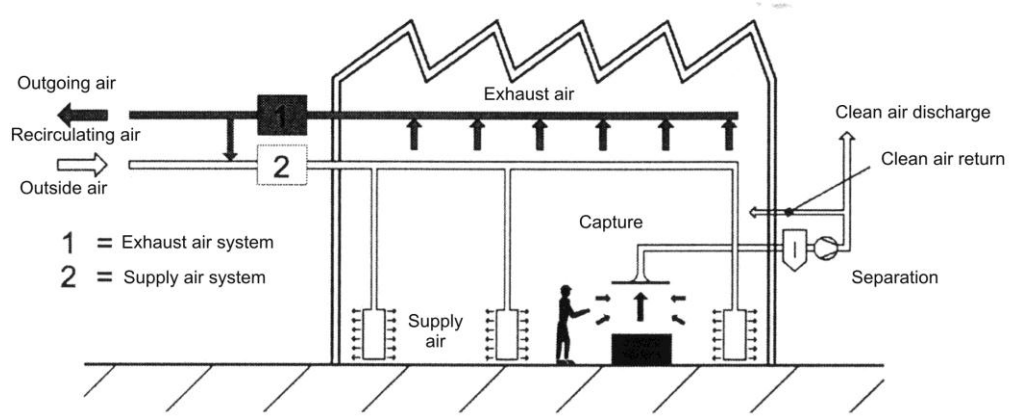

Figure 2: Principle of mechanical ventilation in accordance with EN 12792