6. Ventilation and humidity

The condition of the interior space should always be comfortable for the occupants of the building. The hygienic minimum for ventilation is in most cases provided by the natural flow of air through the unsealed spaces of the windows and doors. It is necessary to periodically ventilate the rooms, preferably for a short time and when the windows are fully opened
For the appearance of mold, a humidity of 65-85% is required. Typically, mold appears in cellars, bathrooms, window frames, around air conditioners and cold walls where condensation may form. The cold walls are mostly around the thermal states. Thermal motifs occur in places where there are significant external heat flows such as corners, terraces, windows, and corners of the building. In particular, mold may also develop in places where cold walls are blocked by shelves that prevent air exchange.
An average household contributes to the release of about 10 liters of water in the surrounding air per day. The greater the percentage of bathing and cooking; a small part comes from breathing. Another source of water in the air is the presence of plants in the room. The water used for watering is ultimately released into the air. Particularly during summer fungal spores are present in the ambient air. In dry, hot weather above all black mould releases large amounts of spores to the air. Spores in the ambient air are then regularly found in interior rooms. For intact living space constructions these normal spores have no chance to survive. Under unfavourable conditions in the interior rooms, however, fungal spores thrive and both cause damage to the building structure and impair the health of the tenants.

For their growth mould spores require high relative humidity (65 - 85%). In interior rooms they therefore preferentially infest cellars, bathrooms, window frames, air conditioning units, air humidifiers and cold wall areas, where condensation can occur. Cold wall areas are found above all in connection with "heat bridges". Heat bridges arise where there are significant heat flows to the outside, such as junctions to balconies with continuous concrete slab, in the vicinity of windows or in building corners and of course wherever thermal insulation is defective or lacking. In particular, mould can grow where cold wall areas are blocked by cabinets or book shelves and no air exchange can take place.

6.1. Relationship between humidity and ventilation

Air always contains water or moisture. A measure of its level is the relative humidity. 0% relative humidity means there is no water vapour in the air. 100% relative humidity means the air is saturated with water vapour and can no longer take up additional water. This case occurs, for example, with fog, when virtual drops of water appear to fall from the air. The capacity of the air to take up water vapour depends very strongly upon the temperature. Cold air has a very limited capacity for taking up water, while warm, dry air has a very high capacity. This is the reason that ventilation is so important in order to expel the accumulated humidity from rooms: The cold air, which contains very little water vapour, is heated in the flat. In the absence of sources of humidity in the flat, this would lead to very dry air with low relative humidity. When sources of humidity are

present, the heated and In the meantime dry air can take up this water vapour without problem. One cubic metre of air can take up around 17 grams of water vapour before the air becomes saturated. However, it must be considered that a relative humidity much higher than 60% should not be exceeded, as this value is considered to be the limit value for a healthy room climate.

6.2. Relationship between humidity and heating

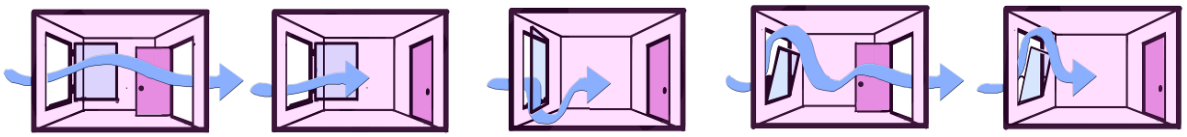
Ventilation losses represent a large part of the overall heat losses in a home. In old buildings this is around 40%, and in low-energy buildings this can be as much as 60%. Not infrequently half of the room heat energy is "thrown out the window" by to improper ventilation.
Nevertheless, to conclude that one should no longer ventilate or ventilate only as infrequently as possible would be false. The outer walls of buildings are not only nearly impermeable to air and water. Walls do not breathe! One must therefore ensure healthy room air by ventilating reasonably. At the same time, water vapour and the odours and harmful substances accumulating in the flat must be expelled by ventilating.
The art of ventilating correctly, then, consists of ventilating as much as necessary, but no more. In passive houses (see Chapter 7) this is ensured by a ventilation system with heat exchanger or in some houses, without optimised energy consumption, by an exhaust air system (without heat recovery). In most flats, however, the tenants must understand how to ventilate correctly.
Avoid the permanent open tilting of windows
In principle the rule that the humidity accumulating in a flat should be expelled as efficiently as possible without loss of the entire heat stored in the walls and without "cooling down" the flat applies. During the heating period this should not be done by the permanent open tilting of windows, but by cross-ventilation or brief intensive ventilation, with the windows wide open, however only for a few minutes.

6.3. Ventilation installations in households

Depending on how it is achieved, there is natural and mechanical (forced) ventilation.

Natural ventilation is also called aeration and occurs under the influence of either wind or temperature difference.
The time required for proper natural ventilation and full air change in a room is described in the pictures below. The duration depends on the selected ventilation method.
The organisation of good natural ventilation depends to a great extent on the temperature differences, the prevailing wind direction and its average speed in the respective area, and the variations in speed and direction during individual seasons as well as during the day.
The shape of the building and the surrounding environment also affects it.

Appropriate layout of the ventilation openings, windows and spaces is necessary to ensure air movement in the right direction.



A B C D E

1-5 minutes 5–10 minutes 10-15 minutes 15–30 minutes 30–60 minutes

A - Ventilation with wide open windows and doors;

B - Ventilation with wide open windows;

C - Ventilation with few open windows;

D - Ventilation with partially open windows and wide open doors;

E - Ventilation with only partially open windows.

Mechanical ventilation is achieved by creating a system pressure through a fan.

Depending on the type of ventilation, there is local, general exchange and mixed. Local is the one that is installed at a source of harmfulness (odors, dust, etc.). The simplest example of local ventilation is the kitchen absorber. Total exhaust ventilation is the one that feeds and sucks air from the volume of the room. There is, or at least must be, such ventilation in every establishment. Mixed ventilation, in turn, is a ventilation system with simultaneous common and local ventilation in one room.

A key factor in managing the operating costs of buildings is to achieve a comfortable microclimate while reducing energy consumption.

Recovery in ventilation systems is often used to increase the efficiency of these systems and reduce energy costs. Deteriorating environmental and operating costs are decreasing. The advantages of an improved microclimate for the inhabitants are indisputable; it increases the working capacity, reduces the sickness and absences and in this also has a positive economic effect.

Recovery (recuperation - recovery, recovery) - recovery of energy or materials for reuse in the same technological process.

Figure 1 Principe of recuperation

Recovery is a process where exhaust air is used to heat or cool fresh air. Heated or cooled air passes through a heat exchanger and heats or cools the fresh air. This reduces heating and cooling costs by delivering heat from heated domestic air to fresh air, but cold outside air in the winter and back in the summer.