

Operation of ventilation and air conditioning systems in the context of the current Covid 19 pandemic 24.04.2020, Version 2

From an energy and hygiene point of view, ventilation and air conditioning systems are an indispensable prerequisite for the operation of many buildings. Regular maintenance and servicing is of decisive importance for a safe system operation.

Against the background of the current corona pandemic, operators of ventilation and air conditioning systems are confronted with questions regarding the use of the systems, some of which are dealt with in this statement. In this paper, the associations BTGA, FGK and RLT-Herstellerverband summarise the current recommendations and pass them on on the basis of the up-to-date state of knowledge. As soon as further information is available, this recommendation will be supplemented.

Ventilation and air conditioning systems ensure a high degree of safety already when they process the outside air by filtering the supply air, as small particles and droplets can be separated in the system according to the filter class used. Due to the secure supply of purified outside air, the operation of a ventilation and air conditioning system always leads to a dilution of possible contamination and the virus load in a building. In addition, the risk of infection can be reduced by a targeted humidification of the room air. Professional planning, zoning and pressure maintenance also ensure that pollutants from the exhaust air of a room cannot spread throughout the entire building. Recirculated air operation should be avoided if possible.

Basic questions regarding the transmission of corona viruses

According to the current state of knowledge, corona viruses are transmitted by droplet infection. Since aerosol transmission cannot be ruled out, a good ventilation of rooms with the highest possible proportion of outside air is always recommended. This reduces the viral load in the room by supplying filtered and processed fresh air and removing polluted room air. The operation of ventilation and air conditioning systems leads to dilution effects and thus to a reduction of the viral load in the room. This results in the following recommendations for the operation of the systems:

- Do not switch off the ventilation and air conditioning systems, do not reduce the fresh air volume flows, but increase them if necessary.
- Reduce recirculation air proportions, if there are any in the systems, in favour of fresh air proportions.
- If necessary, extend the operating times of the systems before and after the regular periods of use.
- Secondary air units (fan coil units, DX indoor units, induction units, etc.) are only effective as intended in the respective individual utilisation unit. They do not transfer the air to other utilisation units and are therefore not critical. The primary air from induction units contributes to a dilution of a possible virus load in the rooms. When using systems without direct primary air connection (DX indoor units, possibly fan coil units), adequate ventilation must be ensured by ventilation systems or window ventilation.

- All ventilation systems achieve a dilution effect through the exchange of air in the respective room - the specific load of possibly existing viruses in a room per m³ decreases. Thus the risk of infection is reduced in principle. The dilution is considerably improved and the viral load is further reduced by the targeted supply of processed outside air and the removal of polluted room air.
- Minimise or avoid overflow of different utilisation units (preferably balanced air volume flows in the utilisation units). It should be noted that overflow in normal buildings via doors, windows and leaks can practically never be ruled out, but switching off the ventilation and air conditioning system would always lead to an increase in the average virus concentration. Systems with humidification should be set in such a way that a beneficial humidity (40 to 60 %) is used, because:
 - the human susceptibility to infections is relatively reduced by a suitable air humidity,
 - if the air is too dry, the droplets shrink more through evaporation and remain suspended for longer (aerogenic transfer),
 - particles adhere better to surfaces at higher relative air humidity and have less tendency to be whirled up
 - most seasonal respiratory viruses are inactivated in the medium humidity range of 40 - 60 %.

Transmission of corona viruses by ventilation and air conditioning systems

A transmission of corona viruses via ventilation/air conditioning systems can be excluded according to the current state of knowledge. Droplets which could contain the corona virus cannot be introduced into the rooms via the fresh air and supply air pipes, also due to the filtration. Exhaust air pipes, which take up exhaust air possibly contaminated with droplets from the rooms, do not transport these into other areas, since the systems are operated in negative pressure and thus no exhaust air can escape even if there should be leaks in the pipes. Depending on the design, leaks in a ventilation and air conditioning unit and a heat recovery unit (HRU) can lead to a small proportion of exhaust air being transferred to the supply air. Correct system planning using modern concepts prevents this from happening by:

- Overpressure in the supply air section compared to the exhaust air section: Due to the arrangement of overpressure and underpressure areas, even heat recovery systems or rotors cannot transfer any exhaust air to the supply air.
- If the supply and exhaust air units are designed separately, e.g. with circuit compound systems to the heat recovery unit, the transfer of exhaust air proportions to the supply air can be excluded.

Filtration

Air filters ensure a significant reduction of dust and aerosol concentrations in ventilation and air conditioning systems and in the supply air of rooms. Already by using filter class ePM1_{≥60} % (previously F7), a significant reduction is achieved, since viruses adhere to particles or are bound in droplets.

Filter maintenance

Viruses are always bound to droplets or dust particles and therefore usually do not float freely in space. They are therefore stored in the filter material like all other particles. Personal protective equipment PPE (protective gowns, gloves, mouth/nose protection FFP3 - possibly differing according to the applicable risk assessment - and protective goggles) must be worn for the maintenance and replacement of loaded filters.

Room air humidity

Room air humidity is a factor in the transmission of viruses. Studies have shown that the transmission of influenza viruses and other respiratory viruses decreases at a lower relative humidity of 40 - 60 %. The latest findings suggest that this also applies to corona viruses. If humidity control is possible with the ventilation/air conditioning system, it should be carried out as follows:

- For systems without humidification, it should be considered which ventilation rates are appropriate under the current personal occupancy levels.
- In systems without humidification, it is also necessary to check which outdoor air rates are appropriate for winter operation, since too high a volume of outdoor air leads to a reduction in the relative humidity of the room air.
- In systems with a dehumidification function, excessive room air humidity should be avoided, since excessive humidity facilitates germ growth.
- For systems without dehumidification, it is also necessary to check which outdoor air rates are appropriate for summer operation, as a reduction in the relative humidity of the room air can be achieved through the outdoor air volume.

Sources:

- [1] Robert Koch Institute (RKI) / CCI: Should ventilation systems be switched off as a precaution against the transmission of COVID-19 ("corona viruses")?
The RKI answered: Since COVID-19 is an infection spread primarily via droplets (and not primarily via airborne infection), it can be assumed, based on the current state of knowledge, that SARS CoV-2 will not spread further via operated ventilation systems (for example in public buildings, hotels).
- [2] COVID-19
Guidance for infection prevention and control in healthcare settings
Department of Health and Social Care (DHSC), Public Health Wales (PHW), Public Health Agency (PHA) Northern Ireland, Health Protection Scotland (HPS) and Public Health England as official guidance:
- [3] WHO, INTERIM GUIDANCE DOCUMENT Clinical management of severe acute respiratory infections when novel coronavirus is suspected: What to do and what not to do: Airborne precautions ensure that healthcare workers performing aerosol-generating procedures use PPE, including gloves, long-sleeved gowns, eye protection and particulate respirators (N95 or equivalent). Whenever possible, use adequately ventilated single rooms when performing aerosol-generating procedures.
- [4] Comment Prof. Dr. med. Dipl.-Ing. Hans-Martin Seipp, Technical University of Central Hesse, 17.03.2020 Extract:
Ventilation and air conditioning systems can only act as a source for third parties if:
A) Recirculated air is run WITHOUT HEPA filters (HEPAs are completely safe from H-13 on!)
A reduction of the risk starts from F-9 - depending on the load condition.
B) There is not enough air exchange supplied to the room.
- [5] Air, Surface Environmental, and Personal Protective Equipment Contamination by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) From a symptomatic Patient, JAMA, published online March 4, 2020
- [6] Dr. med. Walter Hugentobler, Comment on COVID-19 guidance, 23.03.2020
- [7] Annual Review of Virology, Seasonality of Respiratory Viral Infections Miyu Moriyama, Walter J. Hugentobler and Akiko Iwasaki, 2020
- [8] POSIZIONE DI AiCARR, SUL FUNZIONAMENTO DEGLI IMPIANTI DI CLIMATIZZAZIONE DURANTE L'EMERGENZA SARS-COV2-19, AiCARR 2020

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