

## **Operation of ventilation and air-conditioning systems under the boundary conditions of the current Covid-19-pandemic 22.04.2020, Version 2**

Ventilation and air conditioning systems are an essential prerequisite for the operation of many buildings from an energy and hygienic point of view. Regular servicing and maintenance are of crucial importance for safe plant operation.

Against the background of the current corona pandemic, operators of HVAC systems will be confronted with questions about how to deal with the systems, some of which will be dealt with in this statement. The associations BTGA, FGK and RLT-Manufacturer Association summarize the current recommendations with this paper and pass them based on the current state of knowledge. This recommendation will be completed as soon as further information will be available.

Ventilation and air conditioning systems ensure a high level of safety through the treated outside air by filtering the supply air, since small particles and drops can be separated in the system according to the filter class used. Due to the ensured supply of filtered outside air, the operation of a ventilation and air conditioning systems always leads to a dilution of possible pollutant as well as the viral load in a building. In addition, the risk of infection can be reduced by targeted humidification of the indoor air. Professional planning, zoning and air flow pressure strategy also ensures that pollutants from the extract air of a room cannot be distributed throughout the building. Recirculation mode should be avoided if possible.

### **Fundamental questions about the transmission of corona viruses**

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

Based on that, the following recommendations for the operation of the systems result:

- Do not switch off ventilation systems, do not reduce the outside air volume flows, but increase them if possible.
- Reduce the recirculating air, if present in the systems, in favour of the outdoor air.
- If necessary, extend the operating hours of the plants before and after the regular time-of-use.
- Systems that work with secondary air (fan coil units, induction devices) do not lead to any transmission of pollutants if no additional zones are connected via these devices. Primary air contributes to a dilution of the virus load in the rooms. In systems without a direct primary air connection (DX indoor units, fan convectors if necessary), adequate ventilation by systems or window airing must be ensured.
- All ventilation systems achieve a dilution effect through the air exchange in the respective room, the specific load of possibly existing viruses in the room per m<sup>3</sup> decreases. In principle, this reduces the risk of infection. Through the targeted supply of treated outside air and through the removal of polluted indoor air, the dilution is significantly improved, and the viral load is further reduced.

- Minimize or avoid overflow of different zones (balanced air volume flows in the zones if possible). It should be noted that overflow in normal buildings due to 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 mean virus concentration. Systems with humidification should be set to a healthy humidity level (40 to 60 %) because:
  - vulnerability of humans to infections is relatively reduced by healthy air humidity,
  - if air is too dry, droplets shrink more due to evaporation and remain suspended for longer (aerogenic transmission),
  - particles adhere better to surfaces and are less whirled up at higher relative humidity and
  - most seasonal respiratory viruses are inactivated in the medium humidity range of 40-60 %.

### **Transmission of corona viruses by air conditioning systems**

According to current knowledge, the transmission of corona viruses via ventilation and air conditioning systems can be excluded. Due to filtration, droplets which could contain the corona virus cannot be introduced into the rooms via the outdoor and supply air ducts. Extract air ducts that take in any droplet-contaminated extract air from the rooms do not transport it to other areas, as the systems are operated in negative pressure and therefore no extract air can escape even if the ducts leak.

Leakages in the air handling unit and in the heat recovery unit (HRU) can lead to the transmission of a small proportion of extract air to supply air depending on the type of the unit. Correct system design with modern concepts prevents this by:

- Overpressure in the supply air section compared to the extract air section:  
Due to the arrangement of overpressure and underpressure areas, no extract air can be transferred to the supply air even by heat recovery systems such as rotors.
- If the supply and extract air units are designed separately, e.g. with circuit compound systems to the HRU, the transfer of extract air components into the supply air can be excluded.

### **Filtration**

Air filters provide a significant reduction of dust and aerosol concentration in ventilation and air conditioning systems and in the supply air. A significant reduction is already achieved by using the filter class ePM1  $\geq$  60 % (formerly F7), since viruses adhere to particles or bound in droplets.

### **Filter maintenance**

Viruses are always bound to droplets or dust particles and therefore do not floating freely in spaces. Therefore, they are stored in the filter material like all other particles. Personal protective equipment PPE (protective gowns, gloves, mouth / nose protection FFP3 – possibly deviating from the risk assessment – and safety glasses) must be worn for the maintenance and replacement of loaded filters.

### **Room air humidity**

Indoor air humidity plays a role in the transmission of viruses. For the transmission of flu viruses and other respiratory viruses, it is known from studies that the transmission is minimum at a relative air humidity of 40-60 %. The latest findings suggest that this fact also applies to corona viruses.

If air humidity control is possible with the ventilation / air conditioning system, this should be done as the following:

- relative air humidity should be kept in the comfort field range between 40 – 60 %.

Systems without humidification:

- it is important to consider which ventilation rates are appropriate under the current occupancy rates,
- it should also be checked for winter operation which outdoor air rate is appropriate since cold, dry outdoor air leads to a reduction of the relative humidity of the indoor air.

### 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 primarily spread via droplets (and not primarily transmitted via air), it cannot be assumed, based on the current state of knowledge, that SARS-CoV-2 will be further spread via operated ventilation systems (e.g. 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  
Technische Hochschule Mittelhessen 17.3.2020 Excerpt:  
As a source for third parties, AHU systems can only work if:  
A) Recirculated air travels WITHOUT HEPA filters (HEPAs are completely safe from H-13 on!)  
From F-9 - depending on the load condition - a reduction of the risk begins.  
B) brings too little air exchange into 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] Walter Hugentobler, MD, Comment on COVID-19 guidance, 23.03.2020

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