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RECOMMENDATION concerning HYGIENIC ASPECTS IN AIR HANDLING UNITS

This recommendation gives basic guidance for hygiene of air handling units. It addresses the essential issues to be taken into account in development, manufacturing, specifying, installation, commissioning, operation and maintenance of complete units, components and sections. This recommendation also takes into account the economic and life-cycle issues thus providing guidance how the technical issues of air handling units could best serve the overall targets of healthy and sustainable building.

SUMMARY

The purpose of air distribution system is to provide healthy, fresh and clean air into the building. However, the air distribution system may become a major odour and contaminant source in the building. Air handling units are often blamed to be a problem source and even main contributor to the sick building syndrome (SBS). However, with proper attention to hygiene aspects the SBS risk can be minimised. It is possible to eliminate this risk nearly completely , not only in newbuilding but also in renovation and during operation.

Health aspects have also to be taken into account in design and construction. Throughout the construction process all components of the air distribution system shall be protected properly, and before handing over the entire installation shall be inspected, and cleaned if necessary.

The air distribution system, especially if cleaning is completely neglected, may become a source of health problems, too. Dust and moisture together will make a good base for bacteria and mould growth.

It is, for the reasons above, necessary to build the air distribution system so that it can be kept clean enough during the whole lifetime of the installation. Impurities shall be stopped by air filters at all inlets.

Benefits from a clean installation are many – varying a lot but typically 10...100 - times higher than the relevant maintenance costs.

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AIR HANDLING, AIR CONDITIONING AND REFRIGERATION

NECESSITY OF CLEAN INSTALLATIONS

The purpose of air distribution system is to provide healthy, fresh and clean air into the building.
It has been, however, revealed during the recent years that the air distribution system may become a major odour source in the building, in some cases even more emitting than people, building and furnishing materials and activities indoors. The basic justification for clean installations are presented in EUROVENT Recommendation 07, and valid also for air handling units.

BASIC REQUIREMENTS

The air distribution system shall be designed, manufactured and installed in such a way that cleaning of all internal surfaces and components or the AHU is possible. See EUROVENT Recommendation 07.

DESIGN ASPECTS

Sufficient space shall be arranged next to the equipment for maintenance and cleaning operations. Basic space requirements are presented in prEN 13779.

DESIGN AND CONSTRUCTION (INCL. MANUFACTURING AND INSTALLATION ASPECTS)

GENERAL

In manufacturing and construction Recommendation 07 and ENV 12097 give the basic aspects to be taken into account. Special attention shall be paid on the following aspects:
-complete cleaning before shipment
-during transportation and storage, the AHU must be sealed in a way that contamination is avoided
-after installation on site, the AHU must be cleaned completely

The following examples of material, access and installation requirements, presented in prEN 13053, are for normal (e.g. residential, office) and high hygiene level (e.g. hospitals) applications. For each criterion they can be applied independently of each other. More information concerning design criteria, maintenance intervals and operation aspects can be found in VDI 6022.

REQUIREMENTS FOR NORMAL APPLICATIONS

Accessibility/access doors

Every section shall have at least one access door or easily removable access panel, to guarantee easy access for cleaning and servicing the components and the casing, unless the section is accessible through another section. The elements of air handling units shall be accessible upstream or downstream for cleaning purposes, or alternatively they shall be easily and safely removable; this shall be taken into account when designing the fittings for pipes and ducts.

Cleaning and maintenance

Air handling units shall be designed and constructed such that cleaning and maintenance can be easily carried out. To enable this the inner surfaces of the equipment shall be readily cleaned*.*

Air tightness

The ingress of unfiltered air through casing leakage can cause hygiene problems. Therefore, the casing air tightness shall comply with the requirements specified in table 2 of EN 1886.

Filters

Filter bypass leakage shall not exceed the value given in table 4 of EN 1886.

Humidifiers **(for more information: look at VDI 6022)**

Air humidification plants shall be operable in such a way that they do not cause any hazard to health.

Only humidifier water contain bacteria in a concentration that is not detrimental to health is used for air handling purposes. If it is suspected to contain more bacteria, the humidifier water shall be checked for pathogenic bacteria.

The upper limit value for non-pathogenic bacteria is 10,000 cfu/ml (cfu= colony-forming unit). However, from a bacteria content of 1,000 cfu/ml onwards in the humidifier water, the plant should be checked and cleaned. National authorities can specify additional requirements to these default values.

A person responsible for the maintenance and inspection of the humidification plants should be appointed. All measures taken shall be recorded.

The manufacturer's maintenance instructions shall be available and observed. The cleaning and maintenance intervals for each individual plant shall be determined and specified from actual operating experience, e.g. by means of periodical water analyses (determination of the number of bacteria, dissolved solids content) and by means of visual checks (dirt accumulation).

In the case of humidifiers operating with recirculating water, from the point of view of reducing the number of bacteria, the dissolved solids content, and the dirt particles, it is better to empty the tray completely rather than to bleed off continuously.

Disinfectants can be used during cleaning after all the accumulated dirt has been removed, however, disinfectants shall not get into the room air through the humidification process.

Sufficient overflow shall be arranged in evaporative humidifiers. Ultraviolet treatment and regular flushing are recommended. In case of steam humidification, the steam shall not contain any substance hazardous to health.

Coils

The same requirements for drainage, cleaning, materials and disinfection apply as for humidifiers.

For cooling coils that can dehumidify the following points shall be observed:

a) No water droplets shall enter the components or sections downstream of the coil.
b) The design of the drain pan shall not allow the retention of condensate for long periods, therefore the drain pan needs to be sloping.
c) The connecting pipes shall be insulated where they pass through the casing, so that there will be no condensate from them.
d) It shall be possible to install a correctly designed drain trap as a part of the drainage system.
e) If there is a droplet eliminator, it or its parts shall be removable for cleaning purposes, without affecting any of the other unit components.
f) It shall be possible to clean the cooling coil from both sides in situ, or alternatively, it shall be removable for cleaning purposes.
g) The drain trays of cooling coils shall be made of corrosion resistant materials and be readily cleaned.

Sound attenuators

The surfaces of sound attenuators shall be able to withstand abrasion, and shall not rot. No fibres shall be loosened during service.

Fan position

The position of the fans in the air-handling unit shall be arranged so that proper pressure conditions are maintained to avoid any risks of leakage of contaminated air. This is especially important for units where transfer of particles and gases are possible within the heat recovery section.

Drainage and prevention of condensation

Penetration of rain or snow into the unit should be prevented by protecting the outdoor air openings against rain and snow and having low air speed into outdoor air openings. In cold climates it can be necessary to have a watertight plenum section between the outdoor opening and the unit (or the first section) which guides the water immediately out of the building and/or is connected to drain.

NOTE: Cold bridges in cabinets introduce a risk of condensation on the inner or outer surfaces, depending on which side of the unit is colder. The bridging factor class, as defined in clause 7 of EN 1886, should therefore be selected to take into account the climatic conditions in which the unit is expected to operate.

Instructions for maintaining cleanliness

The manufacturer shall provide instructions for cleaning, including recommendations for cleaning intervals, methods, and equipment to be used.

REQUIREMENTS FOR SPECIAL APPLICATIONS

Air handling units with high hygiene requirements (hospitals, clean rooms etc.) shall also meet the requirements defined in this clause.

Accessibility

The components of air handling units shall be accessible for cleaning purposes, through access doors both upstream and downstream, or alternatively they shall be easy and safe to remove.

Smoothness

Any half-closed profiles or joints that can accumulate pollutants and dirt, and are difficult to clean, shall not be accepted, especially in the cabinet floor. All fibrous and porous material, except replaceable components like filter cells, shall be protected by suitable smooth material, which can withstand frequent cleaning. Screws and other similar components shall not protrude from the internal walls.

Inspection windows and lights

All units shall be provided with inspection windows and internal lighting for checking at least the fans, filters, humidifiers and cooling coils.

Drainage/prevention of condensation, humidifiers

For evaporative humidifiers a continuous overflow shall be arranged. Ultraviolet treatment and regular flushing are recommended*.*

For non-pathogenic bacteria contained in the humidifier water used for air handling purposes, the upper limit value is 1,000 cfu/ml. However, from a bacteria concentration of 100 cfu/ml onwards in the humidifier water, the plant should be checked and cleaned. National authorities can specify additional requirements to these default values.

It is reasonable to use ultraviolet sterilizers for reducing the number of bacteria. When designing and adjusting them, however, care shall be taken that no ozone is generated and enters the served space. Biocides can only be used if, under no circumstances, they are detrimental to the health of the occupants in the areas served by the air-handling unit.

CRITICAL COMPONENTS

Special attention has to be paid on the cleanliness of **air filters, sound attenuators** and **humidifiers.**

The condition of these components is generally a good indicator of need for cleaning, so it is recommended to start inspection from these components. After cleaning, all these components shall be inspected to ensure that no damage has occurred and that the cleanliness and functioning are as intended.

CLEANING ASPECTS

See Recommendation 07, which can be applied for AHU cleaning.

References

EN 1886 Ventilation for buildings - Air handling units - Mechanical performance
prEN 13053 Ventilation for buildings - Air handling units - Ratings and performance for units, components and sections
ENV 12097:1996 Ventilation for buildings - Ductwork - Requirements for ductwork components to facilitate maintenance of ductwork systems
prEN 13779 Ventilation for buildings - Performance requirements for ventilation and air-conditioning systems
VDI 6022 Hygienic aspects for the planning, design, operation and maintenance of air-conditioning systems. 1998 (in German and English)
Recommendation concerning cleanliness of ductwork in ventilation systems. ***EUROVENT Recommendation 07*****.**

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