Federation of European Heating, Ventilation and Air Conditioning Associations

Address:
Rue Washington 40
1050 Brussels
Belgium

- www.rehva.eu
- info@rehva.eu
- Tel: +32 2 514 11 71
- Fax: +32 2 512 90 62
Use of REHVA Guidebook
Power Point Presentations

• This Power Point Presentation can be freely used for training purposes by REHVA members.
• It is prepared by the main author to the REHVA Guidebook.
• Please refer the original author always when making the presentation.
• Inform REHVA secretariat each time the presentation is used: info@rehva.eu
Cleanliness of ventilation systems
a REHVA guidebook

Pertti Pasanen
University of Kuopio,
Department of Environmental Science
Finland
pertti.pasanen@uku.fi
Aim and scope of the guidebook

To gather information on international criteria for cleanliness in ventilation systems and the methods for implementation of cleanliness

• to document the most important criteria for the cleanliness of air handling equipment and system
• to guide to proper design of clean ventilation system
• to guide to proper installation of clean ventilation systems
• to guide to the evaluation methods of cleanliness
• to guide to the efficient cleaning methods
• to guide to verification of cleanliness and maintenance practices
• to guide to available training practices

REHVA guidebook is focused in cleanliness control in new installations as well as in existing systems
Cleanliness criteria for ventilation systems

- **Cleanliness criteria in various countries**
  - requirements
    - European (EN12097)
    - national
      - e.g. building code in Finland
        » ventilation system shall be clean and maintain healthy and safe indoor air quality
  - voluntary guidelines
    - national (associations), (e.g. ISIAQ chapters)
      - e.g. in Finland
        » ventilation system shall be visible clean
        or dust accumulation on duct surfaces shall be less than 1.0 g/m² in new systems, oil residues less than 50 mg/m², limitations for fibres and micro-organisms
Cleanliness criteria for ventilation systems

• Different need for criteria for dust deposits in the system
  – existing systems (maintenance)
  – new systems (commissioning)

• The major contaminants to avoid (in New system)
  – dust deposits, amount of oil residues, filings from installations

• Criteria for various components (in the existing systems)
  – filters
  – coils
  – humidifiers
  – cooling tower
Design principles of a clean ventilation system

The goal of design is to design high IAQ, the other things are involved in it

• Design
  – Setting the IAQ target values in conceptual design process with user, architect and mechanical engineer
  – Design phase mechanical designer designs the clean HVAC system according to specifications and gives the instruction of the methods in aiming to clean HVAC system
The goal of design is to design high IAQ, the other things are involved in it

- Critical design features:
  - placing of fresh air intake, and exhaust, mechanical room, selection of components
  - dimensioning; air velocities in air grilles and louvres, cooling coils, heat exchanges, high efficiency filtration (2 steps),
  - sound attenuators, selection of materials (low fibre release)
- Installation with “low dust” clean technique, protection of open ends
- Contract document

- Good documentation and instructions for maintenance of cleanliness guarantees the continuity of the information transfer
Design principles
of a clean ventilation system

• design and maintenance aspects
  – cleanability
    • openings
    • sufficient space
    • dimensions

• More details in the referred main documents
  – EN 12097, EN 13053, EN 13779
  – FiSIAQ 2001, D2, VDI 6022
Installing
a clean ventilation system

- protecting against impurities
  - continually during all the building processes
- storage
Installing
a clean ventilation system

• protecting against impurities

  • installation work (cutting the ducts, closing the open endings)
  • timing the working processes:
    – do balancing and flow measurements when no dust sources are present in the building site
    – do no clean the ductwork or system before all construction work is completed
Installing a clean ventilation system

- **levels of cleanliness**
  - basic
    - demands for manufactured products
    - delivery; not specially protected
    - checking of the cleanliness before installation; debris free
    - not special requirements for covering
  - intermediate
    - storage area should be clean and dry
    - component should be covered during installation
  - advanced
    - ducts and components should be capped or protected in all phases of construction, including transportation and storage
Installing a clean ventilation system

- Dust accumulation on duct in different building processes
  - Efforts of cleaning control in ventilation systems built according cleanliness control protocol (P1) and less demanded control (P2)

![Graph showing dust accumulation in different HVAC cleanliness classes](image)
Verification of the cleanliness of ventilation system

- **Evaluation methods**
  - visual inspection
    - aided with visual scale
    - recommended as a basic method
A set of pictures in **newly installed and existing** air ducts

**Scale for new**

- Clean
- 0.2 g/m²
- 0.4 g/m²
- 0.7 g/m²
- 1.0 g/m²
- 1.3 g/m²

**Scale for existing**

- Cleaned
  - Dust residual below determination
- 0.4 g/m²
- 0.7 g/m²
- 1.4 g/m²
- 2.3 g/m²
- 2.8 g/m²
Verification of the cleanliness of ventilation system

HOW to quantify the dust deposits
- methods for solid deposits
  - mass
    - sampling on filter with vacuum pump
    - wiping with cloth (with solvent)
    - wiping with cloth (without solvent)
    - tape method
    - vacuum test (NADGA)
  - thickness
  - comp
  - thickness meter
Verification of the cleanliness of ventilation system

Note the differences in the methods

- filter sampling (loosening technique)
- tape method (capacity of the tape, hygroscopicity)
Verification
of the cleanliness of ventilation system

WHAT else to measure than dust deposit
– microbial contaminants
  • surfaces
  • water systems
– airborne particles
  • mass and number
– fibres
  • on the surfaces, in the air
– oil residues
  • surface (mainly for uninstalled components)
Cleaning
of a ventilation system

• Cleaning methods
  – dry cleaning methods
    • mechanical brushing
    • compressed air
    • hand vacuuming
  – wet cleaning methods
    • hand washing
    • steam washing
    • mechanical power washing
      – use of detergents
Cleaning of a ventilation system

- Instructions for selection of cleaning methods
  - air intake unit
  - filter chambers and fan
  - heat exchangers and coils
  - humidifiers
  - porous components
    - sound attenuators
    - surfaces of thermal insulations
  - terminal devices
- Disinfection (when and how?)
  - ductwork
    - usually needed only when excessive microbial contamination has been cleaned
  - humidifiers
    - included in a maintenance protocol
Training practices

- training practices described in different codes
  - EVHA training standard
  - VDI 6022 training standard
  - Swedish training standard
  - NADGA training standard
Report and documentation

• **Inspection and cleaning work shall be well documented**
  – recommendations for detailed information of the contents of the document
    • descriptions of system
    • descriptions of methods used
    • visual information, proofs (photos)
    • conclusions
    • **recommendations** for building owner and management personnel
Relationships between the guidebooks and standards

- REHVA guidebook is not an official guideline or regulation, but it recommends the best proven practices for maintaining hygienic and clean ventilation systems
  - National regulations with more stringent values should always be followed
  - The guidebook is useful for practitioners who like to follow the recent international practices
- Standard EN 12097 gives requirements for ductwork design and construction in order to ensure the cleanability of the system, focusing on the size and location of access openings
- “Hygiene requirements for ventilation and air conditioning systems and units” (REHVA Guidebook no 9) goes in more detail to hygiene and health issues of the systems and components
- “REVHA Guide to cleaning and hygiene management of ventilation systems" and "EVHA Good practice document for grease extract cleaning" are targeted to cleaners
Thank you for your attention

To order the REHVA guidebooks:
www.rehva.eu / section Bookstore
or through your national member