Federation of European Heating, Ventilation and Air Conditioning Associations

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Cleanliness of ventilation systems a REHVA guidebook

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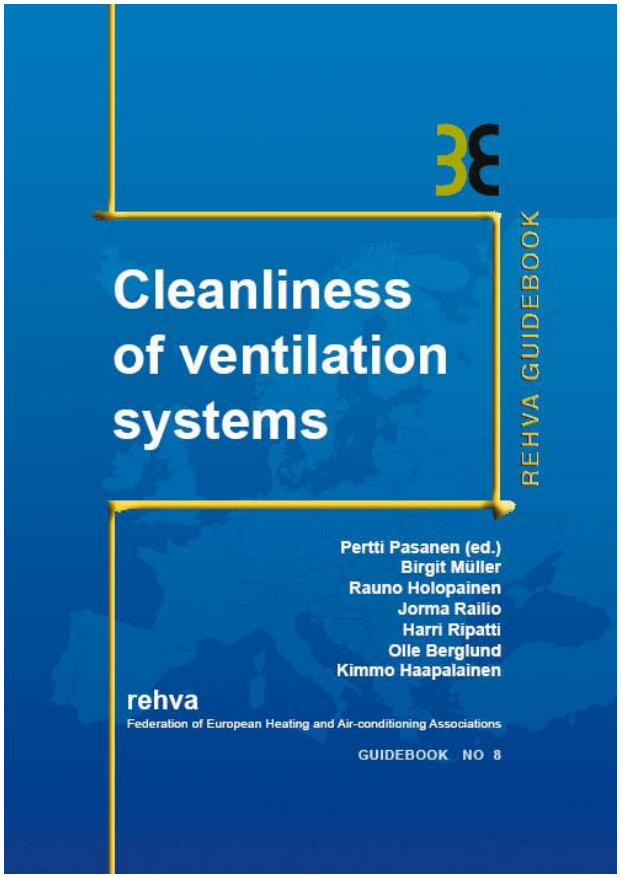


Aim and scope of the guidebook

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/m^2 in new systems, oil residues less than 50 mg/m^2, 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

Design principles

of a clean ventilation 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

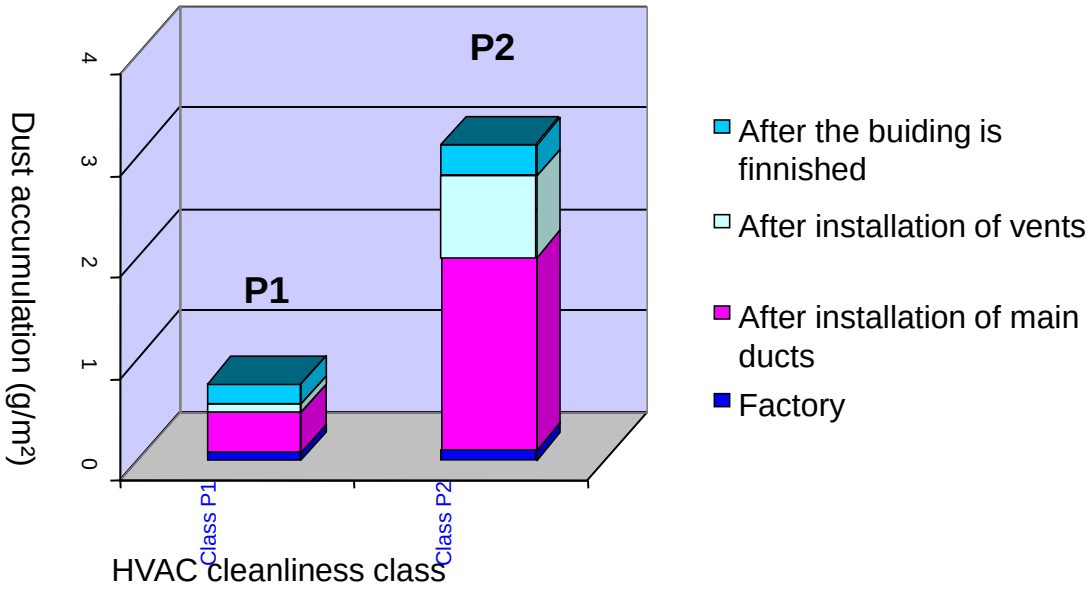
a clean ventilation system

- **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

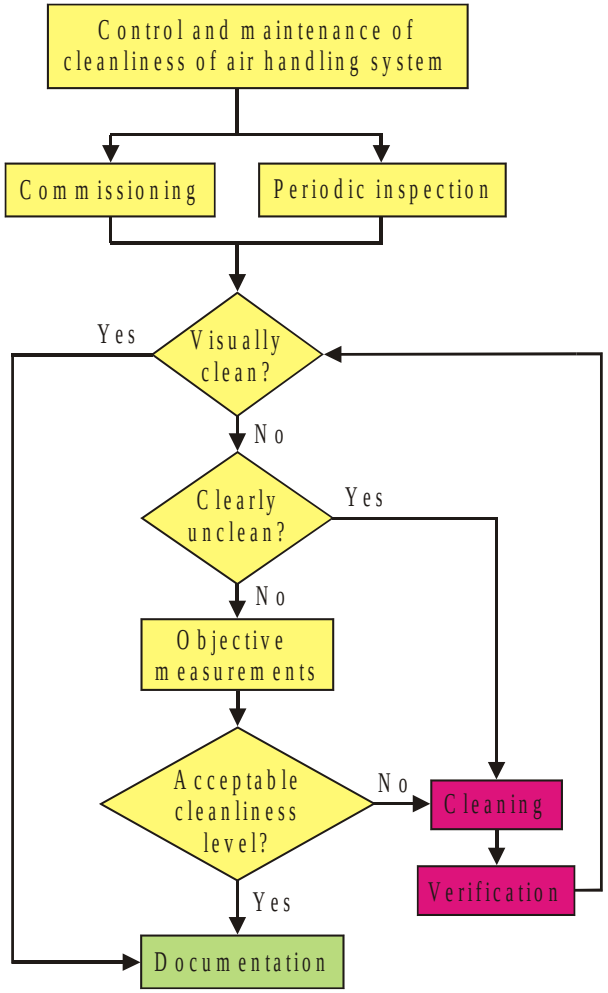
- **Dust accumulation on duct in different building processes**
  - Efforts of cleaning control in ventilation systems built according cleanliness control protocol (P1) and less demanded control (P2)



Verification

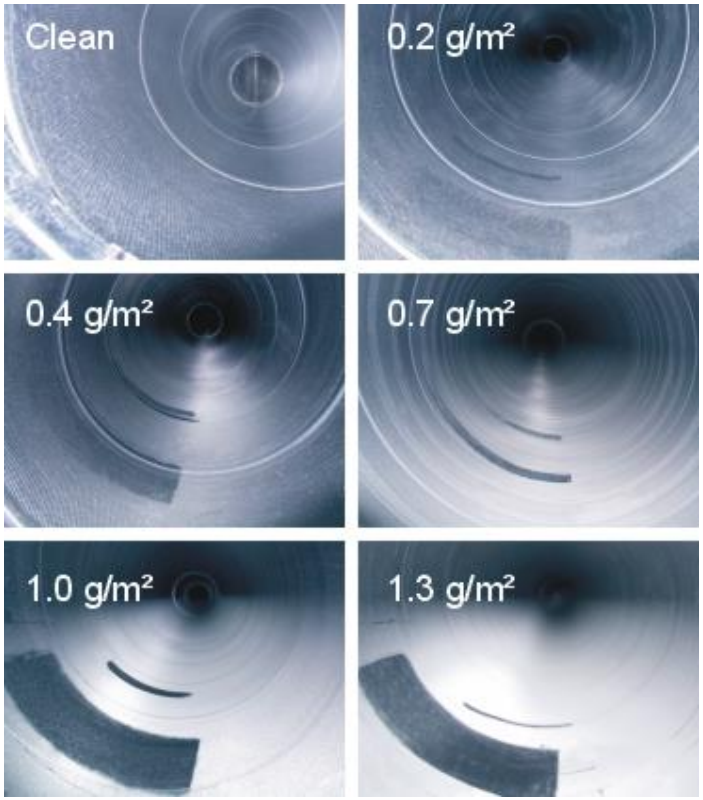
of the cleanliness of ventilation system

- **Evaluation methods**
  - visual inspection
    - aided with visual scale
    - recommended as a basic method

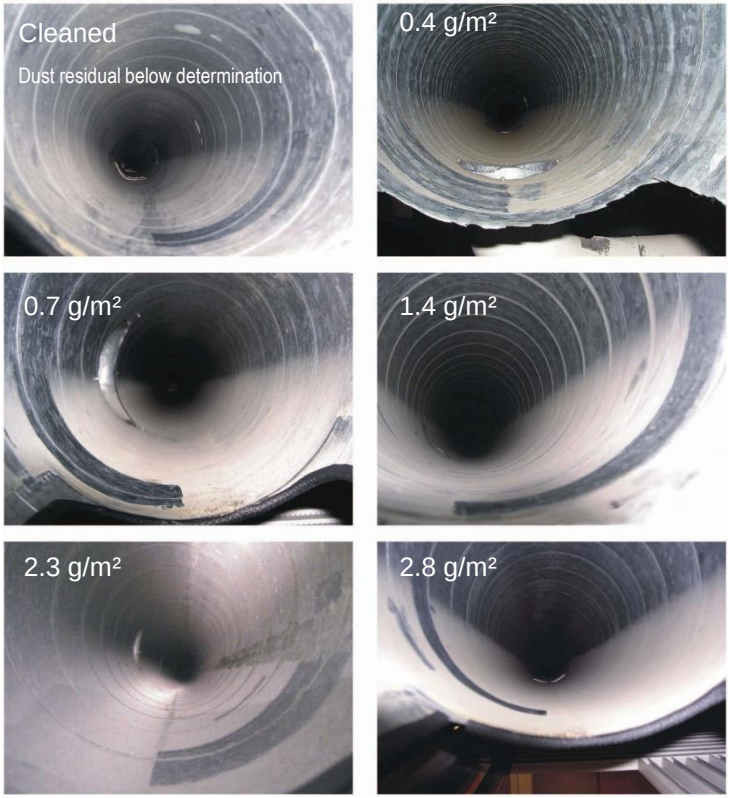


A set of pictures in newly installed and existing air ducts

Scale for new



Scale for existing

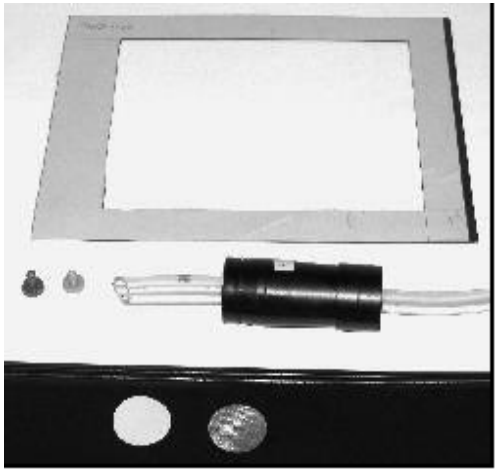


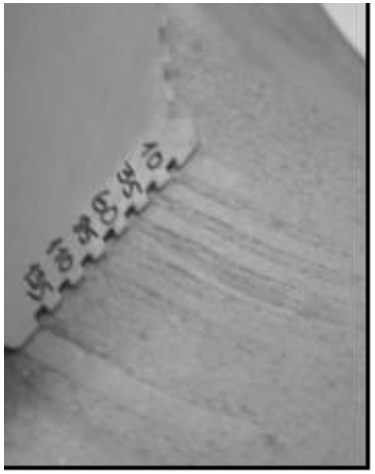
Verification

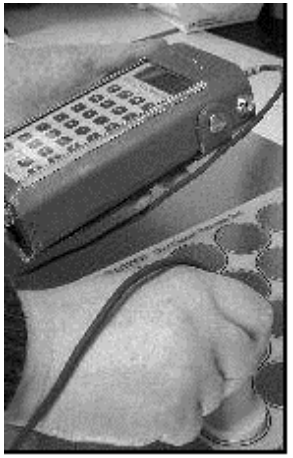
of the cleanliness of ventilation system

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





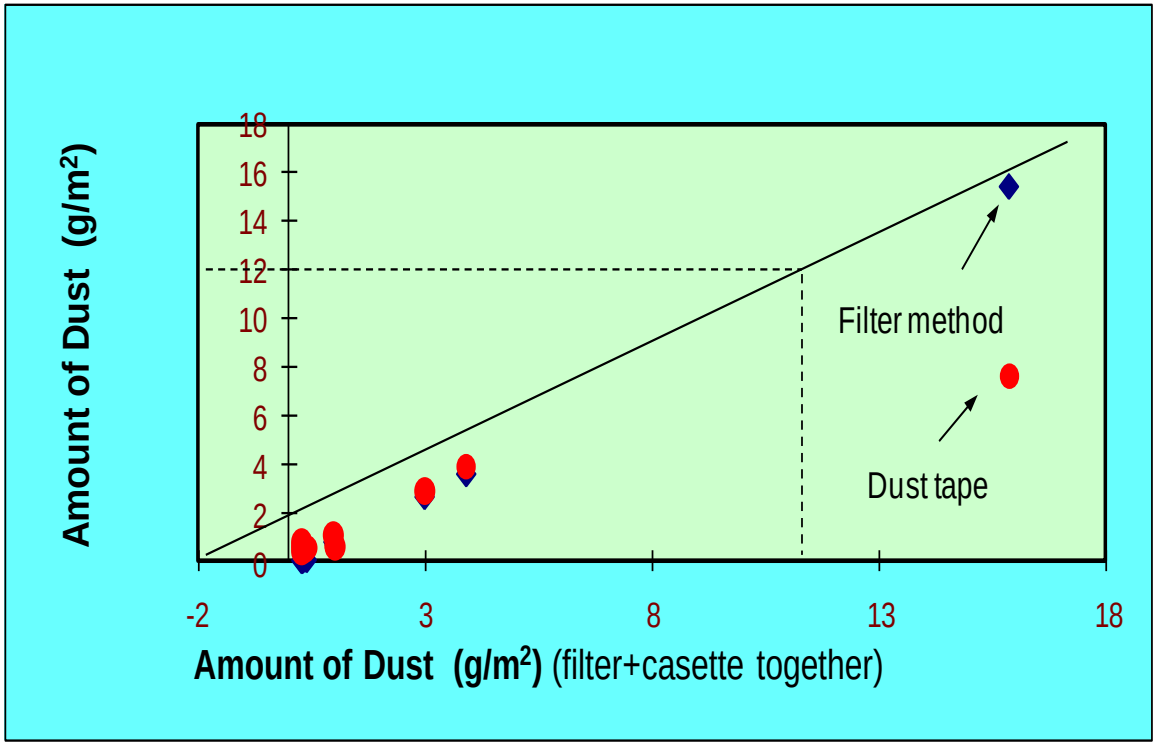


Verification

of the cleanliness of ventilation system

Note the differences in the methods

- filter sampling (loosening technique)
- tape method (capasity of the tape, hygroscopicity)



Verification

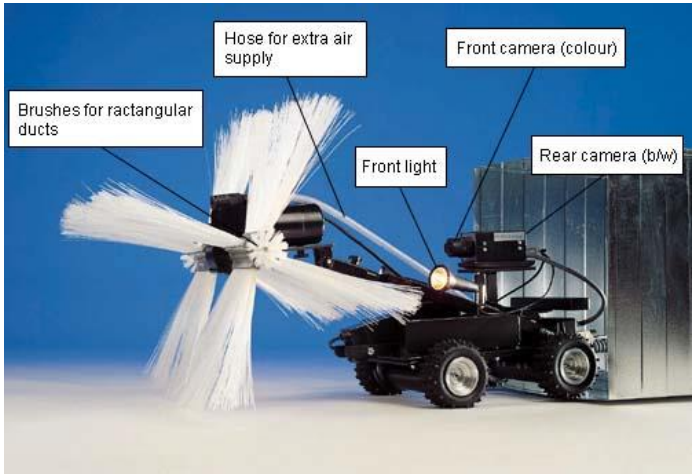
of the cleanliness of ventilation system

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

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