Quality of ventilation systems in residential buildings
- Status and perspectives in Finland

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Development of markets in residential buildings

Distribution of residencies in Finland
Distribution of ventilation systems in Finland

Reculations & building code
FiSIAQ, Classification of indoor Environment, labeling of building products


March 2013: Classified priducts
Building materials
-2248 products, 170 companies
HVAC products
-253 products, 10 companies

Products and design
Demands for the products

- Demands for HVAC system products for residential buildings are the same than in general: tightness, physical properties, standardized dimensions
- Cleanliness: Finnish classification of indoor environment
  - Oil residues:
    - 50 mg/m² for products manufactured without lubrication
    - 300 mg/m² for products that need lubrication in manufacture
  - Dustiness
    - >0,5 g/m² delivered new components
    - >0,7 g/m² for installed ventilation systems
  - The products should not release odour or fibres
  - Testing once with every 6 years, new application every 3 years

Design

- No specific demands for designers of ventilation in residential buildings: Demand C for designer (ref. A2, building code)
  - Degree in HVAC engineering
- Design features of the systems are described in the building code, D2
  - Air flow rates, cleanliness demands, cleanability, maintenance aspects, energy efficiency/recovery
- Designers are familiar with building code and demands
  - Design of ventilation systems is checked by the authorities who gives the permission to built
  - In some cases changes are done during installation, leading to poor performance of the system (smaller ventilation unit, lack of sound attenuation)
  - Too small dimensions of ducts (balancing problems, noise)
Installation

- HVAC installers have an education for degree, specialization in installation or the installation can be chosen as a minor subject
  - Duct cleaners have their own degree
- No special certification is needed for residential building,
  - Building owner may install the system by himself
- If cleanliness class P1 is selected to follow, only the classified products need to use
  - This is rare for residential buildings
- Installation company need to balance the system and show the balancing notes with air flow to the authorities in commissioning
Commissioning

- According to the building code the new building needs to fulfill the criteria
  - Commissioning focuses on building structures, dimensions, safety in installation of electrical network, and less closely to ventilation performance (is done less professionally)
- For ventilation systems, the air flow measurements are demanded, those are done by the installation company, or his consultant
  - Usually not checked by authorities. Are they real, or correct?
- Cleanliness criteria are set
  - Visual inspection
  - Measurements seldom done in residential buildings

Evaluation of the cleanliness

- Visual scale aids to estimate the mass deposited in the ducts (g/m²)
  - Old ducts
    - Clean 0.4 g/m²
    - 0.7 g/m²
    - 1.4 g/m²
    - 2.3 g/m²
    - 2.8 g/m²
  - New ducts
    - Clean 0.2 g/m²
    - 0.4 g/m²
    - 0.7 g/m²
    - 1.0 g/m²
    - 1.3 g/m²
Maintenance and inspections

**Maintenance**

- In flats the building maintenance personnel usually takes care of the maintenance of the ventilation system
  - Yearly change of filters, usually ok
  - Inspection of the cleanliness usually once in 10 years
  - Kitchen extract filters cleaned 1-2 times per year by occupants
  - In old houses with exhaust air only, the cleanliness of ducts checked once in ten years, < 50% of buildings follows
    - Sufficiency of supply air is problem
- In terraced and single family houses the occupant take care of the maintenance
  - Change of filters 1-2 times per year, usually ok
  - Cleaning of kitchen extract 1-2 times / year
  - Cleaning once in 10 years, < 50% of the houses/apartments
**Inspection**

- Inspection of performance is done by professional maintenance persons in flats
- In terraced and single family houses by owners, depends on the activity of the owner
  - Consulting companies, duct cleaning companies
  - About 50% of the houses orders a cleaning once in 10 years
    - Air flow rates are checked and the systems are balanced after the cleaning
  - For comparison, the duct work in hospitals is cleaned > 90% every five years, and schools and daycare centers >70% in every 5 years
- According to field studies the real ventilation rate is usually less than the criteria 0,5 ach/h. **ACH 0,4 1/h is common average**

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**Summary of problems observed regarding the quality of residential systems**

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Thank you!