Quality of ventilation systems in residential buildings: status and perspectives in Estonia

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Tallinn University of Technology

Workshop: "Securing the quality of ventilation systems in residential buildings: status and perspectives” Brussels, March 18-19 2013

Residential ventilation market

<table>
<thead>
<tr>
<th>Type of ventilation system</th>
<th>Type of dwelling and construction period</th>
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<tbody>
<tr>
<td></td>
<td>Detached houses</td>
</tr>
<tr>
<td></td>
<td>Apartment buildings</td>
</tr>
<tr>
<td></td>
<td>1920-1945</td>
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<td></td>
<td>1946-1970</td>
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<td></td>
<td>1971-1990</td>
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<td>1991-2010</td>
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<td>1941-1960</td>
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<td>1961-1980</td>
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Graphs showing:
- Percentage of different types of dwellings
- Number of apartment buildings
- Net area of dwellings, m²

Percentage charts for different construction periods.
### Residential ventilation market

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- **No ventilation**
  - (window airing, no special stack for ventilation, air leakages through envelope)

- **Natural supply and exhaust**
  - (passive stack ventilation)

**Often the stack is blocked by waste.**
**Not airtight / straight**

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**Leaky windows**

**Stack for ventilation beside stack for stove’s chimney**
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<td>Natural supply and mechanical exhaust</td>
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<tr>
<td>Mechanical supply and exhaust with heat recovery</td>
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- Leaky windows
- Outdoor air intake
- Stack for ventilation
- Heat recovery
Residential ventilation market: new apartments

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<td></td>
<td>&lt;1920</td>
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<td></td>
<td>1921-1945</td>
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- Exhaust ventilation (centralized) 68%
- Exhaust ventilation (apartment based) 12%
- Balanced ventilation with heat recovery (centralized) 15%
- Balanced ventilation with heat recovery (apartment based) 8%

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<tr>
<th>Distribution of ventilation</th>
<th>Ventilation air flow, l/(s·m²)</th>
<th>Ventilation air change rate, h⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhaust ventilation (centralized)</td>
<td>0.0</td>
<td>Indoor climate category II 0.42 (l/m²)</td>
</tr>
<tr>
<td>Exhaust ventilation (apartment based)</td>
<td>0.1</td>
<td>Indoor climate category III 0.30 (l/m²)</td>
</tr>
<tr>
<td>Balanced ventilation with heat recovery (centralized)</td>
<td>0.2</td>
<td>Average: 0.3 (l/m²)</td>
</tr>
<tr>
<td>Balanced ventilation with heat recovery (apartment based)</td>
<td>0.3</td>
<td></td>
</tr>
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Products

- **Requirements for products**
  - **Estonian Building Law:**
    - products of residential ventilation should meet the requirements of European Harmonised standards;
    - if no HS: technical approval of:
      - specific building product,
      - member country of EU or
      - European Free Trade Association (EFTA)
  - **Certification Mark (CE):**
    - demanded if required by standards
  - **Eurovent certification** is sometimes required by the customer (products are tested similarly)
  - **Declaration of conformity** must be provided:
    - all construction products, for which there is a valid:
      - harmonized standard for product,
      - technical approval or
      - which have been provided for safety
Products

- **The main problems of products**
  - high noise level of products
  - absence or too less silencers
  - automation system of products
  - installation manuals in Estonian language (required in regulation)
  - solving these problems is commonly the task of designers or installers.
- Manufacturers of products usually do not take any measurements
- Problems during the warranty time, are solved usually by manufacturers

Design

- **HVAC engineer's professional standard:**
  - HVAC engineer (EKR Level 6);
  - Certified HVAC engineer (EKR Level 7);
  - Authorized HVAC engineer (EKR Level 8).
Design

- The design of ventilation system is done according to design standards (prescriptive rules and performance requirements)

Installation

- Profession: "ventilation duct fitter":
  - professional qualification in 3 levels;
  - can be acquired in 5 Vocational Schools
  - ~75 % of ventilation installers do not have any professional preparation at all.

Ventilation can be built by everyone!
Installation

- Profession
- **Requirements, quality regulation:**
  - Good building traditions are based on valid standards and quality regulations.
  - Constructional information catalogue
  - Finnish HVAC quality regulation (LVI RYL)
  - Electrical installation: by Directive 71/305/EEC.
- Building Law: installer must provide the customer the following documentation:
  - Design (and its changes);
  - Works diary;
  - Acts of covered works;
  - Protocols of working meetings;
  - Other documentation like as-built drawings and certifications of conformities.

Comissioning

- **Building Law:** it is not possible to get the certificate of occupancy before providing the measurements of airflows: **commissioning and measurements are mandatory:**
  - Does the building meet the requirements;
  - Does the building project and measuring protocol meet the requirements;
  - Does the technical documentation meet the requirements.
- **Who can?**
  - a certified company,
  - detached houses: owner has also the rights for commissioning.
Comissioning

- **Measurements** of airflows and sound levels generated by the ventilation:
  - Ventilation airflows must follow the design values (±20…10%)
  - The level of sound pressure from service systems in living spaces can not exceed $L_{pA,eq,T}$ 30 (25)dB.

- **No educational or training schemes** for commissioning of residential ventilation systems.

- Commissioning specialists are often **not competent** and might accept lower quality and extensive replacements in comparison to the initial design.

Maintenance

- **Suggestion from standard**: maintenance works:
  - Everyday maintenance (or short period maintenance);
  - Regular maintenance to find out the problems;
  - Main maintenance (yearly maintenance);
  - Maintenance based on official regulations.

- **Requirement**: ventilation systems should not be cleaned less than once a year (rarely done).

- **Recommenation** to change the filters 2 times a year

- **Who can?**
  - apartment buildings: a special company,
  - detached houses: owner has also the rights.
Maintenance

Common solution:
- Maintenance is not done at all or
- Done only in case the problem has already taken place
- Ventilation systems do not operate properly or
- Are switched off

Main problems:
- Filters are not changed
- Ventilation ducts are not cleaned
- Ducts are without cleaning and access panels

Perspectives

Today, it is basically impossible to fulfill energy performance requirements without ventilation HR

Regulations

Detached houses:
- Genral airflow: 0.42 l/(s·m²)
- Heat recovery:
  - Efficiency: 80%
  - SFP <2,0 W/(l/s)
- Noise level
  - $L_{P,A,eq,T}$ 25dB.

Apartment buildings:
- Genral airflow:
  - Apartment based control: 0.42 l/(s·m²)
  - Centralized control: 0.50 l/(s·m²)
- Heat recovery:
  - Plate HR
  - Wheel HR (apartment)
  - Exhaust air heat pump
Conclusions

- The major quality problems

<table>
<thead>
<tr>
<th>Topic</th>
<th>Major causes of quality problems</th>
<th>Existing quality schemes or incentives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
<td>Products control systems are not working properly, product documentation is not translated into Estonian</td>
<td>yes: EU regulation No 305/2011, Governmental orders and laws</td>
</tr>
<tr>
<td>Design</td>
<td>no consideration of noise levels, no ventilation sound attenuators between the apartments, ventilation units are designed on max speed</td>
<td>yes: residential ventilation standards, Governmental orders and laws</td>
</tr>
<tr>
<td>Installation</td>
<td>The quality of installation is bad, installations are not made by the ventilation project</td>
<td>yes: Finnish LVI RYL, by EVS-EN 60947-1:2001/A2:2002, Directive 71/305/EEC</td>
</tr>
<tr>
<td>Commissioning</td>
<td>Commissioning specialist is not specialist in a field of ventilation,</td>
<td>yes: Estonian Building Law, Governmental ordinance nr 11</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Maintenance is not done by the regulations and product guidelines</td>
<td>yes: EVS 830:2003, Governmental ordinance nr 55</td>
</tr>
<tr>
<td>Inspections</td>
<td>No regulations</td>
<td>no</td>
</tr>
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