QUALITY OF VENTILATION SYSTEMS IN RESIDENTIAL BUILDINGS: STATUS AND PERSPECTIVES IN ROMANIA

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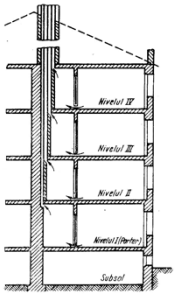
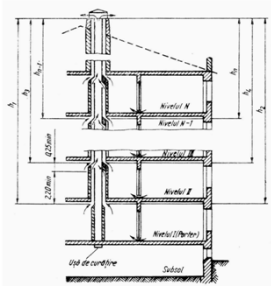
Current situation of buildings constructed before 1989

- Multifamily buildings:
  - natural ventilation in individual shafts (up to 4-storey buildings) or common shafts (over 4 floors) built of masonry or precast concrete,
  - balancing air intake - by infiltration windows joints,
  - use of ventilation cowls,
- Context and problems:
  - 1993 → ownership changed from state to of owners,
  - No effective check inside the apartments → common shafts were often dismantled for refurbishing and enlarging the interior space → suppressing ventilation system for lower floors,
  - New local wall-fans connected to the common shaft (to "improve" the air quality) without solving the problem of balancing air intake → action over other users connected to the same ventilation shaft,
  - Installing insulated air-tight windows → suppressing the balancing air flow infiltration (ventilation only by opening the windows) → air quality is moderate or low → high humidity and thermal bridges → sick building risk.





Situation of the new residential buildings

- Multi-storey new buildings:
  - General mechanical exhaust systems in bathrooms without exterior windows,
  - Balancing air intake grilles mounted in kitchen's or room's outside walls (often air intake compensation is omitted),
  - Small exhaustion wall-fans connected to a common ventilation shaft → fans switch-on together with lighting switch-on (short delay),
  - Exhaust hoods in kitchens (recirculation mode or with ventilation shafts for exhaust air).
- Single or multi-family houses:
  - Generally simplified ventilation systems (mechanical exhaust ventilation for bathrooms without outside windows (rarely) and ventilation hoods for kitchens),
  - Heat recovery is seldom used (exhaust warm air from bathrooms and supplying preheated fresh air in main rooms),
  - Some air handling units for ventilation and air conditioning with a mixing room for fresh air intake ratio.
- Market for residential ventilation systems:
  - could become slightly higher by informing the owners and raising the awareness of users on causes of low quality air in rooms and need for reducing energy consumptions, showing the solutions on the market
  - Actual market increase is moderate due (also) to the global economic situation.

Products on the Romanian ventilation market

- Market is still dominated by small wall-fans:
  - Apparently solves ventilation problem in bathroom spaces,
  - Heat recovery is gaining ground → user's awareness on energy saving (rising energy prices),
- Hygro-controlled ventilation grilles:
  - introduced to Romanian market and promoted by manufacturers and installers of window systems,
- Certification of products:
  - CE marking,
  - Technical Agreement (two years validity),
- Interest of producers:
  - Focused mainly on the **public, trade and office buildings** (greater demand and higher value of equipment → commercially attractive),
  - Frequently product presentations and trainings are organized, providing guidance on equipment selection for planners, investors and technical staff assembly companies,
  - Interest of providers in **residential** ventilation equipment is still **relatively low** (low demand of investments).

Design of ventilation systems

- Reference documents:
  - Installation's Engineering Manual,
  - Technical regulation (code) **I5-2010** (design, installation and operation of ventilation and air conditioned systems),
- Design hypothesis / requirements:
  - Organised ventilation → **general** and **constant** at least during periods when outside temperature does not allow frequent opening of windows,
  - Airflow must be achieved by supplying air into the main rooms (living room, bedroom, office) and exhaust to the service rooms (kitchen, bathrooms, toilets),
  - Design values (tables) – flow rates / IAQ class.
- Practical considerations:
  - Additional 'milestone' docs: Law 10/1995 (Quality in construction), Law 372/2005 (EPB), MC 001-2006 (EPB Calculation Methodology), relevant EN/ISO/CR,
  - Limiting investment's costs → no Ventilation design documentation → no or 'poor' systems, no HR → ventilation systems not meeting requirements, high energy use and poor IAQ.

IAQ class	Short description
IDA 1	High quality of indoor air
IDA 2	Medium quality of indoor air
IDA 3	Poor quality of indoor air
IDA 4	Low quality of indoor air

No. main rooms	Exhaust air flow rates m3/h				
	Kitchen	Bath & showers	Add. shower	Toilets	
				Single-	Multi-
1	75	15	-	-	-
2	90	15	15	15	15
3	105	30	15	15	15
4	120	30	15	30	15
> 5	135	30	15	30	15

The number of main rooms	1	2	3	4	5	6	7
Total exhaust flow – min. values [m3/h]	35	60	75	90	105	120	135
Kitchen reduced flow – min. values [m3/h]	20	30	45	45	45	45	45

Commissioning, Maintenance and Inspections

- Commissioning:
  - Performed by the installer or by the supplier's technical staff if there are strict conditions for high-value equipment warranty.
  - Generally (residential buildings) → no technical details for commissioning → instructions provided by the supplier in the delivery package or according to manufacturer's website,
  - Most times commissioning procedures depend on the operator experience and the existence of internal working procedures based on an international best practice guidance,
- Maintenance:
  - Generally in charge of the beneficiaries who often do not give much importance to the system, only when it is out of order or it presents operating noticeable abnormalities,
  - Maintenance contracts are rarely signed with ventilation systems maintenance companies (preference to benefit of these companies services only in case of failures),
- Inspection:
  - The State Inspectorate in Constructions- ISC is the responsible authority for the verification of compliance with the laws and regulations in force,
  - In the residential area, check of the ISC is often limited to the structure, the check of ventilation systems is often neglected.

Installation of ventilation systems

- Installation:
  - Generally (residential buildings) → lack of technical details (qualification schemes) for installing ventilation systems,
  - Lack of dedicated training courses for the installers,
  - Equipment delivered with operating manual and warranty certificate → usually the only documentation that the owner has, in the absence of a design documentation,
- BUILD UP Skills Romania – IEE project → Qualification Roadmap to 2020:
  - Development of a **coherent system** to ensure the **qualification of the building workforce** relating to energy efficient technologies (including ventilation systems) **is needed**,
  - The first step is to adopt and implement the **National Qualification Framework**,
  - Priority measures are proposed in the **Qualification Roadmap to 2020** (under development and endorsement),
  - The existing **occupational standards** for HVAC installers need to be revised and adapted to the need of implementing energy efficiency technologies, and adequate qualification schemes are needed.
- Provide requirements to develop market needs:
  - Minimum requirements on efficient ventilation systems, qualification of installers and quality assurance for the execution of works are mandatory actions to ensure the uptake of thermal refurbishment programs and to support the implementation of nZEBs in Romania.

Conclusions and perspectives

- Challenges:
  - In the residential area the ventilation systems market is still undeveloped → low demand and poor check made by state authorities (despite of very stringent regulations),
  - Lack of interest from producers in the residential area and the lack of training courses for designers, installers and technical staff for commissioning and maintenance → decreasing the quality of systems designed and installed → poor indoor air quality with indirect repercussions on the energy savings and human health,
  - Need for adapted / tailored technological solutions → uptake residential market,
  - Need for training of the experts involved (architects, designers, energy auditors, inspectors),
  - Need for raising awareness – GOV, Inspectorates, Teachers → Education !
- Update the legal framework in buildings:
  - Introduce adequate definition of 'nearly zero energy buildings' in Romania,
  - Detail and clarify legislation and enforcement on ventilation & EP certification,
  - Provide minimum requirements for residential ventilation (adequate to very energy efficient buildings, e.g. ventilation with heat recovery),

- Qualification of HVAC installers (short and medium term):
  - Development of large impact and long-lasting **qualification schemes for HVAC installers ,**
  - Introducing quality check requirements for airtightness and efficiency of ventilation systems for high performance residential buildings.

Thank you for your attention

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