Building and ductwork airtightness in Europe: Drivers and trends

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INIVE

BUILD UP Webinar

1 July 2013
2011: 12 member countries
2012: 15 member countries
2013: 17 member countries
Tight Vent®
Europe
BUILDING AND DUCTWORK AIRTIGHTNESS PLATFORM
Right and Tight: What’s New in Ductwork and Building Airtightness?

Legislative drivers and new research on the importance of building and ductwork airtightness are leading to increased activity in this aspect of building energy performance. Qualification schemes for competent testers, training and events and where to find the best information are summarised here.

Increasing pressure on building and ductwork airtightness with the EPBD recast

Examples of measures taken

The impact of envelope and, to a lesser extent, ductwork airtightness is accounted for in the energy performance regulations in many European countries (ASEPI project report). The examples that follow include measures taken both for building and ductwork airtightness with respect to requirements and EP-calculation methods, as well as steps to encourage market transformation.

Airtightness requirements in European countries

An increasing number of countries (e.g. Czech Republic, Denmark, France, Germany, Ireland, Netherlands, Norway, Portugal, UK – for more, read this article published at 2009 AIVC conference) include in their regulations either required or recommended minimum airtightness levels with or without mandatory testing. The number of tests performed on a voluntary basis is rapidly increasing either because of the energy penalty for untested buildings in the calculation method or due to the specific requirements of a given program.
Outline

• Increasing pressure on building and ductwork airtightness with the EPBD recast
• Requirements in EU countries
• Incentives through calculation procedures and/or subsidies
• Conclusions
• Perspectives
Increasing pressure on building and ductwork airtightness with the EPBD recast

Energy impact

– Several sources report an energy impact on the order of:
  • 10 kWh/m² of floor area per year for the heating needs in a moderately cold region (2 500 degree-days)
  • 0 to 5 kWh/m²/year for the ducts plus the additional fan energy use

– See www.asiepi.eu

– Some more recent work…
Increasing pressure on building and ductwork airtightness with the EPBD recast

- Looks at 2 similar dwellings in 2 phases
- Compares heat loss coefficients based on measurements
- Concludes that **15% energy savings** potential going:
  - From $11.5 \text{ m}^3/(\text{m}^2\cdot\text{hr})$ @50 Pa (average current value)
  - Down to $5 \text{ m}^3/(\text{m}^2\cdot\text{hr})$ @50 Pa (achievable)
Increasing pressure on building and ductwork airtightness with the EPBD recast

• There is a growing number of studies showing the significant impact of building and ductwork leakage in hot and mild climates as well (e.g., Spain, Portugal)

• Convergence between good IAQ and good airtightness, with an appropriate ventilation system

Evaluation of air leakage and its influence on thermal demands of office buildings in Madrid

QUAD-BBC, Indoor Air Quality and ventilation systems in low energy buildings

- Laure Mouradian, CETIAT and Xavier Boulanger, Association air.h

Evaluation of the impact of low energy buildings and ventilation systems on indoor air quality

Changes in building design and construction in the context of increasing building energy efficiency calculated in occupancy periods only. The possible interactions between pollutants or with the building are not taken into account.

The study also shows that the ventilation performance can be improved, especially in main rooms when improving building airtightness. While we could fear the contrary, improved airtightness appears to be beneficial to IAQ in our test cases.

For more information, the reader may download the synthesis report (in French) at http://www.airh.asso.fr/etudes.aspx
Increasing pressure on building and ductwork airtightness with the EPBD recast

→ The EPBD recast (2010/31/UE, 19/05/10)

Building and ductwork airtightness is a key issue

**Article 9**

Nearly zero-energy buildings

1. Member States shall ensure that:

(a) by 31 December 2020, all new buildings are nearly zero-energy buildings; and

(b) after 31 December 2018, new buildings and buildings owned by public authorities are nearly zero-energy buildings.
Airtightness requirements in EU countries

• Requirements evolve
  – Although there is no explicit requirement for airtightness in the directive
  – Poor airtightness is often penalized in regulations in the member states
    see www.asiepi.eu,
  – In some countries, there are explicit minimum requirements

• On-going survey
# Airtightness requirements in EU countries

<table>
<thead>
<tr>
<th>Country or Region</th>
<th>Programme, Standard or Regulation</th>
<th>Indicator</th>
<th>Minimum requirement in some cases</th>
<th>Maximum(s) value for the building leakage****</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium, Flanders (BE)*</td>
<td>Flemish EPB regulation</td>
<td>q50</td>
<td>No (default value)</td>
<td>--</td>
</tr>
<tr>
<td>Czech republic (CZ)***</td>
<td>CSN 73 0540-2 (2011) (Standard)</td>
<td>n50</td>
<td>Yes</td>
<td>Level I: from 0.6 h⁻¹ for passive houses to 4.5 h⁻¹ for naturally ventilated buildings Level II: from 0.4 h⁻¹ for passive houses to 3.0 h⁻¹ for naturally ventilated buildings</td>
</tr>
<tr>
<td>Czech republic (CZ)***</td>
<td>TNI 73 0329 (2010) (Preliminary Standard)</td>
<td>n50</td>
<td>Yes</td>
<td>0.6 h⁻¹ for a single-family passive house 1.5 h⁻¹ for a single-family low-energy house</td>
</tr>
<tr>
<td>Czech republic (CZ)***</td>
<td>TNI 73 0330 (2010) (Preliminary Standard)</td>
<td>n50</td>
<td>Yes</td>
<td>0.6 h⁻¹ for a multi-family passive residential building 1.5 h⁻¹ for a multi-family low-energy residential building</td>
</tr>
<tr>
<td>Denmark (DK)**</td>
<td>Danish building regulation (BR10)</td>
<td>w50</td>
<td>Yes</td>
<td>From 1 l/s/m² for low energy buildings to 1.5 l/s/m²</td>
</tr>
<tr>
<td>Finland (FL)**</td>
<td>Finnish building code, requirements and instructions 2012</td>
<td>q50</td>
<td>Yes</td>
<td>4 m³/h/m²</td>
</tr>
<tr>
<td>France (FR)***</td>
<td>Regulation RT2012, Effinergie label</td>
<td>Q4Pa_surf</td>
<td>Yes</td>
<td>0.6 m³/h/m² for new single family houses and 1 for other residential buildings</td>
</tr>
<tr>
<td>Germany (DE)**</td>
<td>En EV 2009 (Regulation), DIN 4108-2011, DIN V 18599 (Standards), Passivhaus (Program)</td>
<td>n50 and q50</td>
<td>Yes</td>
<td>From 0.6 h⁻¹ for Passivhaus to 3 h⁻¹ for houses without mechanical ventilation system</td>
</tr>
<tr>
<td>Greece (GR)*</td>
<td>--</td>
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<td>No</td>
<td>--</td>
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<td>Italy (IT)*</td>
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<td>No</td>
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</tr>
<tr>
<td>Netherlands (NL)**</td>
<td>Dutch building code, building act 2012</td>
<td>qv10</td>
<td>Yes</td>
<td>0.2 m³/s</td>
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<tr>
<td>Norway (No)*</td>
<td>Norwegian Technical Building Regulations</td>
<td>n50</td>
<td>Yes</td>
<td>3 h⁻¹</td>
</tr>
<tr>
<td>Poland (PL)*</td>
<td>Technical Requirements as of 12 04 2002</td>
<td>--</td>
<td>No</td>
<td>--</td>
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<tr>
<td>Portugal (PT)*</td>
<td>--</td>
<td>--</td>
<td>No</td>
<td>--</td>
</tr>
<tr>
<td>Spain (ES)***</td>
<td>CTE-HE1/CTE-HE2 (Regulation)</td>
<td>--</td>
<td>Only for components</td>
<td>--</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Minergie***</td>
<td>q50</td>
<td>Yes</td>
<td>n50st&lt;0.6 (Passive houses) and n50st&lt;1 low energy houses</td>
</tr>
<tr>
<td>Sweden</td>
<td>--</td>
<td>q50?</td>
<td>Yes</td>
<td>Maximum leakage for passiv houses of 0.3 l/m²(^2)</td>
</tr>
<tr>
<td>United Kingdom (UK)**</td>
<td>UK building regulation, approved document part L</td>
<td>q50</td>
<td>Yes</td>
<td>Mostly 10 m³/h/m² (value from 3 to 5 m³/h.m² are foreseen for the next regulation)</td>
</tr>
</tbody>
</table>
Airtightness requirements in EU countries

Lessons learnt from the survey

– Most countries account for building airtightness in their EP regulations
– Several countries have **minimum requirements** either for specific programmes or regulations
– **Mandatory testing** applies in several countries
– The market share concerned varies a lot
– Several airtightness indicators are used
– Credit for better ductwork airtightness is included in Belgium and France
Airtightness requirements in EU countries

Mandatory testing comes or has come gradually into force in several countries

Subjecting samples of newly built dwellings to a pressure test is compulsory.

Tests must be carried out for new HVAC systems in buildings larger than 1,000 m².

Municipal council is required to demand airtightness measurements in no less than 5% of the construction projects.

Tests must be carried out in dwellings, sampling rules apply.

Airtightness of all new residential buildings must be justified either with a test or by an approved quality management approach (which involves testing on samples). Ductwork pressurization test is mandatory in Effinergie buildings.
Incentives through calculation procedures and/or subsidies

Most energy regulations in Europe include the impact of building airtightness on the overall energy performance calculation (ASIEPI project report).
Incentives through calculation procedures and/or subsidies

• Encouragement for Quality Management approaches in France
• Allows non-systematic testing
• Initially controversial approach but mandatory testing would probably not have been included in the new regulation (2012) without this possibility
  – Evaluation programmes with independent control are underway
  – Positive feedback so far although improvements are possible

PDCA cycle (source: Wikipedia)
Incentives through calculation procedures and/or subsidies

![Graph showing distribution of measured airtightness of houses with and without implementation of an approved quality management approach (France). The graph compares cumulative frequency (%) against air permeability at 4 Pa (m³/h per m² of envelope area exc. lower floor). The graph highlights the essential element that has allowed minimum airtightness requirement in RT 2012.]
Incentives through calculation procedures and/or subsidies

Good airtightness as pre-condition for specific programmes

– Programmes based on PassivHaus or Minergie-P
– Mentioned in the ASIEPI project for:
  • **Norway**: governmental House Bank gives economic incentives
  • **France**: BBC-Effinergie label, since 2007, endorsed by French government to claim for subsidies
  • ...

Questions raised

• Does the market react positively to these changes?
• Does it improve the quality of buildings in practice?
• How do we set up effective control frameworks to avoid wrong declarations (intentionally or not) in EP calculations?
• ...
Summary

• Recent studies and developments confirm the relevance of improving building and ductwork airtightness in the EPBD recast context

• Airtightness requirements evolve significantly in the member states

• More and more countries require explicitly airtightness testing for specific programmes or for a wide range of buildings

• These changes raise a number of questions, including how to efficiently control the compliance with respect to airtightness
Acknowledgements

The TightVent Europe “Building and Ductwork Airtightness Platform” was launched on January 1, 2011. It aims at facilitating exchanges and progress on building and ductwork airtightness issues.

Diamond partners

Gold partners

Associate partners

ECF has given substantial support to TightVent in the start-up phase.

The Air Infiltration and Ventilation Centre was inaugurated through the International Energy Agency and is funded by the following countries:

Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Italy, Japan, Republic of Korea, Netherlands, New Zealand, Norway, Poland, Portugal, Sweden, and United States of America.