OUTLINE

■ DUCTWORK AIRTIGHTNESS IN FRENCH REGULATION

■ LEAKAGES – EXAMPLE OF A EP CALCULATION

■ FD E51–767 DUCTWORK TIGHTNESS MEASUREMENTS
Ductwork Airtightness in French Regulation

In new buildings, the ductwork class is an input data in the Energy Performance calculation (RT2012 : EP Regulation)

→ No minimum requirement
→ Impact on heating loads / cooling loads

If a better value than the default value is used in the EP calculation :

→ a measurement is required to justify Class A, B or C
→ this measurement has to be performed by a qualified independent technician

Since 2013, Effinergie + label requires Class A

Database overview
Evolution of the number of measurements

![Graph showing the evolution of ductwork airtightness measurements in France]

Source – CEREMA Database of ductwork airtightness measurements in France
DUCTWORK LEAKAGES

EXAMPLE OF A EP CALCULATION

Single family house

CLIMATIC CONDITION:
- Zone H1a
- Floor area: 98 m²
- Total loss area: 290 m²

Source – OCR (http://ocr-expertise.fr)
### Characteristics of the house

#### Building envelope

<table>
<thead>
<tr>
<th>Parois</th>
<th>Libellé</th>
<th>Système constructif du bâti</th>
<th>Ep. isolant (mm)</th>
<th>R isolants m².K/W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plancher bas</td>
<td>Paroi de vide sanitaire</td>
<td>ITR - Polystyrène</td>
<td>50</td>
<td>0.27</td>
</tr>
<tr>
<td>Plancher haut</td>
<td>Paroi interne + doublage intérieur</td>
<td>ITR - Laine minérale (λ = 0.040)</td>
<td>20 x 6</td>
<td>6.9</td>
</tr>
<tr>
<td>Plancher Haut</td>
<td>Plancher Haut</td>
<td>ITR - Laine minérale (λ = 0.032)</td>
<td>14</td>
<td>4.38</td>
</tr>
<tr>
<td>Paroi verticale</td>
<td>Paroi de vide sanitaire</td>
<td>ITR - Laine minérale (λ = 0.032)</td>
<td>20 x 6</td>
<td>6.9</td>
</tr>
</tbody>
</table>

#### Technical equipments

<table>
<thead>
<tr>
<th>Chauffage</th>
<th>Chauffage à condensation</th>
<th>Rdt : 97.8%</th>
<th>Puissance : 24 [kW]</th>
</tr>
</thead>
</table>

#### Hot water

<table>
<thead>
<tr>
<th>Ballon thermodynamique</th>
<th>Air extérieur - 250L</th>
</tr>
</thead>
</table>

#### Lighting system

<table>
<thead>
<tr>
<th>Puissance d'éclairage moyenne = 8 [W/m²]</th>
</tr>
</thead>
</table>

#### Ventilation system

| Source – OCR (http://ocr-expertise.fr) |

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Ductwork airtightness is a input data in EP calculation

![Ductwork airtightness class](http://ocr-expertise.fr)
Ductwork leakages
Example of a EP calculation

MVHR
- Nominal air Flow : 105 [m³/h] (max 180 [m³/h])
- Exchanger : 82% Heat Recovery Efficiency
- Supply Ductwork and Extract Ductwork :
  - 25% inside conditioned space
  - 75% outside conditioned space

<table>
<thead>
<tr>
<th>Ductwork airtightness Class</th>
<th>Heating [kwhep/m²]</th>
<th>Energy saving [kwhep/m²]</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default Value</td>
<td>30,6</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

Source – OCR ( http://ocr-expertise.fr )

Ductwork leakages
Example of a EP calculation

Default value : No mandatory test
Class A, B or C : Mandatory test

The ductwork airtightness measurement has to be performed :

- by a qualified independant technician
  (About 100 certified testers according to a national qualification scheme for ductwork testers)
- according to the FD E51-767
FD E 51-767

Ventilation for buildings – Ductwork tightness measurements

FD E51-767

FD E51-767 -> National guidance to specify how to use test standards:

- On site with various kind of ductwork (different materials, different shapes, ...)
- Different use of building (non residential building, residential building...)
- To take into account the usual operating pressure of the ventilation system
- How to sample
- How to take into account specific devices (plenum box, flexible sleeve, ...)

FD E51-767
FD E51-767 refers to:

- **EN 12 237**: Ventilation for buildings – Ductworks – Strength and leakage of circular sheet metal ducts
- **EN 1507**: Ventilation for buildings – Sheet metal air ducts with rectangular section – Requirements for strength and leakage
- **EN 13 403**: Ventilation for buildings – Non-metallic ducts – Ductwork made from insulation ductboards
- **EN 12 599**: Ventilation for buildings – Test procedures and measurement methods to hand over air conditioning and ventilation systems

**Measurement of ductwork surface area**:

- FD E51-767 refers to: EN 14 239 Ventilation for buildings — Ductwork — Measurement of ductwork surface area

Only for individual system (in residential buildings) it’s also possible to calculate the surface area with another method:

\[ 0.1 \times \text{Floor area of the dwelling} \]
Test pressure:

Type of ductwork:
- Supply air ducts: Positive pressure
- Exhaust air ducts: Negative pressure

Use of building:

<table>
<thead>
<tr>
<th>Building</th>
<th>Test pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Building – Single family houses</td>
<td>± 80 Pa</td>
</tr>
<tr>
<td>Residential Building – Multi family building</td>
<td>± 160 Pa</td>
</tr>
<tr>
<td>Non Residential Building</td>
<td>± 250 Pa</td>
</tr>
<tr>
<td>Non Residential Building if</td>
<td>$</td>
</tr>
</tbody>
</table>

How to sample:

- Individual system (residential)
  - 100% of ductwork (Exhaust ductwork and Supply ductwork)

- Collective system (residential) and non residential system
  - All kinds of ducts (size, type of ducts, type of section, type of accessories, ...)
  - One of those requirements shall be met:
    - Case 1: $L/Aj \geq 1$ and $Aj > 10 \text{ m}^2$ and $Aj > 10 \%$
    - Case 2: At least one whole floor to the ventilation unit and $Aj > 10 \text{ m}^2$ and $Aj > 20\%$
    - Case 3: At least one whole column to the ventilation unit and $Aj > 10 \text{ m}^2$ and $Aj > 20\%$
How to sample:

CASE 2 – example

A : equipment for measuring
○ : exhaust or supply unit
◇ : sealed

How to sample:

CASE 3 - example

A : equipment for measuring
○ : exhaust or supply unit
◇ : sealed
How to sample:

If there are several ventilation units and air handling units

Method of sample selection:

- If $N \leq 5$, each ductwork have to be tested
- If $N > 5$, number Of ductwork to be tested:
  \[ 5 + 40\% \times (N-5) \]
  
  $N$ : number of unit

Measuring method – specific devices

- To Give penalties if some parts can’t be tested to use it for the EP Calculation
- Method to seal off the diffuser (exhaust units / supply units) or the climate beams

Plenum box included

Plenum box not included

1. Exhaust or supply unit or Climate beams
2. Sealing instead of unit
3. 5 Plenum box
4. 6 Sealing in the duct
Measuring method – specific devices
Method to seal off the connection to the Ventilation unit

Flexible sleeve included

Flexible sleeve not included

1 – 5 Ventilation unit (fan, air handling unit...)
4 – Sealing in the ventilation unit
2 – 6 Flexible sleeve - Connection
Ductwork – Ventilation Unit
3 – 7 Ductwork
8 Sealing in the duct

<table>
<thead>
<tr>
<th>Flexible sleeve</th>
<th>Climat beam</th>
<th>Plenum box</th>
<th>Penalties Correction of measured values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Included</td>
<td>Included</td>
<td>Included</td>
<td>x 1</td>
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<tr>
<td>Not included</td>
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<td>x 1.5</td>
</tr>
</tbody>
</table>
Thank you for your attention

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