Residential Air Handling Units

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Eurovent Certita Certification launched in 2014 the 1st European wide certification programme for Residential Air Handling Units (RAHU)[1]. After nearly two years the Eurovent Launching Committee for RAHU – composed by six European manufacturing companies – finalized the Operational Manual and rating Standard for RAHU. The scope of this programme includes all supply and exhaust residential ventilation units equipped with heat recovery system (including heat-pumps) up to 1 000 m³/h nominal airflow. This programme relies on the latest European testing standards [3] and European regulations (Ecodesign [4], Energy Labelling [5]). This certification programmes aims to become the reference tool for all European consumers regarding the compliance checking of RAHU.

[1] These products are also known as "Balanced Ventilation Units (BVU)", "heat recovery units" or "Residential Ventilation Units (RVU)".

Background of the European Market on RAHU

The market share of RAHU can be estimated to be approximately 30% of the units sold in Europe (see **Figure 1**) thus representing a significant market share.

The distribution of ventilation units in terms of types (balanced, exhaust, etc.) and depending on the country highlights the fact that the situation is very different. **Figure 2**, despite representing the status in 2007, provides interesting information on this matter.

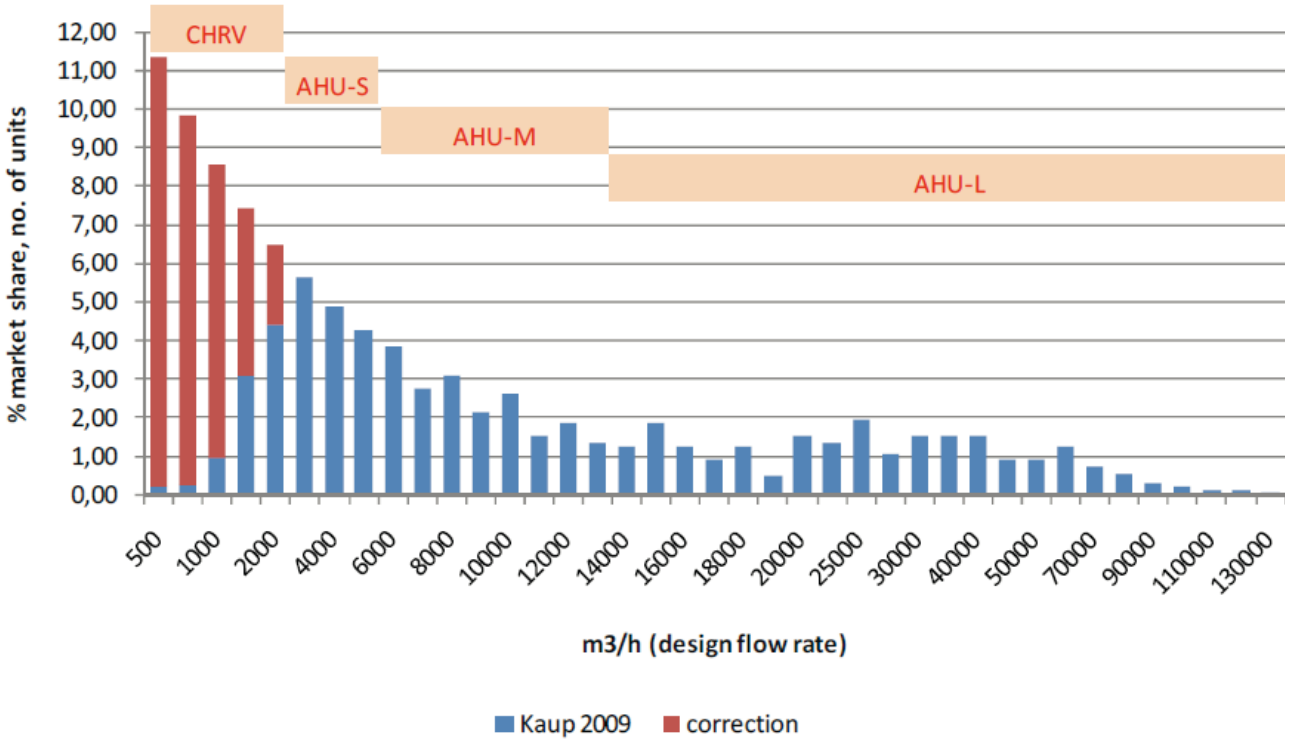

Figure 1. EU 2008 sales size distribution (from Fig 2-2 p21 in [1]).

Ventilation systems in new buildings:

	FI	UK	NL	DK	IT	PL	FR
Supply and exhaust	90% (house), 30% (coll)	<1%	60%		YES	5%	5%
Exhaust only mechanical ventilation	10% (house), 70% (coll)	<1%	40%	Flats	YES, env 5% (5)	7%	95%
Natural ventilation	0	40%		Houses	NO	87%	0%
Local ventilation	0	20% (1)			YES	1%	0%
Airing (window)	0	100% (3)			Most common	–	0%

Ventilation systems in existing buildings:

	FI	UK	NL	DK	IT	PL	FR
Supply and exhaust	30% (house), 5% (coll)	<1%	10%		Few	1%	1%
Exhaust only mechanical ventilation	30% (house), 75% (coll)	≈ 10%	50%	Flats <15 year (4)	YES	5%	40%
Natural ventilation	<40% (house (1)), 20% (coll)	2%	30%	Houses	NO	93%	19%
Local ventilation	<10% (house (2)), 0% (coll)	20% (1)	10%		YES	1%	30%
Airing (window)	0	100% (3)		Flats >15 Year (4)	Most common	–	10%

Figure 2. Ventilation systems in new and existing buildings in Europe, from (Ledean, 2007) cited in [2].

In Nordics countries for instance, balanced ventilation units with heat recovery systems covers the large majority of the systems newly installed and an already significant part of the systems installed in existing buildings (approximately 30%). In Southern Europe, airing and local ventilation systems are the most common systems installed even in new buildings. In France, mechanical ventilation is widely used however balanced units remains a very small part of the newly installed systems, the majority of the system being central exhaust mechanical ventilation. In Eastern Europe, natural ventilation seems to be the most common way in both new and existing buildings.

If we look at the evolution of the market it can be seen that in an overall increasing market for ventilation units, the market of balanced units with heat recovery systems is the most dynamic (see ICVHR – central ventilation systems with heat recovery in **Figure 3**).

The introduction in European countries of thermal building regulations provides an impulse for this system. Indeed on one side the increase of the air tightness of the building envelops obliges building consultants to rely on mechanical ventilation systems to ensure that the demanded air exchange rate within the building is met. On the other side the increase of the thermal insulation of building envelops required to meet the best standards in terms of energy use leads to the situation where the heat losses due to the renewal of the fresh air inside the building represents a significant share of the total heat loss (up to 40% in some cases). As a consequence the recovery of the heat of the exhaust air seems to be more and more a must.

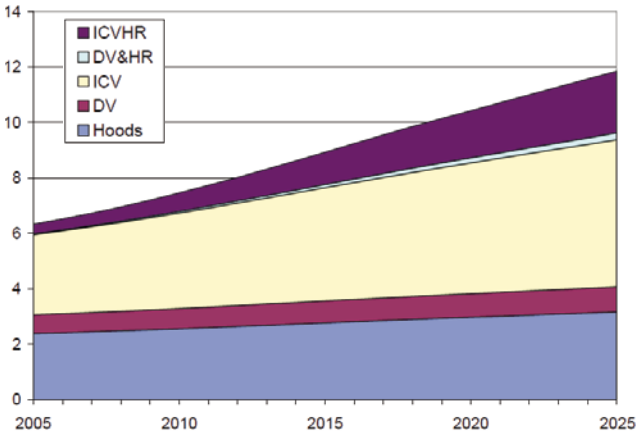

Figure 3. Projections to 2025, consumption estimate EU 25 for residential ventilation products Energy Consumption of ventilation systems in EU residential dwellings – Estimations (TWh) (from Fig 2-7 p58 in [2]).

Background of the Compliance Schemes in Europe

Several schemes exist in Europe (mandatory local regulations or voluntary schemes) but they are all valid only in one country or one region of Europe.

From one scheme to another the technical characteristics checked and the testing standards used may vary a lot. Finally different minimum requirements may be applied from one scheme to another.

The great diversity of the different schemes found in Europe may be linked to the different national or local regulations and/or building codes regarding residential ventilation.

In this context the European Regulations on Ventilation units recently published (Ecodesign regulation defining minimum efficiency requirements [4] and Energy Labelling regulation defining energy efficiency classification for residential ventilation units [5]) are a good start to harmonize the way RAHU are rated in Europe. However, despite the European regulation provides a new framework regarding the way performances are rated and classified, it may not be sufficient. Indeed these regulations are based on manufacturer's self-declaration and market surveillance activity has been very poor so far when dealing with energy efficiency checking[2]. Market surveillance activity in Europe is currently the duty of each member state. The priority is obviously put on safety and health regulations. With limited means the European Market Surveillance bodies have difficulties to check all the products covered by Ecodesign and Energy Labelling regulations.

Introducing a European wide, voluntary and third party certification scheme based on these new regulations will allow European consumers to rely on the performances of the products sold on the European market.

[2] More information on European Market Surveillance activity can be found at http://ec.europa.eu/enterprise/policies/single-market-goods/internal-market-for-products/market-surveillance/index_en.htm

[3] See the Eurovent RAHU programme description at http://www.eurovent-certification.com/en/Certification_Programmes/Programme_Descriptions.php?lg=en&rub=03&srub=01&select_prog=RAHU

[4] See the complete list of Air Handling Unit manufacturers Eurovent certified and the description of the programme at www.eurovent-certification.com.

The new Eurovent Certified Performance programme for Residential Air Handling Units

The description of this programme and the reference documents can be found on the Eurovent Certified Performance website www.eurovent-certification.com[3].

1. Scope

Ventilation units covered by this new certification programmes are ventilation units:

- With supply and exhaust (balanced)
- up to 1 000 m³/h nominal airflow
- with a heat-recovery system (plate heat exchanger, rotary heat exchanger or heat-pump)

These units are intended for small to medium residential buildings (single dwellings or small collective dwellings). It is to be noted that a Eurovent certification programme for units with higher nominal airflows already exists and covers more than 80 manufacturers in Europe, Middle-East and Asia[4].

2. Certified Characteristics

All characteristics useful to the end users are certified. They are coming from either European Standards [3] or European regulations ([4] and [5]).

2.1. Leakage

The leakage class as defined in the European standard EN 13141-7:2011 is certified. This class takes into account both internal and external leakages. **Figure 4** provides the definition of the different classes for the pressure method used for plate heat exchangers. For rotary heat exchangers the tracer gas method shall be used.

Class	Pressurization test		
	Internal leakage (at 100 Pa)		External leakage (at 250 Pa)
A1	≤ 2 %	and	≤ 2 %
A2	≤ 5 %	and	≤ 5 %
A3	≤ 10 %	and	≤ 10 %
not classified	> 10 %	or	> 10 %

Figure 4. Leakage classification for the pressure method for supply and exhaust ventilation units as defined in EN 13141-7:2011.

2.2. Airflow

Airflow performances of the unit are certified. **Figure 5** describes the airflow/pressure certified window. This window aims to cover the most common working points of the unit.

The maximum airflow is in particular certified and published on the ECP website.

2.3. Electrical consumption

The effective power input at reference point and the specific power input (SPI) at reference point are also checked and certified. The SPI is the ration between the effective power input at reference point and the nominal airflow as given in Equation (1).

$$SPI = P_e / q_v, \ [W/(l.s^{-1})] \quad (1)$$

2.4. Heat recovery efficiency

The efficiency of the heat recovery systems is given by either:

- The temperature ratio on supply side for plate and rotary heat exchangers, or
- The COP/EER for heat-pump heat recovery systems.

Figure 6 provides the testing conditions of the temperature ratio.

Application mode	Standard test			Cold climate test[a]
Point Number	1	2	3	4
Heat exchanger category	I and II (mandatory point)	I (optional) and II (mandatory)	I and II (optional)	I and II (optional)
Extract air				
Temperature θ_{11}	20°C	20°C	20°C	20°C
Wet bulb temperature θ_{w11}	12°C	15°C	12°C	10°C
Outdoor air				
Temperature θ_{21}	7°C	2°C	–7°C	–15°C
Wet bulb temperature θ_{w21}	–	1°C	–8°C	–
[a] additional test for cold climates				

Figure 6. Testing conditions of the temperature ratio for plate (I) and rotary (II) heat exchangers ([3]).

The efficiency at cold climate conditions is also checked for units intended to be used at outside temperature down to –15°C.

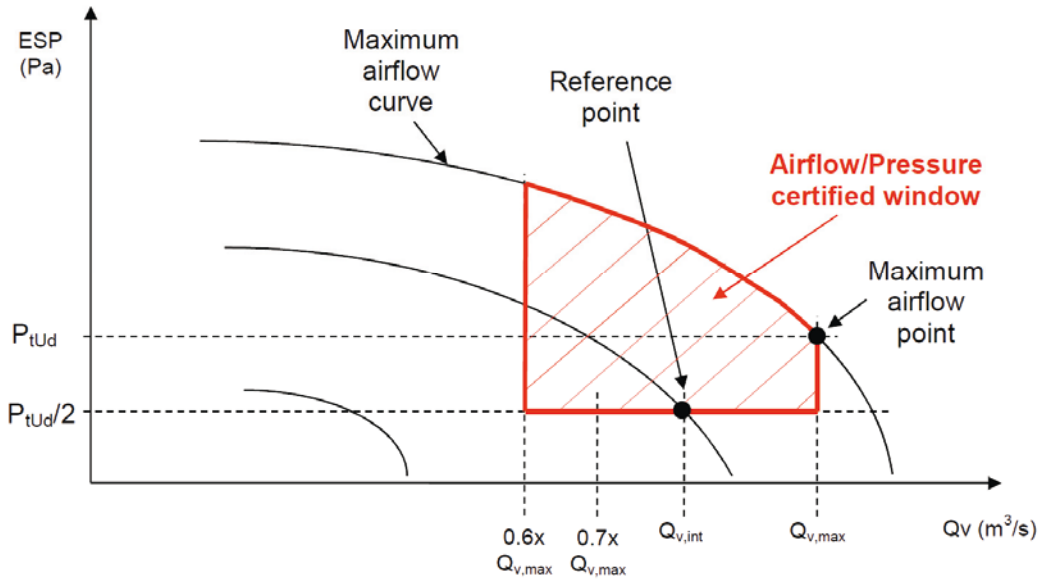

Figure 5. Definition of the airflow/pressure certified window.

2.5. Energy efficiency

The Specific Energy Consumption (SEC) in kWh/(m².year) is the way used in the European regulations to assess the energy efficiency of residential ventilation units. This performance aims to evaluate the yearly energy consumption (if positive) or energy supply (if negative) of residential ventilation units per square meter. It takes into account the energy consumption of the fans and of the defrost system as well as the energy recovered due to the heat recovery system (see Equation (2)).

SEC = *Fans electrical consumption – Energy recovered due to the heat recovery device + Electrical consumptions during defrost mode* (2)

The SEC basically derives from the electrical power input at reference point and the temperature ratio. It is to be noted that the SEC is defined only for plate and rotary heat exchangers and not for units with heat-pumps heat exchangers.

The complete and detailed formula for SEC can be found in [4] and [5].

Energy Labelling No 1254/2014 [5] defines also the corresponding energy efficiency classes based on SEC (see **Figure 7**).

This regulation defines also the way this energy efficiency class has to be labelled on the unit (see **Figure 8**).

2.6. A-weighted global sound power levels [dB(A)]

Finally up to 5 different sound power levels are certified (**Figure 9**). This allows assessing the overall impact of the unit in terms of sound emission.

3. Rating Standards

All certified performances are defined according to the latest European standards ([3]) and European Regulations ([4] and [5]).

4. Overview of the main characteristics of the Eurovent Certification programme for RAHU

The Eurovent certification programme for RAHU is part of the accredited scope of Eurovent Certita Certification[5]. This accreditation means that it is managed according to ISO 17065 standard which

SEC class	SEC in kWh/a.m²
A+ (most efficient)	SEC < –42
A	–42 ≤ SEC < –34
B	–34 ≤ SEC < –26
C	–26 ≤ SEC < –23
D	–23 ≤ SEC < –20
E	–20 ≤ SEC < –10
F	–10 ≤ SEC < 0
G (least efficient)	0 ≤ SEC

Figure 7. Definition of the energy efficiency classes for residential ventilation units from 1st January 2016 according to Energy labelling regulation No 1254/2014 [5].

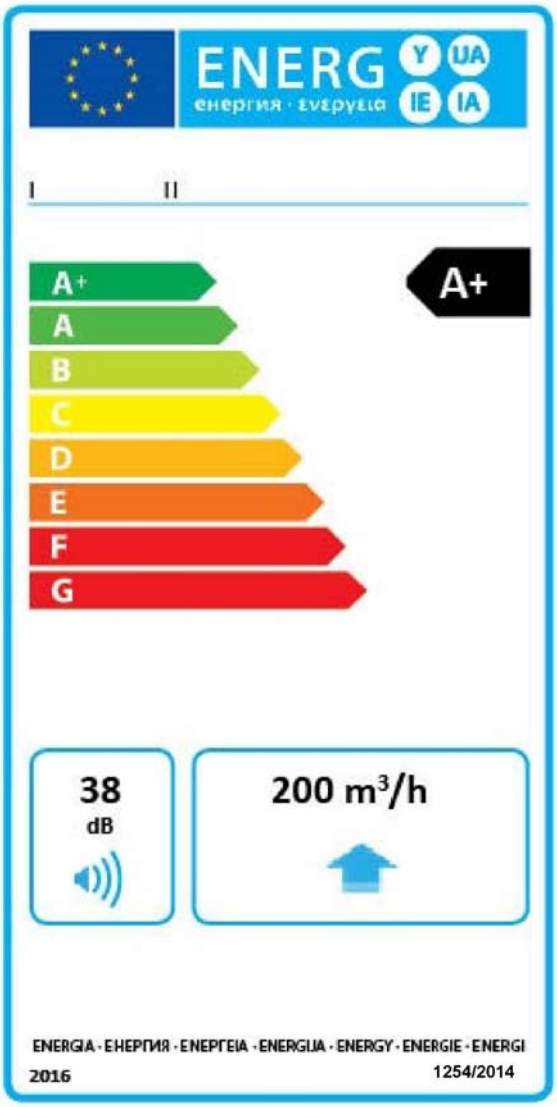

Figure 8. Label for balanced ventilation units after 1 January 2016 according to Energy labelling regulation No 1254/2014 [5].

5 Eurovent Certita Certification is accredited by COFRAC, see scope and validity at www.cofrac.fr. This accreditation is compliant with the European co-operation for Accreditation (EA) also member of International Accreditation Forum (IAF) with mutual recognition agreement.

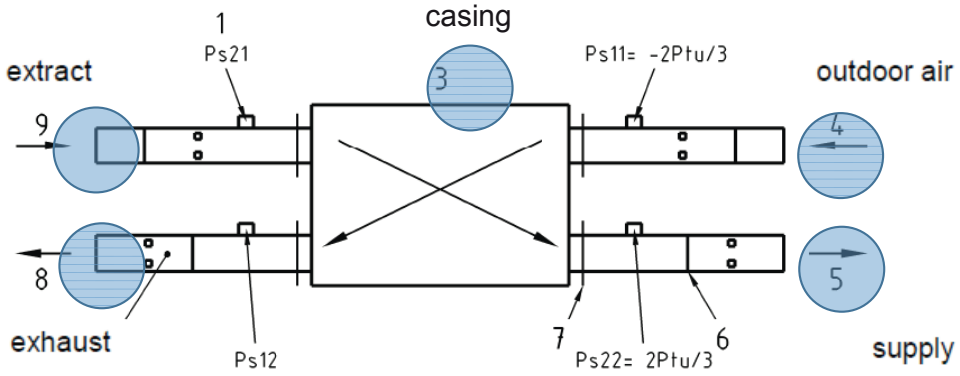

Figure 9. Sound power levels certified: Extract, Exhaust, Outdoor air, Supply and Casing.

insures the quality of the third party certifier regarding its impartiality and competence.

Moreover all compliance tests are performed by European laboratories accredited according to ISO 17025. Tests are performed according to the same procedures thus insuring the reliability of the test results.

Finally the products tested in independent laboratories are directly purchased on the market through an anonymous process.

Conclusion

With increasing regulations related to the energy efficiency of buildings, systems and products in Europe, and the up-coming increase of regulations regarding indoor air quality, there is a strong need to have energy efficient ventilation products in residential buildings. In order to provide to European end-users a transparent way to compare one product with each other and to get useful information on the final energy consumption, European regulations have been published in July 2014 with application on 1st January 2016.

In order to provide to the end users confidence in the published performances of such products Eurovent Certita Certification proposes a new certification programme:

- Based on the latest European standards and European regulations
- Managed according to the best practices in terms of third party certification processes.

This certification programme aims to become the reference tool for European Market Surveillance bodies as well as European consumers regarding the compliance checking of RAHU. ■

References

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[2] P. Rivière et al., (2009), Preparatory study on the environmental performance of residential room conditioning appliances (airco and ventilation), Contract TREN/D1/40-2005/LOT10/S07.56606, Study on residential ventilation - Final report February, 2009, after SH comments.

[3] EN 13141-7:2011 - Ventilation for buildings, Performance testing of components/products for residential ventilation, Part 7: Performance testing of a mechanical supply and exhaust ventilation units (including heat recovery) for mechanical ventilation systems intended for single family dwellings.

[4] COMMISSION REGULATION (EU) No 1253/2014 of 7 July 2014 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for ventilation units. Available online at http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R1253&from=EN.

[5] COMMISSION DELEGATED REGULATION (EU) No 1254/2014 of 11 July 2014 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of residential ventilation units. Available online at http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R1254&from=EN.