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Eurovent comments on interim preparatory study report on low temperature emitters

In a nutshell

The first Eurovent comments on the interim preparatory study report on energy labelling for low temperature heat emitters can be summarised as follows:

- **Existing standards EN 1397 and EN 16583 allow the measurement of performances of fan coils;**
- **EN 442 is not applicable to fan coils;**
- **The investigative test is interesting but focused only on house refitting. Fan Coils have a much broader field of application;**
- **Eurovent Certification has developed a labelling scheme for certified fan coils.**

Background

Eurovent with this paper would like to comment on the interim preparatory study report on energy labelling for low temperature heat emitters, in particular the sections related to fan coils.

Punctual comments to the text are reported below. The current labelling scheme adopted by Eurovent Certification is introduced at the end of the document, which the consultant may consider as an example.

Characteristics of fan coils and general comments

It must be noted that in general, the fan coil is a product whose performances are measured according to EN 1397 and EN 16583 standards, and it is designed to work already at low temperatures. There is no need for further standards or methodologies for the assessment of performances.

Supporting what is above, the EN 442 should not be applied to products with forced ventilation. In fact, the scope of the EN 442 states that the standard deals with radiators and convectors, which have the following definitions:

1 Scope

This European Standard defines the technical specifications and requirements of radiators and convectors to be installed in heating systems in buildings including assessment and verification of constancy of performance.

This European Standard deals with radiators and convectors installed in a permanent manner in construction works, fed with water or steam at temperatures below 120 °C, supplied by a remote energy source.

Figure 1: Scope of the EN 442 standard

3.3
radiator
heating appliance, produced with different materials (e.g. steel, aluminium, cast-iron) and with different designs (e.g. plate type, column type, tube type, finned tube type), which emits heat by free convection and radiation

Figure 2: definition of radiator from the EN 442 standard

3.6
convector
heating appliance which emits heat almost entirely by free convection

Figure 3: definition of convector from the EN 442 standard

Both definitions clarify that these products work almost entirely with natural convection. In point A.3, in the catalogue reference data, there is no reference to power supply and power consumption.

Comments to the interim report

4.2.4 Considerations as regards EN 1397 and hydronic fan coil units

The liquid mass flow rates are not a topic in the EN 1397:2021. They are derived from the temperature test points 45/40 °C and 65/55 °C, indicating that it is assumed that at any time the pump – regardless the type of distribution system and pipe diameters - can deliver whatever is needed. In general, the required liquid mass flow rates are quite high when compared to hydronic heating systems using traditional heat emitters. From that point of view, it is questionable whether fan coils units can be used as replacement for e.g. the standard steel panel heat emitters.

In any case, for objective rating purposes, it would be useful to be able to say something about the relationship between flow variations and heat output, for at least one or two of the fan speed settings. A further problem is caused by the fact that manufacturer documentation is not always clear about what rating conditions were used for determining the heat output figures displayed in their brochures.

In general, the performance data provided by manufacturers are currently not sufficient to determine and compare the LT-performance of fan coil units amongst each other nor with the various fan assisted LT convector/radiator types.

The scope of EN 1397 provides a consistent framework for testing fan coil units, ensuring comparable results across different manufacturers and models. All major manufacturers can provide all the information that a customer or an HVAC designer might need to design the plant for different conditions of air temperature and/or unit airflow and/or water flow to the unit and/or supply water temperature.

Most manufacturers also offer a selection tool (which will be mandatory certified for those participating in the Eurovent Certification programme) to display the performance of their fan coil units at different air and water conditions. From these datasheets, it is possible to retrieve the water flow rate and other performances of the fan coil unit.

4.2.5 Proposed investigative tests regarding LT-rating conditions

For radiator/convector- type emitters and for fan coil units, the following investigative tests for determining standard rating conditions LT-applications are proposed:

1. Determine the standard flow rate at 42/38 °C, i.e. ΔT=4.

2. If applicable, maximize standard flow rate. If the flow rate needed for this 42/38 °C test point becomes higher than 180 l/h, the flow is maximized to this value of 180 l/h, corresponding with the maximum allowable flow rate in a standard 15 mm CH-pipe (see Table 5). In such cases the ΔT will be higher than 4 K; actual values for T_{supply} *and* T_{return} *must be recorded.*

This proposed investigative test is technically interesting, although the value of water flow of 180 l/h only focuses on the renovation of houses. The range of applications for fan coil units is much broader.

Besides, existing 2-pipe fan coil units and actual heat pumps with synthetic refrigerant are designed to perform the best with a 5°C ΔT, therefore 42/37 might be a better ΔT than 42/38 to test at a standard flow rate. A limit could be added to the resulting ΔT if it becomes too high for the heat pump to handle.

3. Determine second flow rate. If the emitter under test has a water flow path cross-section (incl. its connection terminal) that is around or above 300 mm², a second series of measurements is performed with a maximum flow rate of 450 l/h, corresponding to the maximum allowable flow rate in a standard 22 mm CH-pipe (see Table 5). If this cross section is smaller, the second series of measurements is performed at 30 % of 180 l/h being 54 l/h. Also, for these measurements using a second flow the actual values for T_{supply} *and* T_{return} *must be recorded.*

As for the previous point, the value of water flow of 450 l/h is focused only on houses refitting. The range of applications for fan coil units is much broader.

4. Measure the heat output at low temperature for both the standard flow rate and the second flow rate. Use the following test point for the compilation of the two characteristic equations for LT-applications:

1. T_{excess} = (30 ± 2.5) K, *resulting in a mean emitter temperature of ≈ 50 °C.*
2. T_{excess} = (20 ± 2.5) K, *resulting in a mean emitter temperature of ≈ 40 °C.*
3. T_{excess} = (10 ± 2.5) K, *resulting in a mean emitter temperature of ≈ 30 °C.*

5. Define T_{excess} *= (20 ± 2.5) K as the characteristic test point for low temperature emitters.*

As stated at the beginning of the document, applying the characteristic equations of EN 442 to a fan coil unit should be avoided for labelling purposes. Fan coil units are already tested according to EN 1397 and are fundamentally different devices from radiators. For example, these equations do not account for the electrical consumption of the fan.

6. In case of fan assisted emitters and fan coils, add (or replace one of the other 3 fan speed tests with) the test sequences (T_{excess} *= 30, 20 and 10 K) using a fan speed setting that produces a sound power of 38 dB(A). This characteristic equation is to be used for comparison with other fan assisted emitters. If a fan assisted emitter also capable of emitting heat when the fans are switched off, the required measurements must also be performed in 'natural convection' mode.*

It is an interesting solution to compare different units, however the uncertainty of measurement and variability of measurement of an acoustic test will, in that case, have a huge impact on the capacity test measurement. Another approach would be to compare fan coil units with the same electric power consumption / electric installation needed.

We suggest that a product working in forced convection would preferably be equipped with an air treatment filter.

Table 33

Which performances are Eurovent Certified performances should be clarified.

Table 34

It is a 2-pipe unit, but the supply temp shown is 70°C which is possible, but doesn't represent a condition of EN 1397 standard . Which performances are Eurovent-certified performances should be clarified.

4.4.4.2 Optimal fan coil units.

As regards fan coil units, the best available technology relates to those units that provide the higher heat outputs at the lower liquid temperatures and the lower noise levels.

With the proposed low temperature rating conditions (see section 4.2.5) the better fan coil units will automatically be differentiated. Apart from offering the better LT-emitters and doing the right heat-output performance tests it is important that more awareness is created in the sector and that the selection and application of LT-emitters is actively promoted, e.g. through an energy label. This is relevant not only for consumers that eventually pay for the LT-emitters, but also for system designers and installers that play a vital role in the envisaged technological transformation of the current heating systems.

Tests at lower output temperatures could be conducted. However, as previously mentioned, for a complete evaluation of a fan coil's efficiency, the electrical consumption of the fan must be considered. It's important to note that there would be significant differences in energy consumption using an AC motor and an EC motor.

The Eurovent Certification Labelling Scheme

Eurovent Certita Certification in partnership with the participants of the ECP-FCU program, which covers ≈76% of the market, created an energy efficiency class for fan coil units. This energy efficiency class is divided into 2 classes, one for cooling and one for heating.
The classes are based on the output of the fan coil units at standard conditions divided by the electric consumption of the fan coil units. The duration of which speed is going to be used throughout the year is also taken into account.

Therefore, FCCOP for 2-pipe fan coil units is already close to a low temperature energy class because the standard condition in heating for this type of fan coil is 45°C/40°C. The formulas for these energy classes are presented below:

FCEER and FCCOP

Based on the definition of Low, Medium and High speed, the Fan Coil Energy Efficiency Ratio (FCEER) and the Fan Coil Coefficient of Performance (FCCOP) are defined as follows:

Equation 1 : FCEER

$$FCEER = \frac{5\% \cdot Pc_{high} + 30\% \cdot Pc_{med} + 65\% \cdot Pc_{low}}{5\% \cdot Pe(c)_{high} + 30\% \cdot Pe(c)_{med} + 65\% \cdot Pe(c)_{low}}$$

Equation 2 : FCCOP

$$FCCOP = \frac{5\% \cdot Ph_{high} + 25\% \cdot Ph_{med} + 70\% \cdot Ph_{low}}{5\% \cdot Pe(h)_{high} + 25\% \cdot Pe(h)_{med} + 70\% \cdot Pe(h)_{low}}$$

Where Pc and Ph respectively stand for the total cooling capacity at standard condition and the heating capacity at standard condition.
Where $Pe(c)$ and $Pe(h)$ respectively stand for the unit power input at standard cooling condition and unit power input at standard heating condition and must be expressed in the same unit as Pc and Ph.

Energy Efficiency Class

Energy Efficiency Classes (A to E) in cooling or heating are respectively based on FCEER and FCCOP in accordance with below tables:

Table 2: Energy Efficiency Classes in cooling and heating for non-ducted FCU

Class	Cooling mode	Heating mode
A	FCEER>=185	FCCOP>=265
B	185>FCEER>=120	265>FCCOP>=160
C	120>FCEER>=80	160>FCCOP>=100
D	80>FCEER>=55	100>FCCOP>=70
E	55>FCEER	70>FCCOP

Table 3: Energy Efficiency Classes in cooling and heating for ducted FCU

Class	Cooling mode	Heating mode
A	FCEER>=85	FCCOP>=85
B	85>FCEER>=60	85>FCCOP>=60
C	60>FCEER>=40	60>FCCOP>=40
D	40>FCEER>=25	40>FCCOP>=25
E	25>FCEER	25>FCCOP

Eurovent and transparency

When assessing position papers, are you aware whom you are dealing with?

Eurovent's structure rests upon democratic decision-making procedures between its members and their representatives. The more than 1.000 organisations within the Eurovent network count on us to represent their needs in a fair and transparent manner. Accordingly, we can answer policy makers' questions regarding our representativeness and decisions-making processes as follows:

1. Who receives which number of votes? At Eurovent, the number of votes is never determined by organisation sizes, country sizes, or membership fee levels. SMEs and large multinationals receive the same number of votes within our technical working groups: 2 votes if belonging to a national Member Association, 1 vote if not. In our General Assembly and Eurovent Commission ('steering committee'), our national Member Associations receive two votes per country.	**2. Who has the final decision-making power?** The Eurovent Commission acts as the association's 'steering committee'. It defines the overall association roadmap, makes decisions on horizontal topics, and mediates in case manufacturers cannot agree within technical working groups. The Commission consists of national Member Associations, receiving two votes per country independent from its size or economic weight.
3. How European is the association? More than 90 per cent of manufacturers within Eurovent manufacture in and come from Europe. They employ around 150.000 people in Europe largely within the secondary sector. Our structure as an umbrella enables us to consolidate manufacturers' positions across the industry, ensuring a broad and credible representation.	**4. How representative is the organisation?** Eurovent represents more than 1.000 companies of all sizes spread widely across 20+ European countries, which are treated equally. As each country receives the same number of votes, there is no 'leading' country. Our national Member Associations ensure a wide-ranging national outreach also to remote locations.

Check on us in the European Union Transparency Register under identification no. 89424237848-89.

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Eurovent is the voice of the European HVACR industry, representing over 100 companies directly and more than 1.000 indirectly through our 16 national associations. The majority are small and medium-sized companies that manufacture indoor climate, process cooling, and cold chain technologies across more than 350 manufacturing sites in Europe. They generate a combined annual turnover of more than 30 billion EUR and employ over 150.000 Europeans in good quality tech jobs.

Mission

Eurovent's mission is to bring together HVACR technology providers to collaborate with policymakers and other stakeholders towards conditions that foster fair competition, innovation, and sustainable growth for the European HVACR industry.

Vision

Eurovent's vision is an innovative and competitive European HVACR industry that enables sustainable development in Europe and globally, which works for people, businesses, and the environment.

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