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Position Paper of the Product Group 'Air Conditioners' PP – 2020-07-29

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Eurovent input to the discussion document of technical Working Group on the review of Regulations (EU) No 206/2012 and 626/2011

In a nutshell

Concerning the European Commission online Working Group meeting to discuss alternative testing methods for fixed air conditioners and heat pumps on 18 June 2020, Eurovent would like to provide its feedback to the proposed discussion paper.

Background

Eurovent thanks the European Commission for setting up this Working Group meeting to discuss alternative testing methods for fixed air conditioners and heat pumps on 18 June 2020.

Eurovent would like to point out that this Position Paper covers only the products assessed in the course of the Working Group meeting (specifically fixed air-to-air split air conditioners and air-to-air split heat pumps in the scope of Regulations (EU) No 206/2012 and 626/2011) and it does not cover portable air conditioners/heat pumps, single/double duct fixed air conditioners/heat pumps (it is to be reminded that further to the Consultation Forum on September 2019, the European Commission is currently assessing the base cases and the minimum efficiency requirements of these units – please refer to the joint APPLiA-Eurovent Position Paper dated 2020-02-06), and units not intended for human comfort applications (which are out of the scope of current revision of Regulations (EU) No 206/2012 and 626/2011).

Solutions for thermal human comfort

Eurovent thanks the European Commission for considering the thermal human comfort and proposing different directions and scenarios to solve the issue for both cooling and heating modes during testing.

We hold that it is necessary to define requirements for test methods to ensure that the efficiency values declared by manufacturers reflect the real use of the products under cooling and/or heating modes by considering both comfort and health issues. Units placed on the market are designed to provide comfort to the occupants at all times during operation. However, this is not reflected in the current test conditions.

We hold that this matter should not be postponed to the next revision. This information is already available, and it is already possible to use the airflow rates range with the corresponding efficiency values.

After a careful assessment taking into consideration occupant comfort and health, as well as product feasibility, Eurovent recommends to limit the airflow rate at 247m^3/h/kW for all test points (A, B, C and D) for air-to-air air conditioners and air-to-air heat pumps under cooling and heating modes of operation (see Table 1 and Table 2). The suggested airflow rate considers the design capacity in cooling mode ($P_{designc}$) and the bivalent capacity in heating mode (P_{biv}).

Heating mode

In heating mode, limiting the airflow rate to 247m^3/h/kW results in the proposed Scenario 1 with a supply air temperature of 32°C, at the bivalent point condition, which is sufficient to keep an occupied room within the comfort heating range (20-23°C) as specified in EN 15251.

Airflow rates lower than 247m³/h/kW can be used during testing, resulting in supply temperature exceeding 32°C.

Test requirements for heating		
Rating point	$T_{outdoor}$/Load Ratio [°C/%]	V/P_h [m³/h/kW]
A (T_{biv})	-7/88%	247
B	2/54%	247
C	7/35%	247
D	12/15%	247

Table 1: Airflow limits in heating mode at the testing points

It is to be pointed out that, according to our internal assessment, the above presented test requirements will affect almost half of the product ranges covered by the current revision (see figure 1).

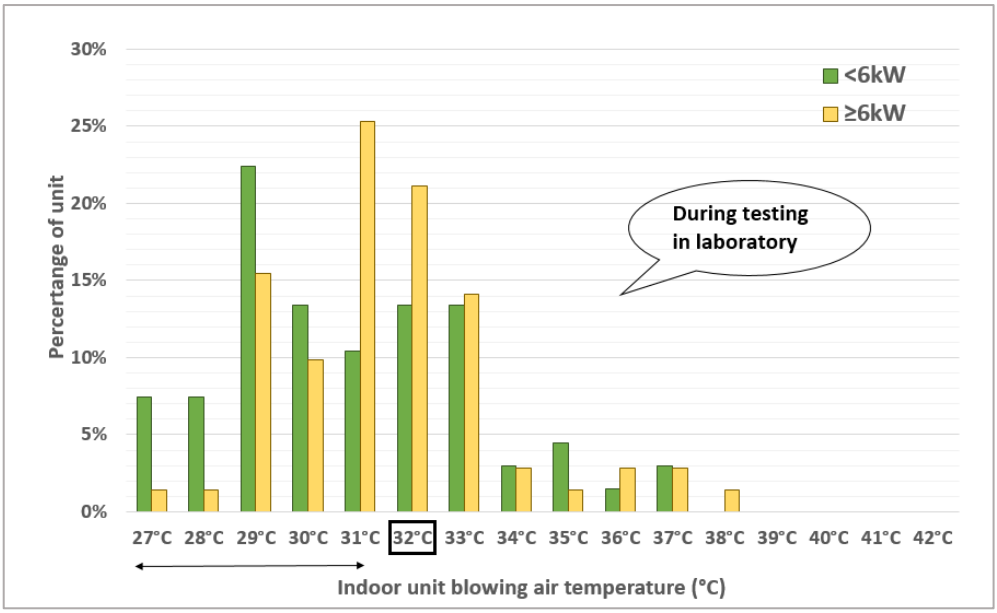

Figure 1: Outlet temperature of indoor units in heating mode when test at -7°C (outside temperature)[1]

It is also to be noted that the building regulations of some EU Member States (e.g. Denmark Bygningsreglemant, BR18, Termisk Indeklima) limit the supply air temperature when heating with air at 35°C.

Thus, in heating mode, Eurovent supports the proposed Scenario 1, which limits the airflow rate to 247 m3/h/kW.

Cooling mode

In cooling mode, we suggest keeping the same maximum airflow rate as in heating mode. It relates to a SHR of 0,9 at cooling design capacity (see Table 2). This is sufficient to provide dehumidification for the different regions of Europe.

[1] 138 split units between 0 and 12kW in EU market from 2018 (mainstream and best products from Eurovent Certita Certification database)

Test requirements for heating		
Rating point	$T_{outdoor}/T_{indoor}$/Load Ratio [°C/°C/%]	V/P_h [$m^3/h/kW$]
A	35 °C / 27(19) / 100 %	247
B	30 °C / 27(19) / 74 %	247
C	25 °C / 27(19) / 47 %	247
D	20 °C / 27(19) / 21 %	247

Table 2: Airflow limits in heating mode at the testing points

Eurovent proposes the same limitation on airflow rates for both cooling and heating mode (this results from a common practice in the product's design phase where the same fan is used for both modes of operation).

Thus, in cooling mode Eurovent supports the same airflow rate as of in heating mode which is 247 m3/h/kW.

It is to be reminded that putting a requirement on the airflow rate and linking it to cooling and heating load is the most practical way as:

- Manufacturers are used to test the airflow rate and declare it in their technical documentation.
- The measurement techniques for airflow rates are better developed, more precise and have lower tolerances and uncertainties compared to the ones for air humidity and air temperature.
- The airflow rate can be used in the product's design phase.

Eurovent also wants to point out that several points need to be carefully addressed:

- It should be possible to perform the thermal human comfort tests in both the calorimeter room and air enthalpy room. In the calorimeter room, the fan RPM of the indoor unit can be checked when performing the airflow rate test and confirmed during the part load tests. In the air enthalpy room, the fan airflow rate can be checked directly as it is part of the test.
- In heating mode, the bivalent temperature shall be set within the range of -10°C and -7°C to limit the effect it has on the unit performance. This is to avoid circumvention by using T_{biv} values higher than -7°C that can allow more supply airflow per heat load required.
- Comfort requirements shall not be applied to units specifically used for cooling in unoccupied rooms such as data centres and control board rooms, where neither comfort nor dehumidification are needed.
- The comfort requirements have to be adapted also for multi-split units. The maximum airflow rate limitation shall be based on the outdoor unit capacity in cooling (or heating if heating only) for the 1:1 capacity ratio between indoor and outdoor units.

Assessment of the other proposed scenarios

Eurovent holds that the scenarios 2 and 3 propose too severe test conditions.

For Scenario 3, the maximum allowed airflow is very low, which would lead into high fluctuations in both the airflow and the air temperature. This would result in in poor performances of the tested unit.

In addition, low flow rates can jeopardize the thermal comfort of occupants, as these will result in insufficient mixing of the supplied air with the room air. This will create overheated zones and

underheated zones (e.g. close to windows and external walls) within the same occupied space. It would directly affect the control, the energy consumption and the performance of the unit.

Eurovent does not support the proposed Scenario 4, as it compares a water-based fan coil unit with an air-to-air system.

First of all, this is not a relevant comparison as they are not similar systems. Water and air have different physical and thermodynamic properties, which explains why for the same mass amount of air and water the energy transferred is different. This implies different design of products depending on whether they use air or water as transfer medium (piping size, heat exchanger size, etc.), control strategies, functionality economic feasibility and hence will lead to unfair comparison of the products.

Secondly, with water-based fan coil units there is the imposed limitation on the water temperature in the heat exchanger. Such a limitation cannot be applied on air-to-air systems: there are many different types of refrigerants and limiting the temperature on the condenser side (heating mode) would be technology prescriptive and will only favour certain type of appliances that are on the market.

Timing and effect on the efficiency

The changes (comfort requirements) in existing requirements will need time to evaluate the impact on the efficiency values of the products on the market, to re-test and for potential re-design of the products.

The proposed timeline needs to be adjusted accordingly; Eurovent holds that at least 2 years between the publication and the implementation of the revised regulations will be needed.

Furthermore, the timing to enforce the requirements in the middle of the year is not appropriate as it is not in line with the general market trends where products are designed and adapted before the middle of the year to anticipate the season sales.

We therefore propose to postpone the implementation of Tier 1 to no earlier than the beginning of 2024.

Finally, the effect on efficiency of the proposed test methods has to be considered for the definition of the MEPS and the labelling classes. We expect that this analysis will be done and in addition will be shared with the stakeholders for further discussions.

Independent test method with unlocked compressor

Eurovent does not support the implementation of mandatory load-based testing in Tier 2, five years after the entry into force of the revised regulation (planned timeline of mid-2027).

Eurovent regards as not appropriate the mandatory use of alternative test methods which are not yet ready for a regulatory process as mentioned in the discussion document. It has been clearly shown during the technical Working Group meeting that the work to establish the method is still ongoing. A clearer insight will only be available by the end of 2020, after the first sequence of Round Robin Tests is conducted.

The proposed test method has not yet proven to fulfil the criteria such as reliability, accuracy, reproducibility and cost effectiveness. Until it is proven, a mandatory implementation is regarded as not appropriate. Eurovent recommends setting up or identify a suitable platform to check whether the test method is feasible. For the time being, there is no system established to encourage that validation.

Furthermore, Eurovent wants to provide additional comments on the proposed methods.

Compensation method

In the following, Eurovent provides additional comments on the compensation method:

- EN 14825 describes a compensation method for air-to-water units in an informative Annex. There is no description for air-to-air systems. As a consequence, the Round Robin Test requires first to perform compensation method in order to have all laboratories being familiar with it and then proceed with the dynamic test.
- There is no evidence proving that the compensation method is more representative. It does not reflect the real use of the product even though the compressor frequencies are not fixed, still the test conditions do not reflect the comfort issues. Furthermore, with the compensation method, test rooms are with artificial load control that are different from ordinary rooms, while the supplied control of the tested product is adjusted for ordinary rooms. So, there is a high risk of control mismatch between the unit control and the test room control, if the unit control is activated. This has to be properly evaluated and avoided.
- Pre-settings will not disappear, for example setting of the fan position or for thermostats that do not show air temperature.
- The uncertainty of the measurement during ON/OFF cycling is not properly evaluated.
- There are several critical points that need to be solved: setting of the compensation load, wet bulb temperature control, stability of the test, uncertainties and the requirement to use only calorimeter room for the test.
- The test results as shown by the Swedish Energy Agency were only for heating. Tests in cooling mode were not performed, which is where Eurovent has concerns regarding the wet bulb temperature control.
- The compensation method uses the calorimeter room. However, it is very likely that the size of the test room has to be adapted to the capacity of the unit under test, to avoid recirculation of air. If this is confirmed, not enough test rooms will be available in Europe and it will become costly testing.
- It also should be noted that many manufacturers use the air enthalpy method as this not only gives better results under heating but also during the product's design phase. If there is no option to use the air enthalpy method to perform the compensation testing method, it may require additional investments for manufacturers to set up the correct facilities.
- It should not be forgotten that any method has to address potential circumvention.

Dynamic method

In the following, Eurovent provides additional comments on the dynamic method:

- Each 19 test points are tested for two and a half hours which might lead to lower test time compared to the compensation method, however the short duration can severely impact the accuracy of the test. The unit needs to react within a very short time interval when changing every two and a half hours the outdoor temperature at a temperature step of 2K/3K which may never happen in reality. The reaction of the unit will influence the test laboratory.
- Figure 2 below is an extract from BAM's test guideline. It shows the duration of one test point with two phases. The phase 1 (30 min) is a preconditioning where the parameters tested should be within the permissible deviation and the Phase 2 (120 min) is the period to record the required data. When changing the outdoor temperature, only 30 min of steady-state will be

required which is not sufficient. This has to be further evaluated and debated during the Round Robin Test.

- ON/OFF cycling, uncertainty, use of calorimeter room only, potential circumvention and consideration of thermal human comfort are shortcomings for the dynamic test method as well.
- It is still not clear how to use the data coming from a dynamic test for Energy Performance of Buildings (EPB) standards. This is necessary, as a lot of effort has been done to ensure that EPB standards accept and use the data declared according to EN 14825, hence Ecodesign, to make calculations possible for each application in Europe.

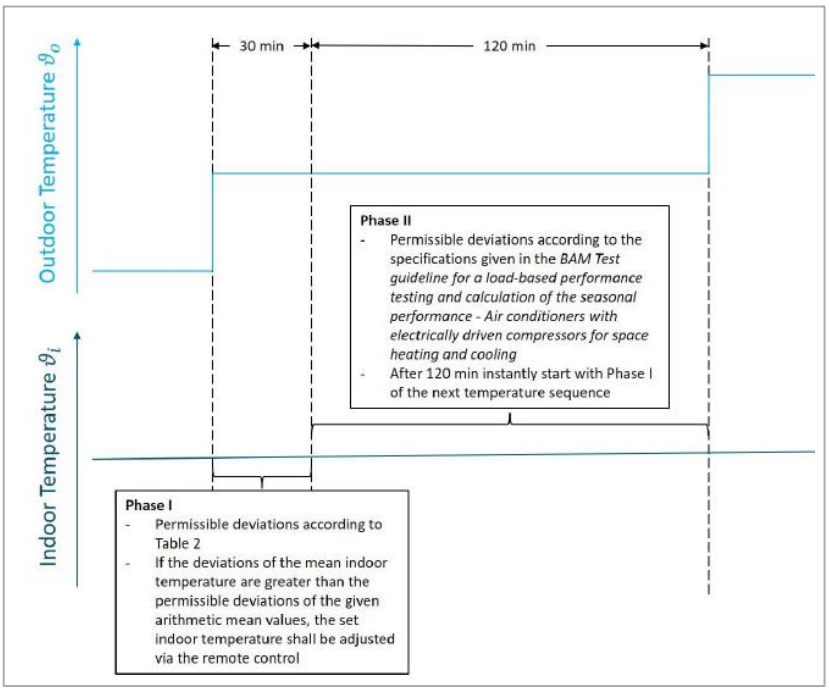

Figure 2: Dynamic test method with two phases (Source: BAM test guideline)

Eurovent welcomes the actions undertaken by the European Commission in order to enhance and better reflect the real use of products during testing, which is very much appreciated. However, as of today, based on the above comments, it is more likely that one Round Robin Test will not be enough to conclude and therefore it is premature to assume and adopt a new test method for 2027.

Other Regions approaches

Eurovent regards as very important a complete evaluation of approaches in place in other regions (e.g. Canada, USA, Japan). Contrary to what was mentioned during the meeting, Canada (CSA) does not have any mandatory compensation method in place. It is a voluntary test as it is in Europe for air-to-water products. USA also investigated thoroughly an application of the compensation method for variable refrigerant fluid (VRF) products, and after several tests, it was decided not to adapt the test, as it resulted to be not yet reliable. Investigations are still ongoing but as a counter measure, it was decided to put requirements on thermal comfort (via sensible heat ratio) and add control verification procedure (CVP). This method is used in Japan (JIS B8616:2015) and USA (AHRI 1230- 2020). It has been developed to validate that the system operation during the test is representative of its intended everyday operation. In Japan, a minimum frequency test has been integrated into JIS B 8616:2015 to

prevent circumvention (Ecodesign Lot 10 study review, Task 1, part 1.2.1.2). In the USA, additional parameters will be checked compared to Japan. These critical parameters (occurring in real life operation) are key variables, which can influence the performance of the unit. These include compressor speed, outdoor fan speed, outdoor expansion valves and outdoor 2-way valves.

Eurovent and transparency

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

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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.

We are Europe's Industry Association for Indoor Climate (HVAC), Process Cooling, and Food Cold Chain Technologies – thinking 'Beyond HVACR'

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Eurovent's roots date back to 1958. Over the years, the Brussels-based organisation has become a well-respected and known stakeholder that builds bridges between the manufacturers it represents, associations, legislators and standardisation bodies on a national, regional and international level. While Eurovent strongly supports energy efficient and sustainable technologies, it advocates a holistic approach that also integrates health, life and work quality as well as safety aspects. Eurovent holds in-depth relations with partner associations around the globe. It is a founding member of the ICARHMA network, supporter of REHVA, and contributor to various EU and UN initiatives.