EUROVENT

COM_11008.3

*Yellow text boxes below indicate specific positions from Svensk Ventilation.*

Brussels, 28 September 2011

Re: **DG-ENTR Lot 6: Air-conditioning and ventilation systems draft report Task 1-5**

Dear Mr Rivière and Mr Kemna,

Eurovent the European Committee of Air Handling and Refrigeration Equipment Manufacturers, representing the manufacturers of Refrigeration, Air-Conditioning, Heating and Ventilation equipment, would like to thank the Consultants for the work done so far.

Eurovent recognize the importance of ventilation and air-conditioning in relation to energy saving potentials and together with the European HVAC&R industry we would like to provide you with our comments and recommendations with regard to the Tasks published so far. In this connection we refer you to the attached document COM_11008.2. As we received some task's very late we will submit our comments latest October 31st and if needed an update of our comments attached.

Eurovent recognize as well the energy saving potentials of energy related products connected to ventilation and air-conditioners: air filtration products and ducts. We discussed this with you before and in our Position Paper COM_04050 dated July 2010 we mentioned briefly the importance. With this document we drawn your attention to the top down calculation we made resulting in a saving potential of respectively 3,150 GWh/a and 29,550 GWh/a for filtration and ducts. We discussed this saving potential with the European manufactures and in close cooperation with the industry we are willing to do the "preparatory" study.

With the attached document we answer as well the Commission questions with regard to:
**F)** Ecodesign on Ventilation Products (ENER Lot 10 and ENTR Lot 6);
**G)** how to consider AHU's in the Ecodesign preparatory studies ENTR Lot 6 and ENER Lot 21?
**H)** discussion about the Base Case on Industrial HT Process Chillers.

We thank you for considering the comments from Eurovent and we remain at your disposal for any additional information that you might require.

Yours sincerely,

Eurovent
Joop Hoogkamer
Executive Director

# Eurovent comments and recommendations on ENTR preparatory study Lot 6: Air conditioning and ventilation systems

## A. Air Handling Units

**Lot 6 – Task 1**
***Product Definition, Standards and Legislation Ventilation Systems for non-residential and collective residential applications*.**

Eurovent is of the opinion that a clear definition is needed of what is an “Air Handling Unit” (AHU) for **non-residential and collective residential** applications.

The common used standards for AHUs are the:
- EN 1886 “*Ventilation for buildings - Air handling units - Mechanical performance*”,
- EN 13053 “*Ventilation for buildings - Air handling units - Rating and performance for units, components and sections*”,
  and the standards referred to in § 2 of the EN 13053, like:
- EN 308 “*Heat exchangers - Test procedures for establishing performance of air to air and flue gases heat recovery devices*”
- EN 779 “*Particulate air filters for general ventilation - Determination of the filtration performance*”
- EN 13779 “*Ventilation for non-residential buildings - Performance requirements for ventilation and room-conditioning systems*”

An Air Handling Unit (AHU) according to EN 1886 is defined as a:
“*Factory made encased unit serving as a prime mover of a ventilation or air conditioning installation where outdoor air, re-circulated air or extract air is treated, consisting of a fan section where a filter section and heat exchanger may be connected. In addition the unit may consist of an inlet section with one or more louvers and dampers, a mixing section, heat recovery section, one or more heating and cooling coils, humidifiers, sound attenuators and additional equipment such as controls, measuring sections etc.*”

The EN 13053 furthermore defines an AHU as a:
“*Factory made encased assembly consisting of sections containing a fan or fans and other necessary equipment to perform one or more of the following functions: circulating, filtration, heating, cooling, heat recovery, humidifying, dehumidifying and mixing of air*”.

Single dwelling buildings in Europe Union have an average useful floor area per dwelling[1,2] of between 55 and 200 m$^2$. The average Air Change per Hour (ACH) in Europe for residential ventilation is between 0,4 and 1,0. prEN 13142:2010 and EN 13141-7 declare a maximum static pressure of 100 Pa for residential ventilation units.

[1] Housing statistics in the European Union 2004. National Board of Housing, Building and Planning, Sweden. Ministry of Regional Development of the Czech Republic
[2] Housing Statistics in the European Union 2010. OTB Research Institute for the Built Environment Delft University of Technology.

**Eurovent proposal**

To use a minimum of **0.15 $m^3$/s** (540 m3/h) and a minimum of **100 Pa** static pressure as the threshold for non-residential and collective residential ventilation. Additional electrical heating not being the main function of the Energy Recovery Unit shall be allowed under Lot 6. Additional electrical heating shall be defined as a maximum of **33%** which is the remaining need for heating responding to Class H2 ($\eta t$ = 0.67) according to EN 13053/A1:2011.

**<u>Lot 6 – Task 5</u>**

***Technical Analysis Ventilation Systems for non-residential and collective residential applications, BAT and BNAT*.**

The energy efficiency of air handling units are mainly effected by the efficiency of motors and fans, filters, heat recovery systems and low face velocity in the unit and duct system. The following comments are under discussion in the Eurovent product group for air handling units and under further studies. They will be completed until middle of September.

To define the right values they have to be linked to a certain time schedule. This has to be done before to combine that with existing time schedules of the existing ErP regulations for fans and motors.
BAT and BNAT proposals cannot be valid for replacement of old units in existing buildings, because normally you don't have enough space for larger units. There must be definition for exceptions.

## Best Available Technology (BAT)

- **Fans*:**

Fans are already regulated in the EU regulation 327/2011and shall comply with this Regulation. The most efficient fans are centrifugal backward curved fans with or without housing. These fans should be standard in AHUs. Efficiency grades starting from 2013 - **58** up to 2015 - **62** could the minimum requirements. These efficiency grades include motors with efficiency class IE2.
The BAT for fans in AHUs can be linked to this already existing ErP regulation for fans.

**Eurovent proposal**

It should only be used centrifugal backward curved fans.
BAT for fans must be linked with the time schedule of the fan regulation in AHUs starting from 2013 with efficiency grade 58 – or starting from 2015 with efficiency grade 62. This value is only valid for the best point of the stand alone fans. Due to the real working point of the fan in the unit you are not always operating in its best point. In an AHU you have additional losses, which are connected to the design of the fan system in the unit.
**Alternatively**, go for the Eurovent energy labelling system class B.

**Note: * these values are linked together in the Eurovent energy labelling system for AHUs.**

- ***Motors*:***

There is already an ErP regulation for Motors. Starting from 2011-06-01 it is only allowed to use motors in efficiency class IE2. Starting from 2017 you have the option to use class IE3 motors or class IE2 motors with a FC (VSD).

**Eurovent proposal**

BAT for motors= using motors efficiency class IE2 with VSD or motor minimum efficiency class IE3 (link to the fan regulation 2017, the starting point has to be defined).
**Alternatively,** go for the Eurovent energy labelling system class B.

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- **Heat recovery system*:**

Efficiency minimum requirements class H2 (EN 13053 version 12/2010), but this has to be linked to different climate zones (efficiency at equal mass flow and under dry conditions)!
**Alternatively**, go for the Eurovent energy labelling system class B where the influence of climate zones is already included.

*Svensk Ventilation: We support the use of SFP in combination with H1 or class A values for energy efficiency. We support the idea of making a geographic adaption of the demands.*

- **Low face velocity in the unit*:**

Linked to the European Standard EN 13053 (12/2010) for AHUs the best velocity class mentioned there is 1.6 m/s.
It should be made a distinction between constant and variable air flow.
The mean value of variable air flow is much lower, it can be estimated nearly at 1.8 m/s linked to 2,3 m/s as a constant air flow.

**Eurovent proposal**

BAT for velocity in AHUs constant air flow 1.8 m/s or variable air flow 2.3 m/s.
**Alternatively**, go for the Eurovent energy labelling system class B.

*Svensk Ventilation: We do not see that face velocity should be used at all. The correct handling of this is to use SFP that will allow the market to find out different solutions meeting the target.*

- **Ventilation system (AHU unit + duct system)**

It is possible to define limits for the specific fan power (SFP) for airstreams in a ventilation system (supply and extract air separately or total). Linked to a lot of building regulations in Europe it might be possible to find accepted values for SFP values, for example 2500 $W/m^3xs$ (supply air and extract air power input related to one airstream, calculation according EN 13779 page 24/25 point 6.5.2).
It has to be considered that SFP values are related to the application. An AHU system for a hospital has higher SFP values than for an office building.

SFP values are also linked to the face velocity in the unit. It might be possible to give no requirements for the face velocity and to talk only about SFP values (Unit+duct system), but doing this it this is not anymore a product regulation and who will be responsible for the duct system?

*Svensk Ventilation: We support the use of the SFP in LOT 6 for AHU. The SFP for an AHU could be given for a set of external pressures and thereby making it possible to compare different AHU:s.*
*SFP200= 1,9 kW/m3/s*
*SFP250= 2,5 kW/m3/s*
*SFP300= 3,1 kW/m3/s*
*If there is a special application, e.g. operation rooms with HEPA filters (500 Pa), the specification could ask for a SFP500 .*

- **Construction of the casing of the AHU**

It can be linked to EN 1886 for AHUs, Leakage class L2.
The influence of other casing parameters on the energy efficiency is very low.

- **Filters**

Based on common practice and usage the BAT for filters is Eurovent energy efficiency Class B. Eurovent proposes to use as a minimum requirement for the efficiency of Air Handling Units to use filters with efficiency class E (e.g. abolish class G and F) when the European ErP legislation on Lot 6 entering into force.

- **Operation**

Controller for the following functions:

- temperature;
- humidity;
- operation hours;
- pressure loss of filter;
- operating in a free cooling mode.
- more frequent filter change, first filter step minimum once a year.

## Best Next Available Technology (BNAT)

- **Fans*:**

In the preparatory study for the fan regulation you can find a reference for the BAT of fans. The efficiency grade mentioned was 70. This value is not realistic for all fan types and sizes. A connection from fans with motors with efficiency class IE4 (not yet finally defined) can reach an efficiency grade up to 65. This might be realistic, but have to be proved.

**Eurovent proposal**

BNAT for fans the efficiency class should be defined depending on a time schedule linked to the fan regulation. Starting 2015 the efficiency grade should be at 62. If this regulation starts later the efficiency grade can be maximum at 65, this value is only for the best point of the stand alone fan. Due to the real working point of the fan in the unit it is not always operating in its best point. In an AHU you have additional losses, which are connected to the design of the fan system in the unit.

**Alternatively**, go for the Eurovent energy labelling class A.

- **Motors*:**

Starting from 2017 motors in efficiency class IE3 with a VSD or IE4 (EC-motors, syncomotors, brushless DC motors).
**Alternatively,** go for the Eurovent energy labelling system class A.

- **Heat recovery system*:**

Efficiency minimum requirements class H1(EN 13053 version 12/2010), but this has to be linked to different climate zones (efficiency at equal mass flow and under dry conditions).
**Alternatively,** go for the Eurovent energy labelling system class A – the influence of climate zones is already included.

*Svensk Ventilation: We support the use of SFP in combination with H1 or class A values for energy efficiency. We support the idea of making a geographic adaption of the demands.*

- **Low face velocity in the unit*:**

Linked to the European Standard EN 13053 (12/2010) for AHUs the best velocity class mentioned there is 1.6 m/s. It should be made a distinction between constant and variable air flow.

**Eurovent proposal**

2.0 m/s combined with variable air flow or alternatively 1.6 m/s with a constant air flow. Lower values are not realistic for non residential ventilation due to limits in space for AHU´s in the building.
**Alternatively**, go for the Eurovent energy labelling system class A

*Svensk Ventilation: We do not see that face velocity should be used at all. The correct handling of this is to use SFP that will allow the market to find out different solutions meetina the taraet.*

- **Ventilation system (AHU + duct system)**

It is possible to define limits for the specific fan power (SFP) for airstreams in a ventilation system (supply and extract air separately or total). Linked to a lot of building regulations in Europe it might be possible to find accepted values for SFP values, for example 2000 $W/m^3xs$ (supply air and extract air power input related to one airstream, calculation according EN 13779 page 24/25 point 6.5.2).

It has to be considered that SFP values are related to the application. An AHU system for a hospital has higher SFP values than for an office building. SFP values are linked to the face velocity in the unit. It might be possible to give no requirements for the face velocity and to talk only about SFP values (Unit+duct system), but doing this it this is not anymore a product regulation and who will be responsible for the duct system.

*Svensk Ventilation: We support the use of the SFP in LOT 6 for AHU. The SFP for an AHU could be given for a set of external pressures and thereby making it possible to compare different AHU:s.*
*SFP200= 1,9 kW/m3/s*
*SFP250= 2,5 kW/m3/s*
*SFP300= 3,1 kW/m3/s*
*If there is a special application, e.g. operation rooms with HEPA filters (500 Pa), the specification could ask for a SFP500 .*

- **Construction of the casing of an AHU**

It can be linked to EN 1886 for AHUs and leakage class L2. A better class is only being used for special application like AHUs for clean rooms.
The influence of other casing parameters on the energy efficiency is very low.

- **Filters**

Based on common practice and usage the BNAT for filters is Eurovent energy efficiency Class A. Eurovent proposes to use as a minimum requirement for the efficiency of Air Handling Units to use filters with efficiency class D (e.g. abolish class G, F and E) two years after entering into force of the European ErP legislation on Lot 6.

- **Operation**

Controller for additional functions:

  - variable air flow linked to air quality , number of people,…

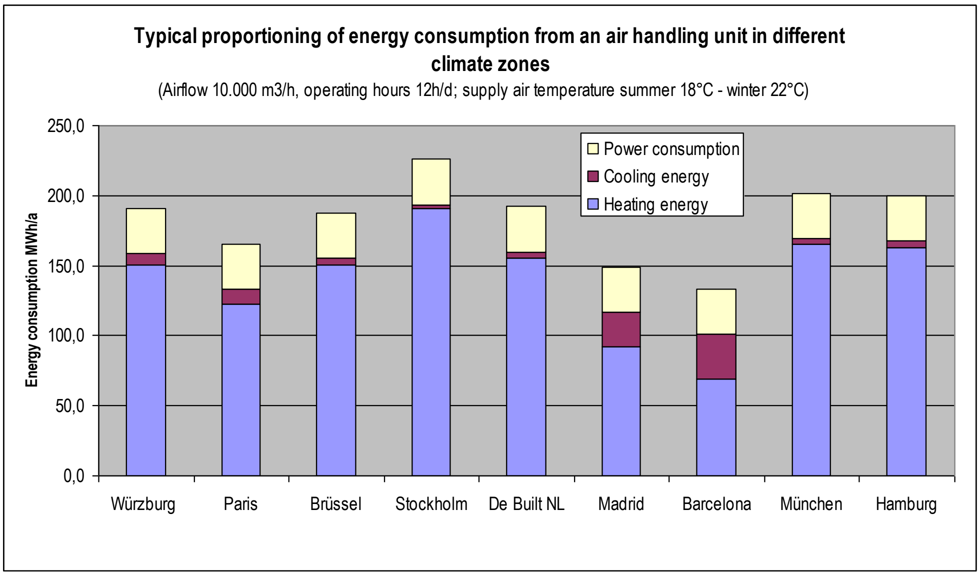
Table 1: Table for energy efficiency calculations

| CLASS | To be used in the calculations | | | Final check of class |
|---|---|---|---|---|
| | All subgroups | Subgroup 1 | | |
| | Velocity | Heat recovery system | | Absorbed power factor |
| | $v_{class}$ | $\eta_{class}$ | $\Delta p_{class}$ | $f_{class-Pref}$ |
| | m/s | % | Pa | - |
| A / A↳ / A↑ | 1,8 | 75 | 280 | 0,9 |
| B / B↳ / B↑ | 2,0 | 67 | 230 | 0,95 |
| C / C↳ / C↑ | 2,2 | 57 | 170 | 1,0 |
| D / D↳ / D↑ | 2,5 | 47 | 125 | 1,06 |
| E / E↳ / E↑ | 2,8 | 37 | 100 | 1,12 |
| <E / <E↳ / <E↑ | No calculation required | | | No requirements |


## Heat recovery

Above Eurovent gives some proposals to substantiate the BAT and BNAT statements about ventilation with air handling units. We already discussed the main effects on the energy efficiency of air handling units, but there is still something open to discuss.

It is well known that heat recovery in air handling units is a very important topic. The following chart demonstrates that even in warmer climate zones there is a high economic potential of heat recovery, but in colder climate zones there is the highest potential.




One side you have the benefit of the heat recovery but on the other side there are the costs for electric energy due to the pressure loss of the heat recovery system in the supply and extract air stream. That means the economic value of a certain energy recovery system is different compared to the different climate locations in Europe. It has to be considered to find a way to evaluate the total efficiency of an energy recovery system linked to different climate zones in Europe.

There is a method of evaluating the heat recovery system to different climate locations in the Eurovent energy label system. There it is done by evaluating the design outdoor temperature for selecting of the air handling unit at winter conditions. Below you find a list with the design outdoor temperature at different locations in Europe. For example we will compare the same air handling unit operating in Germany compared to Barcelona. The necessary heating energy to get a supply air temperature in winter of 22°C in Germany is twice high like in location Barcelona. So the effect of saving energy with the same heat recovery system is totally different. In both cases it is possible to save about 60% of the heating energy or more by the same heat recovery system, but in the location Germany or even in Scandinavia the heat recovery system needs to be more efficient, because the potential of saving energy is much higher.

At the end it is a question of the return of investment. For the same energy recovery system the return of investment in warmer climate zones is much lower.
We like to know or discuss, in which way the influence of different climate zones will be considered in a future ErP regulation for air handling units.

From Eurovent's point of view, for the moment we suggest to use an energy labelling system, where the influence of different climate zones can be fully integrated. You find a similar solution in the ErP regulation for small room air conditioners where the climate effect has been evaluated. This solution cannot be transferred to air handling units, but this gives a rough idea how to deal with this topic.

| Country | City | Min outdoor temperature °C |
|---|---|---|
| Albania | Tirana | -6,1 |
| Austria | Bregenz | -12 |
| | Eisenstadt | -11,9 |
| | Graz | -14,8 |
| | Innsbruck | -14,7 |
| | Klagenfurt | -16,7 |
| | Lienz | -17,1 |
| | Linz | -11,2 |
| | Salzburg | -13,6 |
| | Wien | -9,5 |
| Baltic States | Kaunas | -19,4 |
| | Klaipeda | -15,4 |
| | Riga | -21,1 |
| | Tallinn | -22,9 |
| | Tartu | -23,7 |
| | Vilnius | -21,7 |
| Belarus | Brest | -17,1 |
| | Minsk | -23,7 |
| Belgium | Antwerpen | -9,8 |
| | Bruxelles | -7,9 |
| | Charleroi | -9,2 |
| | Liège | -9,4 |
| Bosnia-Herzegovina | Sarajevo | -14,6 |
| Bulgaria | Sofia | -14,2 |
| | Varna | -11,8 |
| Croatia | Split | -1,6 |
| | Zagreb | -9,9 |
| Chech Republic | Brno | -14,6 |
| | Ceske Budejovice | -16 |
| | Hradec Králové | -18,5 |
| | Karlovy Vary | -16,7 |
| | Liberec | -17,4 |
| | Ostrava | -17 |
| | Praha | -14,5 |
| Denmark | Karup | -13,4 |
| | Kobenhavn | -11,2 |
| | Odense | -11,4 |
| Finland | Helsingfors | -21,3 |
| | Jyväskylä | -32 |
| | Kajaani | -33,6 |
| | Kuusamo | -37,6 |
| | Oulu | -29,9 |
| | Sodankylä | -37,6 |
| | Vaasa | -27,8 |
| France | Bordeaux | -5,8 |
| | Bourges | -8,8 |
| | Caen | -6,6 |
| | Clermont-Ferrand | -11,3 |
| | Dijon | -11,1 |
| | Le Havre | -3,8 |
| | Lille | -7 |
| | Lyon | -9,7 |
| | Marseille | -3,6 |
| | Nancy | -11,6 |
| | Nantes | -5,9 |
| | Paris | -7,1 |
| | Strasbourg | -11,3 |
| | Toulouse | -5,8 |

| Country | City | Min outdoor temperature °C |
|---|---|---|
| Germany | Berlin | -16,6 |
| | Dortmund | -9,4 |
| | Dresden | -18,1 |
| | Essen | -10 |
| | Frankfurt am Main | -10,8 |
| | Hamburg | -13,1 |
| | München | -15,4 |
| | Stralsund | -12,1 |
| | Stuttgart | -11,8 |
| Great Britain | Aberdeen | -6,5 |
| | Birmingham | -7,9 |
| | Edinburgh | -6,6 |
| | Glasgow | -8 |
| | London | -4 |
| | Manchester | -5,7 |
| | Plymouth | -3,2 |
| Greece | Athen | 1,4 |
| | Patrai | -0,1 |
| | Thessaloniki | -4,9 |
| Hungary | Budapest | -10,9 |
| | Debrecen | -15,7 |
| | Poprad | -20,8 |
| | Pécs | -12,1 |
| | Szego | -13,7 |
| | Szombathely | -13,9 |
| Island | Akureyri | -14,2 |
| | Reykjavik | -11 |
| Italy | Ancona | -4,5 |
| | Bari | -0,7 |
| | Bologna | -7 |
| | Genova | -0,1 |
| | Milano | -7,5 |
| | Napoli | -1,1 |
| | Palermo | 5,3 |
| | Roma | -2,8 |
| | Torino | -8,7 |
| | Trieste | -2,5 |
| | Udine | -7,1 |
| Luxemburg | Luxembourg | -10,6 |
| Makedonia | Skopje | -12,8 |
| Netherlands | Amsterdam | -7,2 |
| | De Bilt | -11,7 |
| | Den Haag | -8,6 |
| | Eelde | -13,8 |
| | Groningen | -10,9 |
| | Maastricht | -9,1 |
| Norway | Alta | -23,5 |
| | Bergen | -7,3 |
| | Bodö | -14,3 |
| | Kirkenes | -28,2 |
| | Kristiansand | -15,6 |
| | Lillehammer | -27,2 |
| | Oslo | -18,6 |
| | Sola | -10,9 |
| | Tromsö | -15,3 |
| | Trondheim | -20,2 |
| | Ålesund | -6,1 |
| Poland | Gdansk | -12,1 |
| | Kraków | -16,5 |
| | Poznan | -15,5 |
| | Szczecin | -15,2 |
| | Warszawa | -16,4 |
| | Wroclaw | -16,3 |
| Portugal | Faro | 3,3 |
| | Lisboa | 4,2 |
| | Porto | 0,7 |

| Country | City | Min outdoor temperature °C |
|---|---|---|
| Romania | Brasov | -23,5 |
| | Bucuresti | -13,7 |
| | Constanta | -12,3 |
| | Iasi | -16,7 |
| | Oradea | -15,6 |
| | Timisoara | -13,6 |
| Russia | Dudinka | -47,1 |
| | Irkutsk | -36,9 |
| | Kaliningrad | -16,9 |
| | Kaluga | -28,2 |
| | Kazan | -30,1 |
| | Krasnoyarsk | -37 |
| | Moskva | -24 |
| | Murmansk | -31,7 |
| | Nizhny Tagil | -37,6 |
| | Novosibirsk | -35,8 |
| | Omsk | -35,4 |
| | Samara | -32,2 |
| | Sochi | -4,4 |
| | St. Petersburg | -27 |
| | Syktivkar | -34,8 |
| | Ufa | -36,6 |
| | Vladivostok | -28,5 |
| | Volgograd | -25,8 |
| Serbia-Montenegro | Beograd | -10,5 |
| Slovakia | Bratislava | -12,6 |
| Slovenia | Koper | -2,9 |
| | Ljubljana | -12,4 |
| | Maribor | -16,6 |
| | Novo Mesto | -12,9 |
| Spain | Barcelona | 0,6 |
| | Bilbao | -2,5 |
| | Madrid | -4 |
| | Málaga | 1,9 |
| | Palma de Mallorca | -3,4 |
| | Valencia | -0,9 |
| | Vigo | 1,1 |
| | Zaragoza | -4,1 |
| Sweden | Borlänge | -23,3 |
| | Göteborg | -16,5 |
| | Jönköping | -20,9 |
| | Karlstad | -22 |
| | Kiruna | -33,2 |
| | Kvänum | -17,7 |
| | Luleå | -29,5 |
| | Lund | -13,9 |
| | Norrköping | -18,4 |
| | Stockholm | -18,1 |
| | Sundsvall | -26,2 |
| | Umeå | -27,4 |
| | Växjö | -18,3 |
| | Örebro | -19 |
| | Östersund | -27,6 |
| Switzerland | Basel | -11,1 |
| | Berne | -11,1 |
| | Davos | -24,5 |
| | Genève | -8,6 |
| | Zürich | -11,6 |
| Turkey | Adana | -0,2 |
| | Ankara | -13,7 |
| | Antalya | 1,3 |
| | Bursa | -6,9 |
| | Gaziantep | -8,1 |
| | Istanbul | -3,5 |
| | Izmir | -4,5 |
| | Mugla | -4,9 |
| Ukraine | Kertch | -11,8 |
| | Kiev | -17 |
| | L`viv | -18,7 |
| | Odessa | -14,2 |
| | Simferopol | -8,2 |

## B. hydronic terminal Fan Coil Units (FCU)

Eurovent welcomes the integration of hydronic Fan Coil Units FCU heating and cooling functionality into ENTR Lot 6 as fan coil units with an estimated market volume of 1.1 m sold units in 2010 in Europe* carry significant energy saving potentials.

### Recommendations BAT/BNAT

On January 1st 2011 Eurovent Certificiation Company (ECC) has introduced Energy Labelling as part of the voluntary certification scheme for FCU. The energy labeling system was developed in close cooperation with the industry in order to raise customer awareness of high efficiency equipment introduced to the market by leading industry players. The raising of awareness for energy efficiency products is particularly important as the European FCU market can be considered very conservative and price driven. The highest energy efficiency classes within the labelling system were consequently set to a level that could generally only be reached by FCUs equipped with EC-motors as main product component and leading next available energy efficiency technology.

Most of the few major European suppliers of EC-fan equipped FCUs today are participating in the Eurovent Certification and Energy Labelling scheme. A statistic on the volume of ECC certified models reaching class A and B Energy Classes shows the following share: Today only 5.4% of all listed models** fall into Classes A or B. Within Eurovent Market Intelligence as closely linked to Eurovent Certification with also the major players participating, a good 76% of the overall market is covered*. Evaluating the overall EC-fan equipped FCU supply situation in the market the following needs to be considered:

- only a limited number of EC-fan equipped FCU suppliers exists today in the European market;
- the 24% market supply not covered within Eurovent Market Intelligence and Certification are basic-quality suppliers not having EC-technology within their portfolios

As a consequence today's market share of EC-fan equipped FCUs supplied to the European market can be considered way below 5%. At the same time we estimate the share of units sold for Class G higher than the share of units listed with Eurovent. On the basis of the analysis as above Eurovent recommends the following proceedings:

**2 years after implementation of regulation:**

- definition of EC-motors as core components to increase FCU energy efficiency as BNAT (Best Next Availiable Technology);
- Eurovent Energy Labelling Classes A and B to represent BNAT, as generally only reachable with EC-motors equipped FCU;
- Eurovent Energy Labelling Classes C-F to represent BAT with class F defining minimum BAT energy efficiency level;
- elimination of Eurovent Energy Labelling Class G;
- definition of a Class A+ (in order to keep 7 classes).

**4 years after implementation of regulation:**

- raise BNAT level to Eurovent Energy Labelling Classes A and A+;
- raise BAT level to Eurovent Energy Labelling Classes B-E;

- elimination of Eurovent Energy Labelling Class F;
- definition of a Class A++ (in order to keep 7 classes).

BNAT levels A+ and above shall be reachable by further development of technologies like:

- larger FCU with larger heat exchangers;
- other fan or EC motor technology.

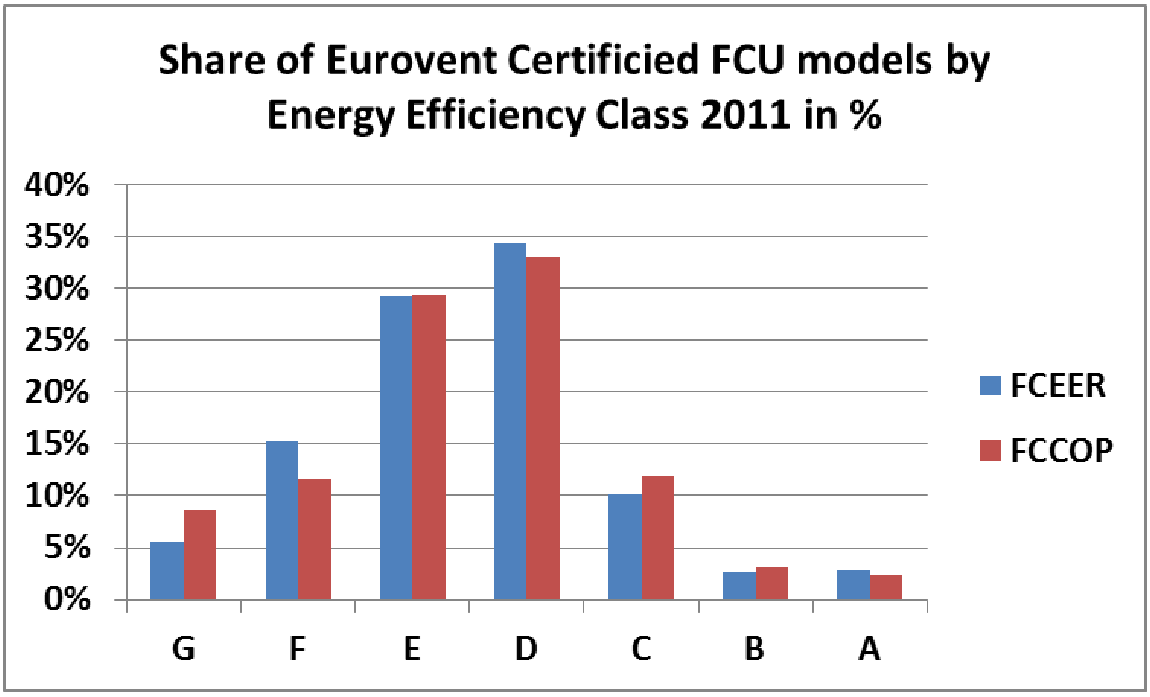



Fig.1: Eurovent Certified FCU models by Energy Efficiency Class 2011

*Source: Eurovent Market Intelligence 2011, estimated 2010 volume in units sold for EU-27 plus Albania, Bosnia Herzegovina, Croatia, Macedonia, Montenegro, Norway, Serbia, Switzerland; Basis: reported unit sales of 26 major European suppliers
** "Listed models" refers to the number of listed model types within Eurovent Certification for FCUs and not number of models sold. Eventually, for the time being there is no statistics on number of units sold by Energy Efficiency Class available. As a consequence, share of units listed can only serve as an indicator.

## Definitions according to Eurovent Rating Standards 6/C/002 and 6/C/002A (Drafts 2011-04)

### Scope

All Fan Coil Units (Ducted and Non Ducted) defined by Eurovent Rating Standards 6/C/002 and 6/C/002A (Drafts 2011-04).

- Non ducted units: Fan Coil Units with air flow lower than 0.7m3/s and a published external static duct pressure at 40 Pa maximum.
- Ducted units: Fan Coil Units up to 1m3/s airflow and 300 Pa available pressure.

A Fan Coil unit is a factory made assembly which provides the functions of cooling and/or heating air using chilled or hot water with air flow to the room ensured by one or more electrically driven fans. Fan Coil Units may be of the cabinet style, within a room, for free air delivery, or of the chassis style, concealed within the building structure with minimal ducting appropriately connected to the inlet and/or outlet of the unit.

The principal components are:

- one or more heat exchangers;
- one or more fans with electric motors;
- an appropriate enclosure;
- condensed water collecting facilities when cooling;
- air filter.

**Total Cooling Capacity**: Total heat energy removed from the air divided by the defined interval of time.
**Sensible Cooling Capacity**: Sensible heat energy removed from the air divided by the defined interval of time.
**Heating Capacity**: Total heat energy supplied to the air divided by the defined interval of time.
**Fan Power Input**: Average electrical power input of the Fan Coil Unit within the defined interval of time.
**Water Pressure Drop**: Difference between input and output water pressure.
Sound Power: Total sound energy radiated by the Fan Coil Unit per unit time.
**A-weighted Sound Power**: A single figure on a specific scale which can be related to the subjective assessment of the loudness of a noise.
**Air flow rate**: Volume air flow through the unit at standard conditions.

**FCEER and FCCOP**

For each unit the participant shall select three speeds called high, medium and low speed. The Fan Coil Energy Efficiency Ratio (FCEER) and the Fan Coil Coefficient of Performance are defined as follows:

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

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

With:

- Pchigh, med, low;
  total cooling capacity at high, medium and low speed respectively [kW];
- Pe (c)high, med, low,
  power input in cooling mode at high, medium and low speed respectively [kW];
- Phhigh, med, low,
  heating capacity at high, medium and low speed respectively [kW];
- Pe (h) high, med, low,
  power input in heating mode at high, medium and low speed respectively [kW].

**Energy Efficiency Classes in cooling and heating**

A to G energy efficiency scale for Fan Coil units based on FCEER and FCCOP and defined as below.

- **Non-ducted Fan Coil units**

| 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>=40 | 70>FCCOP>=50 |
| F | 40>FCEER>=30 | 50>FCCOP>=40 |
| G | 30>FCEER | 40>FCCOP |

- **Ducted fan Coil units**

| 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>=15 | 25>FCCOP>=15 |
| F | 15>FCEER>=10 | 15>FCCOP>=10 |
| G | 10>FCEER | 10>FCCOP |

**Eurovent Certification Energy Efficiency Label for fan coil units - Layout**

The only layout of energy label allowed to be used is the one provided by ECC and shown below. The files of these layouts can be provided by ECC on request.

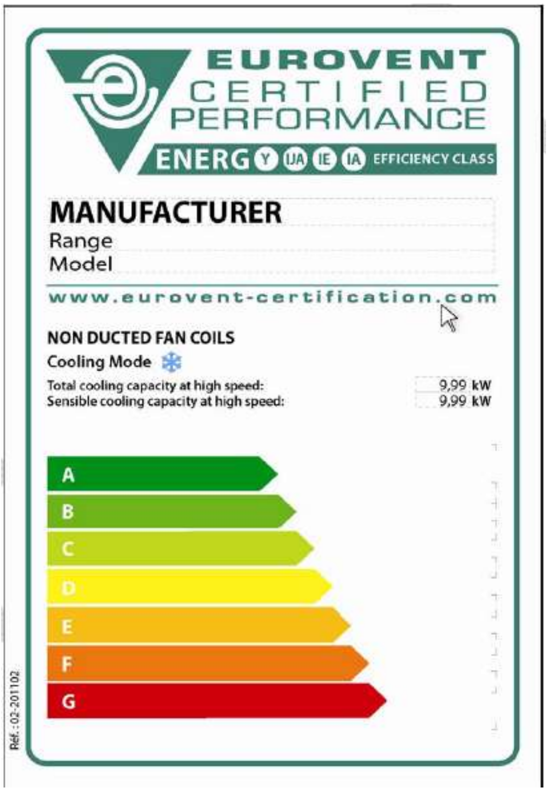



Fig.2: Eurovent Certification energy efficiency label for non-ducted fan coil units in cooling mode

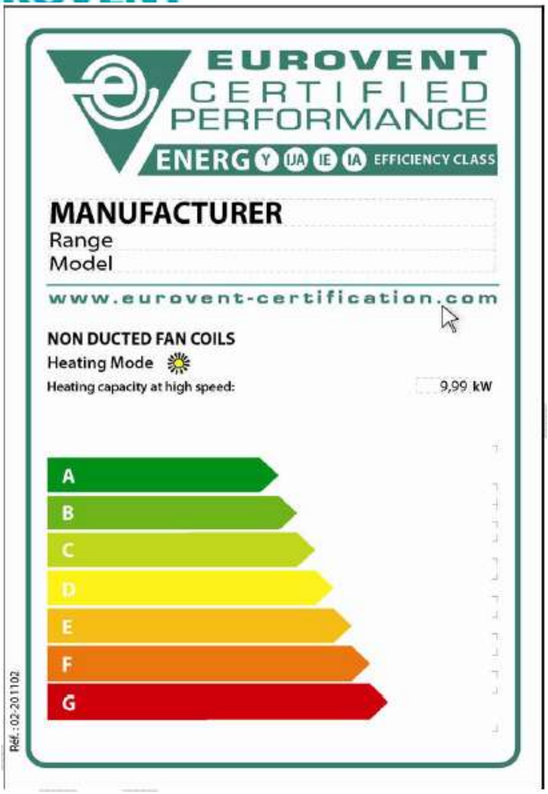



Fig.3: Eurovent Certification energy efficiency label for non-ducted fan coil units in heating mode

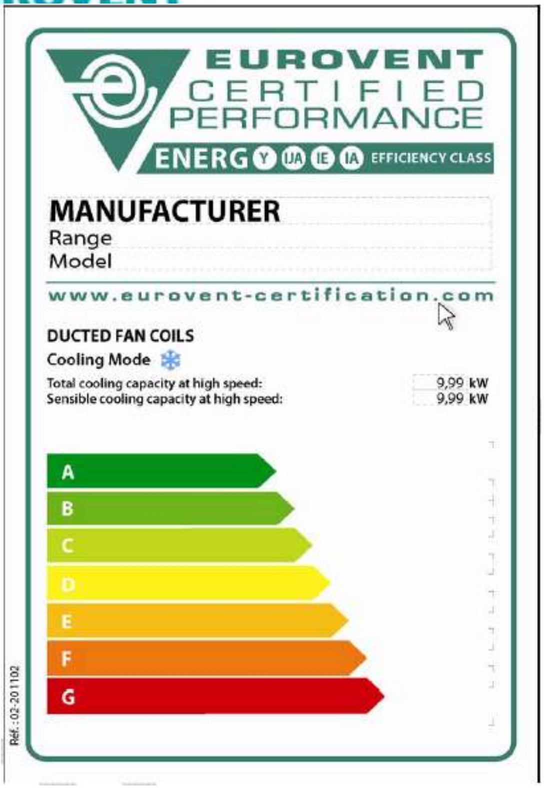



Fig.4: Eurovent Certification energy efficiency label for ducted fan coil units in cooling mode

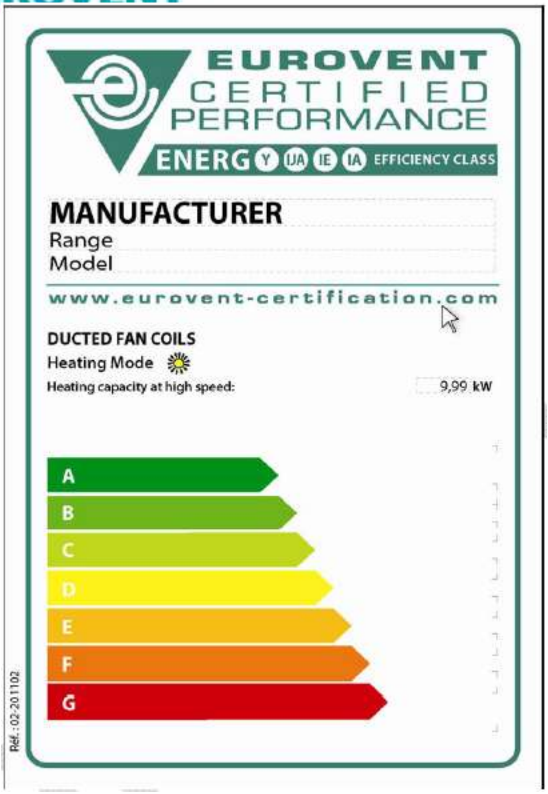



Fig.5: Eurovent Certification energy efficiency label for ducted fan coil units in heating mode

# C. Roof top units

**Lot 6 – Task 1**
***Product Definition, Standards and Legislation Ventilation Systems for non-residential and collective residential applications*.**

Eurovent is of the opinion that a clear definition is needed of what is a “Roof top unit” (RTUs).

**Testing and clasifaction**
Eurovent started a dedicated RTU test classification in 2008. Beforehand RTUs were tested under air conditioning unit test procedures. The aim of the Eurovent Energy Efficiency Classes is to simplify the selection of the best units for each type of Rooftops. The classification is entirely voluntary, not related to any European Directive.
The American Refrigeration Institute (ARI) also has a classification scheme.

The energy efficiency of Rooftops is designated by “Eurovent Class A” or “Eurovent Class B” in catalogues and in the present Eurovent Directory of Certified products.

Generally RTU are more focused on cooling capacity than AHU are. Cooling power in the range of 50 – 200kW.

**Casing**
RTUs do not require model box testing according to EN1886 as AHUs do. The less stringent requirements on the casing encourage RTUs to remain single skinned with neoprene insulation whereas AHUs general will be double skinned filled with insulation.

RTUs will not have connections for water based heating and cooling coils, which makes there installation a degree easier in comparison to AHUs.

RTUs due to the exposed nature of their position outside the building envelope need to be weather resistant constructions. AHUs are generally, but exclusively, placed within the building envelop, this is also to facilitate coil water supplies.

**Components**
Many RTUs use heat pump technology which requires external condenser coils. AHUs generally use heat exchangers together with heating/ cooling coils.

Axial fans are widely used in the RTUs whereas AHU generally employ backward curved bladed radial fans which have a higher efficiency.

**RTU sub-categories**
RTU can further sub-categorised into recirculation and fresh air units.
The recirculation units concentrate more on conditioning the air rather than supplying ventilation, whereas the fresh air units are approaching something more like an AHU with the ability to recover a portion of the energy from the occupied space and deliver fresh air.

## D. Air volume flow and axial fans

**Lot 6 – Task 1**
***Product Definition, Standards and Legislation Ventilation Systems for non-residential and collective residential applications*.**

**Page 17 to 19:**
All definitions from "***Maximum and minimum air volume flow*** *(source EN 13142)" to "**Temperature ratio***" just refers to units for residential ventilations, this should be pinpointed (e.g. by printing "residential ventilation" in a parenthesis besides each definition).

**Eurovent proposal**

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| Add by External leakage and Filter bypass leakage after EN13141-7 and 8 each time the following texts:<br>(residential ventilation) or EN 1886 (non residential)<br><br>And by Humidity and Temperature Ratio after EN13141-7 and 8 each time the following text:<br>(residential ventilation) or EN 308 (non residential) |

**Page 147 last paragraph**

**Eurovent proposal**

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| Use for the average fan+moter+drve efficiency 54% instead of 70% |

## E. Duct silencers

**Lot 6 – Task 3**
***User Requirements, Infrastructure Ventilation Systems***

**Page 65 second paragraph second bullet**

**Eurovent proposal**

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|---|
| Add behind ....fan the following texts:<br>Note: Valid if the fan has high velocity (> 10 m/s) at outlet. |

## F. Electricity consumption

**Lot 6-Task 4:**
***Definition Base Cases Ventilation Systems for non residential and collective residential applications***

**Page 10, 2nd paragraph under 2.4.1:**
Eurovent noted that the text indicates conclusions which not are in accordance with the text in the standard. There is a recommendation, in case of variable flow system, to use 65 % of the design maximum air flow and 65 % of the design maximum external pressure d

drop. The design values are given by the customer to meet his needs. If the customer has a constant flow system then the SFP value shall be calculated for his design point.

**Page 11, 2nd paragraph:**
There is unfortunately some confusion regarding SFP values. The values in this paragraph refers to EN 13779 paragraph 3.5 which handles "specific fan power"; $P_{SFP}$ of each fan.

**Eurovent proposal**

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| Change SFP to $P_{SFP}$ throughout this paragraph. |

## F. Axial fans

**Lot 6 – Task 5**
***Technical Analysis Ventilation Systems for non-residential and collective residential applications, BAT and BNAT*.**

**Article 2.2.1 Fan types**
**Axial fans page 8**

**Eurovent proposal**

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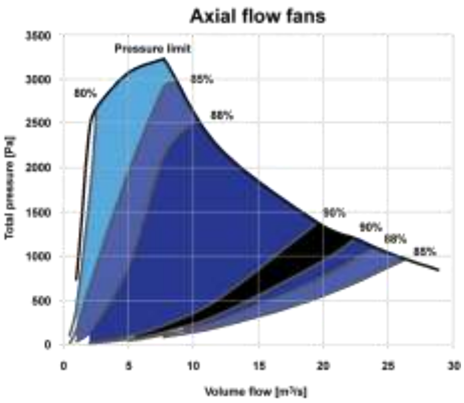
|---|
| To change the current section of the Axial/propeller fans with the following text including two new pictures |

Axial fans built in air handling units for pressure creation is greatly improved when fitted with inlet funnels and downstream guide vanes. Under these conditions the fans are quite suitable for moving large air volumes at medium pressures through a connected duct system. The axial fans are typically fitted horizontally with the outlet directly to the duct. Using a diffuser and connecting a duct to the outlet enables recovery of dynamic fan pressure, which in turn almost removes the loss caused by the build-in.

.
Under some operating conditions the latest generation of axial fans also have lower sound levels.



## F. Ecodesign on Ventilation Products (ENER Lot 10 and ENTR Lot 6)

We took notice of the Commission proposal with regard to the one Ecodesign Regulation for Ventilation products. Eurovent is very in favor of one single Ecodesign Regulation on ventilation products. This means that Eurovent supports the proposal forwarded by the Commission Directorate General for Energy unit C3: Energy efficiency & Intelligent Energy.

Our conditions are however that all relevant standards should be harmonized and a clear definition for residential and non residential ventilation products.

## G. How to consider Air Handling Units in the Ecodesign preparatory studies ENTR Lot 6 and ENER Lot 21?

Eurovent took notice of the question forwarded by the consultants of respectively preparatory study Lot 6: Air conditioning and ventilation systems and preparatory study Lot 21: Central heating products using hot air to distribute heat.

Eurovent supports the view to see air handling units as a ventilation part only and being part of Lot 6.

It is clear for Eurovent that when setting the requirements all the “products” (generators) placed in the air stream of an AHU and having interactions with the AHU should be taken in consideration and cannot be seen separately from each other. This means very tight coordination between the consultants and Commissions responsible for Lot 6 and Lot 21, as requested before by Eurovent.
Eurovent further sees a significant energy savings potential with AHU technologies like free cooling, adiabatic cooling etc. Currently these technologies are not considered in the scope of the Lot 6 study. Eurovent recommends to include the evaluation of these technologies into the considerations of the study.

## H. HT process chillers

Discussing the preparatory studies Lot 1: Refrigeration and freezing equipment and Lot 6: Air conditioning and ventilation it became clear that the consultant of Lot 1 considers HT AC and HT process chillers as one chiller group reason that they assumed that all HT-chillers belongs to the preparatory study Lot 6. We explained that HT AC and HT process chillers are not the same especially when you look at the users profile (AC seasonable and process continuously) and other characteristics

| | Ai conditioning Chiller Lot 6 (prEN 14825) | Process Chiller Lot 1 |
|---|---|---|
| Application temperature range | +5…+7 °C | -30 …+7°C |
| Seasonal operating request depending on ambient | Only above +16°C ambient (mainly summer time) | Durable operation from -30°C to +40°C ambient (whole year) |

| | | |
|---|---|---|
| Part load profile | Dependence from ambient temp. (Load from 10% up to 100%) | Nearly independent from ambient temp. (Load from 80% up to 100%) |
| Chilled fluid for heat transportation | water between 5°C and +7°C | Fluid with or without phase change between -40°C and +7°C |
| Physical characteristics of selected fluid for heat transportation | Nearly constant fluid viscosity and heat transfer characteristics | Viscosity, heat transfer characteristic, specific heat depending on application requirements |
| Dominating part of total cost of ownership | Investment cost | Operation cost |
| Predominant refrigerant | F-gas | F-gas and ammonia for capacities above 100 kW |
| Installation requirements | Also public areas | Machine room only |
| Evaluation value should differ | SEER | SEE(P)R |

This point has been discussed with the chiller manufactures and based on that Eurovent recommends to keep all HT processes chillers with the same product family, so in DG-ENTR Lot 1: Refrigeration and freezing equipment in order the bring all process chillers under one legislation. Due to the time constrain under Lot 1 we will ask DG ENTR to shift the timeline for HT Chillers by at least two years.

## I. Air Filtration and Ducts

Eurovent mentioned before in their Position Paper June 25th 2010 that we recognize the substantial energy saving potentials of products connected to ventilation products and air-conditioners. With regard to this we drew attention to filters and ducts (systems).
In order to demonstrate the energy saving impact of filters and ducts we made for both products a top down calculation to give an indicative saving potential per year

### Air filtration

Air filters are related to high consumption of energy by the fans in the ventilation systems. There is a potential saving by using the most efficient air filter, in terms of low pressure drop and efficiency according to European filter standards. We have the EN13779:2007 standard to recommend air filter classes and quality for indoor air related to the outdoor air. The air filters relates to EN779 and EN1822.

The Filter industry has a good knowledge of the air filters sold in the market and is able to estimate the total amount of air going through the ventilations systems in Europe.

Following energy saving potential (indicative) is based on the preparatory study Lot 11: Fans for ventilation in non residential buildings, April 2008 done by the Fraunhofer-Institut, Frankfurt and:

- energy consumption ventilation fans in Europe, total 197,000 GWh/a;
- total pressure drop of system/air filter, average 800 Pa/130 Pa is 16%;
- in Europe average 600g $CO_2$/kWh.

As for every fan a filter is placed the total fan energy consumption due to fans is 16% of the total fan consumption of 197,000 GWh/a is 31,500 GWh/a.

**Saving potential**
Reducing the pressure drop over the air filter by 10% with retained filtration efficiency is achievable. This means a saving potential of:

- 3,150 GWh/a or 27 TJ/a;
- and based on 600g $CO_2$/kWh equal to 1,900,000 ton $CO_2$/a.

**Conclusion**
Filtration products are important downstream actors in reducing energy consumption and consequently $CO_2$ emissions in Europe.

The air filter manufacturers have to take in consideration the environment and sustainability when developing new air filter products. A low over time, average pressure drop and the filter efficiency is important. Due to health concerns we are shifting to higher filtration classes which are coming together with higher pressure drops. So it is likely that the energy consumption in general of the filters is becoming higher.
Air filters are the main part that changes over time and the easiest way to influence the energy consumption of fans.

**Eurovent recommends**

To include filtration products as stand-alone products in the preparatory study Lot 6 as they are a part of air conditioning and ventilation systems and energy related products in the sense of the ErP Directive.

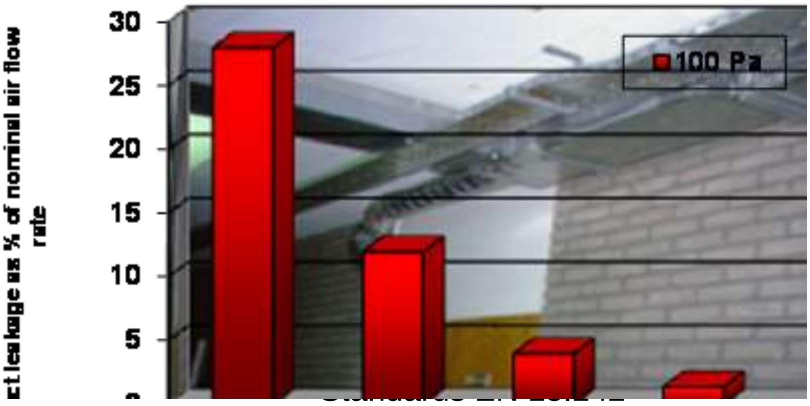
## Duct and duct system

Ducts are defined in the European Norm for Ventilation for buildings - Symbols, terminology and graphical symbols — EN 12792: 2003 as the envelope of a space in which the air is carried. The assembly of the ducts and the other elements of distribution inserted into these ducts forms together the distribution network (or duct system).

A duct system is the conveyer system of treated air from one location to defined destinations in buildings and it is important that all the air arrives at the destination point/outlet. This means that leakages are unwanted with respect to indoor climate and energy saving. Leakages are generally to measure via pressure loss and the Industry has scientific and historical knowledge in engineering expertise, in calculating the energy impact of such.

The European Standards define different classes of tightness for all kind (structural shape) of ducts typically used, and the duct Industry, are utilizing that as to produce and supply products and installation guidelines, so that final duct systems has the demanded tightness as specified. The tighter the duct and duct system is the lower the energy consumption is.

It is not only the excess of electrical power needed for the transport of the enlarged air volume which is wasted but in additional the unnecessary energy input needed for conditioning (heating, cooling and (de)humidification) this extra amount of air caused by leakiness.




Following energy saving potential (indicative and related only to the energy demand for the air transport) when ductwork meets class B tightness is based on the preparatory study Lot 11: Fans for ventilation in non residential buildings, April 2008 done by the Fraunhofer-Institut, Frankfurt and:

- energy consumption ventilation fans in Europe, total 197,000 GWh/a;
- calculations and scientific analyses shows an energy loss of 15% in Air-condition and ventilation installations when duct systems are on an average level in comparison to Class B;
- in Europe average 600g $CO_2$/kWh.

**Saving potential**
Total energy losses for air transport only in Europe by using an average duct systems is:

- 29,550 GWh/a or 254 PJ/a;
- And based on 600g $CO_2$/kWh equal to 17,730,000 ton $CO_2$/a.

**Conclusion**
Ducts and ductsystems for “Air-condition and Ventilation systems”, are important downstream actors in reducing energy consumption and consequently $CO_2$ emissions in Europe.

**Eurovent recommends**

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|---|
| To include ducts as stand-alone products in the preparatory study Lot 6 as they are a connected part of air conditioning and ventilation systems energy related products in the sense of the ErP Directive.. |