EUROVENT
THE EUROPEAN COMMITTEE OF HVAC&R MANUFACTURERS

Position Paper for Member State Representatives of the Ecodesign Consultation Forum

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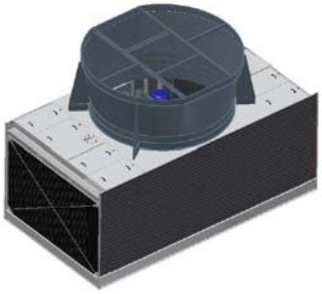
Input for the Ecodesign Consultation Forum on the review of the 'EU Fan Regulation' from European manufacturers of evaporative cooling equipment

1. Call for an exemption of evaporative cooling equipment



Eurovent represents **more than 90% of European evaporative cooling equipment manufacturers.** Based on well-justified technical arguments, these manufacturers **have repeatedly called for an exemption of their equipment from the 'EU Fan Regulation',** which is currently being revised. In the same breath, they are actively supporting a future Ecodesign implementing measure for evaporative heat transfer equipment and have, during a meeting on 20 March 2015 in Paris, initiated preliminary steps required for its development.

1.1 Background

In the opinion of Eurovent and its national member associations, **fan efficiency as defined in the 'EU Fan Regulation' does not constitute a good measure to define the energy efficiency of evaporative heat transfer equipment. Instead, energy efficiency for evaporative heat transfer equipment should be defined as a cooling efficiency,** meaning a ratio between cooling capacity per required electrical power. Energy targets could be defined similar to the energy targets prescribed in the ASHRAE 90.1 energy standard for commercial building energy codes in the United States. Eurovent recently initiated the development of a comparable European measure focussing on evaporative cooling equipment.

Achieving the best cooling efficiency and the highest heat rejection for lowest power consumption is a primary goal of European cooling tower manufacturers. For a vast majority of applications, **the energy required to run the cooling tower fan is substantially less than the energy required for the system which they serve.** Consequently, a continuous development of more efficient heat rejection technologies will result in a lower total system energy consumption.

The requirement to implement improved fan technologies to comply with the 'EU Fan Regulation' would prove counterproductive regarding the continuous development of increased efficient heat rejection technologies. It would **negatively impact the total energy consumption,** as outlined on the following pages through examples on forward and backward-curved centrifugal fans.

The contribution by the evaporative cooling industry to improve the power consumption within the EU through the Ecodesign Directive should remain focused on improving cooling efficiencies.

1.2 Proposal

We hold that, in point 5 of the preamble of the working document 'draft eco-design regulation', the word 'fan' should be added before 'efficiency' as shown in the following:

*(5) Many fans are integrated in other products without being separately placed on the market or put into service in the meaning of Article 3 of Directive 2009/125/EC. To achieve the full cost-efficient energy saving potential, fans integrated in other products where the **FAN** efficiency can be tested separately should be subject to the provisions of this Regulation.*

This is due to the fact that some fans cannot be tested separately from the product they are built in. An obvious example mark wind turbines due to their size, but also fans within cooling towers as they cannot be tested separately.

Furthermore, we hold that the current setup explained in the final report 'Ecodesign Fan Review' by VHK neglects the majority of evaporative cooling equipment put on the European market.

§4.4.2 (p. 45) & §8 (p. 63) of VHK's 'final report' (and in §5.2.2 of the draft standard of CEN/TC156/WG 17 under mandate M500 respectively) sets boundaries for the defined 'test fan'. In these cases, the motor is always positioned within the housing (between inlet and outlet).

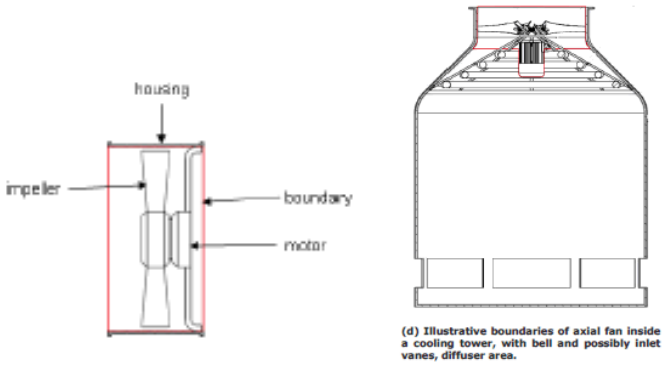


Figure 1: figure d from the final report of VHK

In the evaporative cooling equipment industry, belt driven fans are used in more than 90% of the equipment in order to achieve the best possible fan speed. In this case, the motor is located outside the housing on a support which is part of the entire cooling tower structure. Paragraph 5.2.2 of the draft standard of CEN/TC156/WG17 states that '[a]ll significant elements used during measurements that affect the conversion of power shall be included within the boundary'. This needs to be taken in consideration to determine the fan efficiency.

Figure 2: Example cooling tower setup

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Eurovent holds that the motor and belt drive outside the housing cannot be taken into account for a 'test fan' in order to evaluate the fan efficiency within a wind tunnel test rig.

In case of the evaporative cooling equipment industry, the 'test fan' proposed in the working document 'draft regulation' only offers a solution for the minority of cooling tower products, i.e. those with direct-driven fans. It discriminates the majority of equipment with belt driven fans.

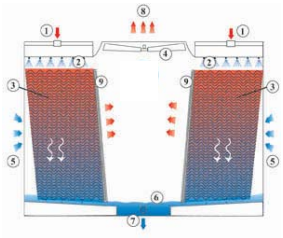
Accordingly, **we reinforce our call for an exemption of evaporative cooling equipment from the future 'EU Fan Regulation'.** As we would like to prevent any loophole resulting from an exemption, Eurovent proposes to add the following definition of evaporative cooling equipment to Art. 1, paragraph 3:

'This regulation shall not apply to fans which are specified to exclusively transport gases consisting of a mixture of liquid water and air having a relative humidity consistently larger than 90%.'

This definition offers a concrete solution to the proposal stated in Art. 4.4.2 in the final report 'Ecodesign fan review' of VHK dealing with 'fans handling gases/vapours'.

1.3 Frequently asked questions (FAQ)

1.3.1 Why does the evaporative cooling industry call for an exemption?



Fan efficiency is not the appropriate measure to determine the efficiency of evaporative cooling equipment such as cooling towers. That said, a cooling tower can have an exceptionally efficient fan, but deliver a poor cooling performance. Unlike other heat transfer technologies, evaporative cooling depends on mixing liquid water with air, which is not directly related to fan efficiency!

The application of minimum fan efficiency levels leads to a misleading interpretation by the market as it pushes manufacturers to strive for fan- instead of maximum cooling efficiencies when developing products. Overall, this would lead to an increased energy consumption.

It is **not possible to adjust the 'EU Fan Regulation' in a way that would solve the problems mentioned above.** For these reasons, **we strongly encourage the Member State's Representatives of the Ecodesign Consultation Forum to recommend an exemption of evaporative cooling equipment.**

Further arguments find itself on top of this Position Paper as well as within previous, more detailed publications of Eurovent on this topic that can be found attached:

- PP - 2014-11-18 - Eurovent call for an exemption of cooling towers from the revised EU Fan Regulation
- PP - 2014-12-11 - Extended Eurovent Position on cooling towers and the EU Fan Regulation

1.3.2 In which manner is evaporative cooling different from air-cooled equipment?

The mixing of air and liquid water is the key driving force of evaporative heat transfer. Air cooled heat transfer equipment, on the other hand, has a high level of proportionality between the airflow (fan efficiency) and heat transfer capability – which is not the case for evaporative cooling equipment!

1.3.3 Where does the proposed exemption text originate from?

The exemption text proposed within this Position Paper derives from a long-term development process within the Eurovent Product Group 'Evaporative Cooling Equipment' and eventually results from a proposal provided by VHK during the '2nd stakeholder meeting' on the fan review in Brussels on 22 January 2015. **Eurovent has continuously developed this proposal in a way as to include all equipment configurations and to prevent loopholes for other types of fan equipment.**

1.3.4 Does the proposed exemption cause any loopholes or an artificial division of the market?

The definition proposed by Eurovent only excludes fans for evaporative heat transfers. Fans in evaporative heat transfer equipment transport a mixture of LIQUID water and air. This, for example, differs from air humidifiers. CONSISTENLY was added in the development process of the proposal to 'a relative humidity consistently larger than 90%'. **This was done in order to eliminate the erratic influence of weather conditions.**

1.3.5 Is the proposed exemption measureable?

Yes, **relative humidity is a quantifiable specification of the gas to be transported and can be measured.**

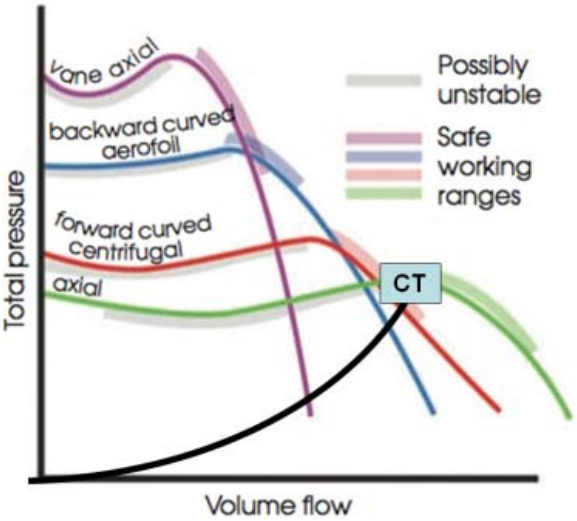
2. Call for lower efficiency requirements on centrifugal forward curved fans in the future 'EU Fan Regulation'

2.1 Position

The evaporative cooling equipment industry uses centrifugal forward-curved (FC) fan technology for forced draft cooling towers in order to overcome pressure for low sound levels.

We consider the efficiency levels proposed in the working document 'Draft Ecodesign Regulation' for fans above 5kW as unachievable for the evaporative cooling industry and call for adjusted levels taking into account reasons outlined in the following justification.

2.2 Justification



In Annex II, the working document 'Draft Ecodesign Regulation' defines the proposed minimum efficiency per fan type. The example image on the left shows that, for fans larger than 5kW, the proposed efficiency requirements cannot be met and FC centrifugal fans should remain available on the EU market for multiple reasons. Data on the fans and calculations can be found attached to this document.

In the evaporative cooling equipment industry, centrifugal FC fan technology is used because of specific characteristics of these fans, which include:

- Best energy efficiency and size match, suitable for the required high volume and medium pressure working point,
- Low fan speed reducing sound power level for applications that would not be met with axial propeller fan technology,
- Ability to overcome external pressures applied in ducted applications and sound-reducing accessories that would not be met with axial propeller fan technology.

FC centrifugal fans have a different performance curve than backward-curved (BC) centrifugal fans. The FC centrifugal fans are more in line with the needs of forced draft cooling towers, i.e. medium pressure and high volume flow.

For a given size envelope, the forced draft cooling tower duty point is usually right of the curve of the BC centrifugal fan. The BC fans usually cannot achieve the equivalent airflow of a FC centrifugal fan as shown on the figure above without an increase in size that would be impractical due to shipping size limitations and necessary air plenum space required to distribute air to the heat exchanger.

2.3 Practical example

Consider a forced draft cooling tower with 2 centrifugal fans, delivering a total volume flow of 27.8 m^3/s at a static pressure of 199 Pa. Such a cooling tower is similar to the one shown on the picture below.

With FC centrifugal fans of 30", the power consumption is only 17.4 kW. Delivering the same performance with a 30" BC centrifugal fan requires 21.9 kW electrical power. Installing BC centrifugal fans is not only less efficient, but also requires a larger motor size (from 18.5 kW to 22 kW). The total efficiency is 56.6% for the FC centrifugal fan and 45.1% for the BC centrifugal fan on this product. BC centrifugal fans do not offer a solution with respect to increased efficiency on the forced draft centrifugal cooling towers, but will increase effective energy consumption instead of reducing it.

BC centrifugal fans require an increased rotation speed compared with FC centrifugal fans to achieve the same performance. Considering the example, the FC centrifugal fan rotates at 360 rpm, but the BC centrifugal fan requires 1048 rpm. This influences the noise generated by the fan. Because the blade tip speed is the main driver for noise, the sound power level would increase by at least 14 dB(A). This is too high and not accepted by the market due to local noise restrictions. A lot of the forced draft centrifugal units are already installed with intensive attenuation to align with sound requirements. Further sound attenuation is not practical as the necessary air restriction would greatly degrade heat exchanger performance will increase effective energy consumption instead of reducing it.

The increased rotation speed of BC centrifugal fans influences the cooling tower design intensively. Bearings, shafts, supporting structure, motors and drive need to be reviewed and redesigned. As an example, the current shaft rotating the centrifugal fans has a critical design speed of 575 rpm, the BC centrifugal fan rotates at almost double this speed. The bearing size depends on the rotation speed of the shaft. Increasing the rotation speed will increase the bearing size.

The increased weight of the BC centrifugal fan (355 kg) versus the weight of the FC centrifugal fan (126 kg) must also be taken into account of a redesign.

In our example cooling tower, the fan housing (scroll and snout) is fully integrated in the product as a supporting structure for the heat exchanging section above (as projected in the picture above). The BC centrifugal fan technology requires a different fan housing resulting in an entire redesign of the product. Based on the above arguments to redesign the product, the end product will consume more raw materials, resulting in a negative environmental impact as well as cost increases.

This example shows that an introduction of BC centrifugal fans into the forced draft centrifugal cooling towers would neither be beneficial for the fan efficiency nor for noise emissions. FC centrifugal fans are necessary in order to achieve best fan efficiencies. The proposed minimum efficiency for centrifugal fans above 5kW is too extreme considering the FC centrifugal fan technology.

About Eurovent

Eurovent, the European Committee of HVAC&R Manufacturers, is the representative of Europe's major national associations in the industry of heating, ventilation, air conditioning and refrigeration. Based on objective and verifiable data, its 24 members from 18 European states represent more than 1000 companies, the majority small and medium-sized. In 2013, these accounted for a combined annual turnover of around 25bn euros and employed more than 120.000 people – making Eurovent one of the largest industry committees of its kind.

Eurovent's roots date back to 1958. Over the years, the Brussels-based umbrella association has become a well-respected and known stakeholder that builds bridges between companies it represents, legislators and standardisation bodies on a EU and international level. The association favours a level-playing field for the entire industry and strongly supports energy-efficient and environmental-friendly solutions. 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 the EU's BUILD UP initiative.

Eurovent possesses two subunits. With Eurovent Certita Certification (ECC), it majority owns an independent certification company, which holds the ISO 45011 (17065) accreditation – fulfilling highest independency, reliability and integrity standards. Open to any company, it is known for its globally-recognised brand 'Eurovent Certified Performance'. Activities are complemented by Eurovent Market Intelligence (EMI), the association's second independent unit. Its Europe-wide data sets are frequently being used to support the development of EU regulation.

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Corresponding Members

Manufacturers in European countries with no national HVAC&R association representing them

Independent Subunits

Organisations with own structures that guarantee a full independency from the Eurovent association

Enclosed:

Files linked within this documents can be found within the 'Attachment' section of Adobe Acrobat.

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