Product Group 'Cooling Towers', Position Paper, PP – 2014-12-11

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Extended Eurovent Position justifying the exemption of cooling towers from the revised 'EU Fan Regulation' 327/2011

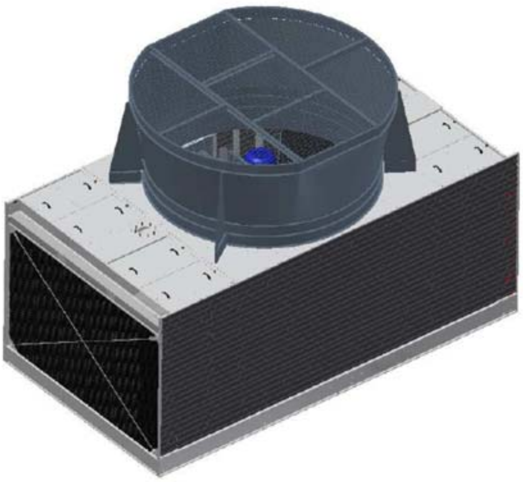
Background

In a position paper published on 18 November 2014, Eurovent and its members were calling for an exemption of Cooling Towers from the revised Commission Regulation (EU) No 327/2011, which sets Ecodesign requirements for fans driven by motors with an electric input power between 125 W and 500 kW (hereinafter referred to as 'EU Fan Regulation'). In a nutshell, this call was based on the following arguments that were described in-depth:

- There are dimensional problems when measuring fan efficiencies.
- The fan system cannot feasibly be separated to make fan efficiency measurements.
- The usual product ranges of manufacturers are so diverse that many models are rarely sold over the lifespan of a product line, which prevents cooling tower manufacturers from effectively testing each fan system.
- The market of cooling towers is significantly driven by energy efficiency and sustainability. Achieving the best cooling efficiency and the highest heat rejection for lowest power consumption is a primary goal of cooling tower manufacturers.
- Cooling tower manufacturers as integrators of fans/impellers place a different product on market than a fan.
- Fans in cooling towers are typically operated at reduced speed for much of the year in most climates, significantly reducing the energy used by the fans while further reducing the need for specific fan efficiencies.

In the following, Eurovent would like to further elaborate on its key arguments. That said, further to the opinion that manufacturers could use test laboratory reports and guidelines from VDI and AMCA for scaling models and testing the models, we would like to provide additional clarifications on the difficulties cooling tower manufacturers would face in case of no exemption from the Regulation.

Primary arguments



A 'fan' is commonly regarded as a configuration of impeller, stator, electric motor, transmission or direct drive and possibly a variable speed drive. In the case of cooling towers, the 'stator' is part of the tower design, which not only includes the fan cowl or fan housing, but also the air movement entering and leaving the fan. For example, velocity recovery stacks placed on the fan discharge (as illustrated on the left) have significant influence on the performance curve of the fan, the operating point and, subsequently, the efficiency.

The way the air enters the fan (as illustrated on the image below) is also of great importance when it comes to fan efficiency. Smooth air entry with little turbulence is desirable, but this is greatly influenced by the integration of the fan in the cooling tower, the type of water distribution, drift eliminators and even the rain density.

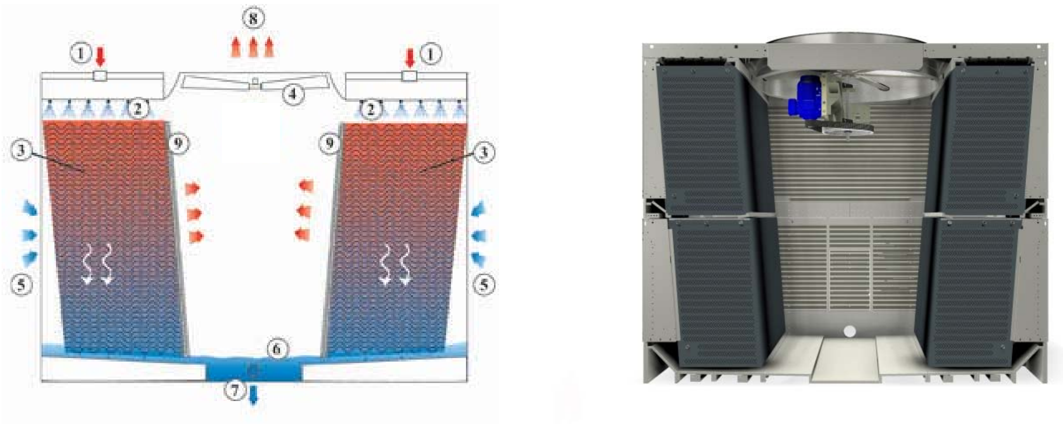


Figure 1: Open cooling tower working principle

Accordingly, there are many factors that influence the performance of a fan in a cooling tower, which are specific for a certain designs, and unique for each model of a product line – even within a series of cooling towers. Arrangements can vary infinitely.

For example, the components involved that have an impact on the fan are, inter alia:

- The water flow,
- The type and quantity of packing,
- The type of water distribution,
- The presence and definition of the sound attenuators at the inlets, at the outlets. the types of drift eliminators,
- The use of plume abatement coils.

Fan curves for rotors used by cooling tower manufacturers generated in a lab do not describe the behavior of the same rotor in the actual cooling tower model. For this reason, it is not only the availability or absence of a lab that is the base for the request for exempting cooling towers from the 'EU Fan Regulation', but the fact that cooling tower 'stators' are very complex. Furthermore, in many cases, cooling towers are so unique that beyond the 'stator' design, there are several other design and operating factors influencing the performance and efficiency of these products.

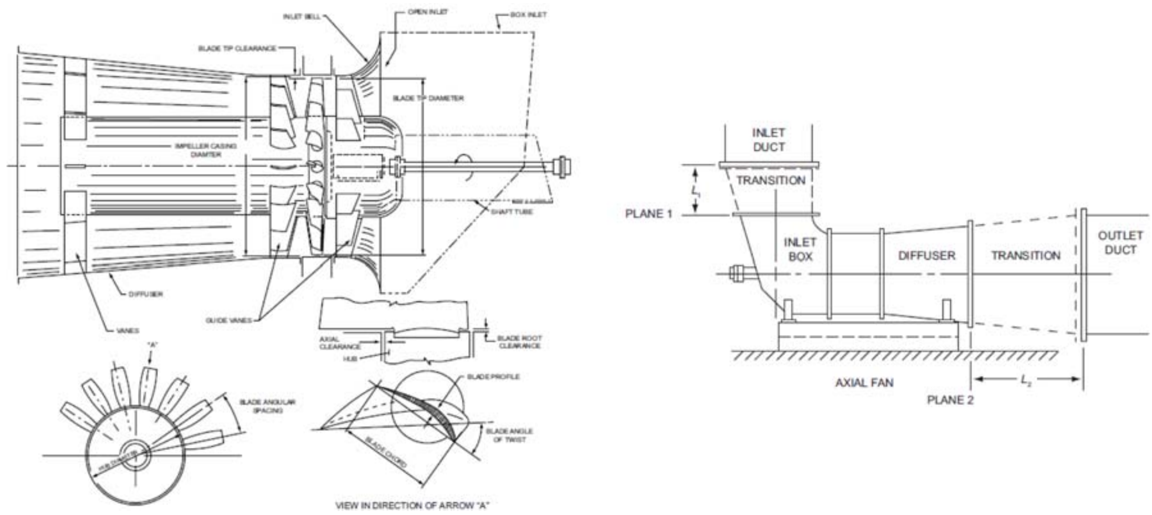


Figure 2: Example of an axial fan and test setup from the referred AMCA publication 802

The experience of AMCA, the American Air Movement and Control Association, refers to fans that are put on the market as such. AMCA's expertise is less focused on cooling tower products with fans incorporated. This is being visualized in many AMCA guidelines (e.g. AMCA Publication 802-02 (R2008): Industrial Process/Power Generation Fans — Establishing Performance Using Laboratory Models), their test facilities, the AMCA members and the presentation of the different fan types, which this organisation is certifying. None of these fan types are used in a cooling tower.

Figure 3: Extract from an AMCA presentation for the Cooling Tower Institute (CTI, USA)

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The cooling tower fan rotors constitute a niche market of the total fan market. Cooling tower fan rotor manufacturers can only test and certify the rotor performance in a test rig according to a standard, but not in a cooling tower itself. The test equipment is already huge for testing just their rotors – of which they sell multiple. This is different to the cooling towers itself.


Figure 4: Example test rigs of a cooling tower fan rotor supplier

Verification of fan efficiency would therefore need to be done 'in situ' on virtually each and every cooling tower model. The costs for such an undertaking (if it was practically possible to test every model on site) would be prohibitive, and with an <u>estimated annual sale of cooling towers of less than 10.000,</u> the benefit of energy efficiency improvement (if any) is very limited and does not stand in any relation with the cost.

The use of fans for cooling towers can range from 0.5 to above 12m diameters. It has been regularly noticed that the actual performance of the fan can only be demonstrated accurately on a full scale. In the same way, for example, the thermic performance of cooling towers is only certified based on full-scale products. Hence, lots of models cannot be tested in laboratories due to their size and absence of facilities.


Figure 5: Large-scale rotors used for cooling towers

Secondary arguments

The main purpose of a cooling tower is to cool water, not to move air. The requested cold water temperature is highly important for the proper efficiency of a process to be cooled, but as the outside temperature is continuously changing, the fan speed is less than 2% of the year at the nominal speed (and optimal fan performance), because the saving on the absorbed power linked to outside temperature is more than 80 times more important than the one on the fan efficiency itself.

Accordingly, it would be counterproductive in terms of energy saving to operate the tower focusing on fan efficiency first. **Focusing on the efficiency of the cooling tower is then a key point, compared with the focus on the fan only.**

If it is required to increase the fan efficiency to a nominal high level within the cooling tower system, then the design of the cooling tower would have to change to one that is more ideal for the fan. This would require a taller air plenum space below the fan. Package cooling towers are limited by shipping constraints to certain shipping volumes. Because of this limitation, increasing the plenum space would sacrifice space for air inlets or heat transfer (fill) volume. The effect, in turn, would be to actually reduce the total heat transfer capacity, even though the fan efficiency was improved.

This would be counterproductive to the primary objective, which is to maximise the cooling efficiency in terms of tons of cooling per fan power used. Thus, mandating for improved fan efficiency would have the unintended consequence of requiring higher fan power to produce the same cooling in a certain box size (volume). Eurovent and its members hold that this is certainly not the intention of the 'EU Fan Regulation' and the European Commission.

Conclusion

Each of the single above items demonstrates how complex and difficult it is to demonstrate fan efficiency in partially repeated cooling towers. **This confirms our first call for an exemption of cooling towers from the revised 'EU Fan Regulation'.**

FYI: Currently, similar issues are being raised in the US, where the DOE is working on fan ruling. The US cooling tower industry is encountering the same issues.

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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