Review of Commission Regulation No. 327/2011

Art 1f
For fans used in industrial processes a 5 year spare “exemption” is too short. It is quite feasible that fans in industrial process, where plant is often “built around fan”, have an operational life of >20 years. If a direct replacement cannot be supplied this will cause major modifications often resulting in an increase is not energy usage. Very often industrial fans are custom made and this includes interfaces with other parts of the plant, unless a direct replacement is available major modification may well be necessary which may lead to an increased environmental impact.

Comparisons with external power supplier and domestic products are **NOT** suitable for industrial products.

The levels and sizes of solid particles suggested are unsuitable. Bearing in mind the push for more efficient fans this is going to “outlaw” all fan designs except high efficiency backward curved and aerofoils for centrifugal fans. A dust load of 200 mg/m³ is approximately x10 higher than the typical design limit for a backward curved fan.
For a similar reason a 1mm practical size would be associated with some sort of conveying fan, certainly **NOT** a high efficiency backward curved required to meet 2018/2020 targets. A size 0.2mm would be more appropriate to a “clean air” fan.

Art 2.1
A single standard for 125 watts to 500 kW is in our opinion, is not practical. The scope and use of fans in such a large range really require the regulation to be sub-divided in order that each market can be more sensibly dealt with. Currently the standard has a bias towards heating and ventilation type fans or those incorporated into domestic products and that are mass produced. This is causing a compromise for other types of fans particularly heavy duty industrial. With the current efficiency levels (2015) these compromises can be worked around, however the proposed levels are taking us even beyond “current best practice” and the compromises will lead to a reduction in choice for end users and probably sever financial damage to the EU’s indigenous industrial fan suppliers

Annex II Para 3.3
Correction for compressibility factor should be removed. The gas power is a function of volume multiplied by pressure. By apply Kp factor this means fans approaching a specific ratio of 1.1 are required to be approximately 2% more efficient than those with a specific pressure ratio of close to 0 (ie a very low pressure fan). See also comments below on high pressure fans.

Proposed levels for 2018 and 2020

The proposed levels are too high and in our opinion unachievable using current or foreseeable technology. In support of this statement we site the following :

1) Fans are a mature, fairly simple technology. There is no scope for improvement electronics or computing to make fans more efficient.
   There is little scope for new materials to make existing fan designs more efficient.
   Materials of construction are similar now to 10, 20 or even 30 years ago, modern equipment (CNC machines, laser cutting, and robotic welding) has made manufacturing more efficient but **NOT** increased fan efficiency.
   Consider table page 43 of VHK discussion document a 47.77 kW fan, proposals are for a 10% increase by 2018 and a further 4% by 2020. In this time the equivalent increase in motor efficiency is 1% (IE3 to IE4). To achieve the 2018 level a fan static efficiency of 77.5% is required for direct drive (.775 x .942). This increases to 80.88% in 2020. (.8088 x .952). A fan impeller efficiency of 77.5% is achievable for a high efficiency backward curve fan, sized around a 45 kW motor. This type of fan may be used in a typical ventilation unit – requiring a large flow with a small pressure increase. However, the scope covers all fans regardless of volume pressure ratio. A fan with a low volume, high pressure ratio will be inherently less

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efficient than a high volume, low pressure fan, even if motor size is the same (ref. IMechE International Conference on Fans 2004 Fan selection – a practical guide C Halstead). For many industrial process fans the 2018 levels will not be achievable. Going to the proposed 2020 levels will in effect rule out anything except the most efficient fans regardless of whether they are suitable for the customer's volume pressure ratio. Having a simple one standard for all fans is not practical; it may work for ventilation fans where the duties lend themselves to high efficient designs but not those in the process industry.
The current 2015 levels are broadly achievable across the pressure range for industrial fans, the proposal 2018 and 2020 levels are **NOT** achievable. Should the commission wish to increase fan efficiency some correction for nature of the fan to be used is necessary. Alternatively change the scope of the regulation to remove industrial process fans.

2) There is no logical reason or "technical sense" for setting fan efficiency between motors and vu's. They are different technologies. For industrial fans VU are an irrelevance, efficiency limits for fans should be set accordingly to physics and on what the market will stand/demand.
Halifax Fan supplies fans for steam boilers that may be 30% efficient should we set the efficiency mid-way between boiler and motor efficiency – of course not.
With regard to fan efficiency, what the fan is used for and what it is driven by is an irrelevance, obviously the motor efficiency has an effect on the overall electrical input power, but it is not relevant to the actual impeller efficiency.
There is no logic that; because required efficiency increased by 4% 2013 to 2015, that addition similar gains can be assumed by 2018 and 2020. Can VHK indicate what "new technologies" are going to be available to justify these increases?

3) We suspect there may be an error in the application of the "anecdotal data" used to set the new limits. Currently fan manufactures give efficiency, either static or total, based on impeller efficiency. The concept of the efficiency based on electrical input power is new and very few manufactures publish data with efficiencies calculated this way, and historically probably no one. Bearing in mind anecdotal data will by its nature be historical, when VHK cite the example of a 7MW fan having an efficiency of over 89% this is more than likely based on impeller efficiency **NOT** input electrical power. If it *was* based on input power the impeller efficiency would need to be something in the region of 96% assuming a motor efficiency of 93%. This is just not practical.
So we can say a very large fan (7MW) best practice has an impeller efficiency of 89% in 2015. Can we therefore assume that **EVERY** fan by 2020 whatever, the application will have an impeller efficiency of 87% from 200 kW upwards. The second reason we think there is an error is the indicative readings is based on figure 1 page 41. Here a 0.4 kW fan has an efficiency shown as 64%. Note this is overall efficiency including motor, a 0.4 kW motor has an efficiency of around 72%. Therefore the fan static pressure must be 0.64 / 0.72 = 0.88 or 88%. This is clearly incorrect. The efficiency of 64% is the static efficiency of the impeller **NOT** the overall efficiency of the whole fan package.
The same graph shows a <0.2 kW fan with a 68% efficiency – to achieve this with such a small motor the fan would have to be >100% efficient. It is clearly wrong.

4) Halifax Fan understands that initially in the absence of any standard using BEP as measure of efficiency has some merit. However, moving forward for large fans that are **NOT** mass produced it would be more sensible to base the efficiency calculation on predicted operating point not BEP. The reason for this is – if the new proposed regulations are now to push fan efficiencies to current best practice and beyond, ie we are looking for relatively small increases in efficiency on a mature product, it can no longer make sense to ignore the fact that the actual operating point may not be the BEP. This will certainly be the case with the current proposed regulations. In order to achieve even the proposed 2018 levels nearly all centrifugal fans are going to have to be shallow backward curves to meet BEP requirement. A backward curve fan tends to produce maximum efficiency around 65% of free air volume (reference API 673 2nd Edition Jan 2002), but if we are forced to use backward curve fans for low volume high pressure applications the operating point may well be at 20-25% free air volume,

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ie well away from BEP, the result is a fan that may meet the regulation but absorb more power than a pre regulated radial fan would have. This is another example of why grouping all fans together regardless of application is a mistake.

In conclusion the assumptions used to set the future limits are not based on true evidence and are wishful thinking that will have a detrimental effect on many European manufacturers, which is contrary to the ethos of such regulations.

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