Annex 2

Working document on possible ecodesign requirements for ventilation fans.

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Subject matter

This implementing measure pursuant to Directive 2005/32/EC establishes eco-design requirements related to ventilation fans with power range 125 W – 500 kW. The Lot 11 preparatory study shows that energy in use phase is the only significant environmental aspects. Ecodesign parameters referred to in Annex I, Part 1 of Directive 2005/32/EC, are not considered as significant.

Definitions

'Fan' means a rotary bladed machine that is used to maintain a flow of a gas, typically air, and which is driven by an electric motor. The types of fans falling within the scope of this implementing measure include power range 125 W – 500 kW.

'Axial flow fan' means a fan having a static pressure development. This definition refers to fan categories 1 and 2 in Annex I.

'Centrifugal fan' means a radial flow fan comprising an impeller where the direction of the entry air flow is vertically to the direction of the exit air flow. This definition refers to fan categories 3, 4 and 5 in Annex I.

'Box fan' means a fan with a box casing installed in a duct run. This definition refers to fan category 6 in Annex I.

'Roof fan' means fans to be mounted on the roof of building by the provision of a curb for a flat roof or a purlin for a sloping roof. This definition refers to fan category 7 in Annex I.

'Cross flow fan' means a forward curved centrifugal fan with impeller of an increased axial length. The air entry to the casing is positioned on the scroll such that the air traverses the impeller. This definition refers to fan category 8 in Annex I.

Other expressions used in this implementing measure shall have the same meaning as in Directive 2005/32/EC.

Eco-design requirements

Products falling under the definitions of paragraph "Definitions" above in this document shall meet the ecodesign requirements set out in Annex I.

Information requirements for components and sub-assemblies

Information requirements on manufacturers are made based on the Lot 11 study.

Conformity Assessment

A conformity assessment shall be carried out according to Article 8(2), and Annex IV (Internal design control) or Annex V (Management system for assessing conformity) of Directive 2005/32/EC.

Market surveillance

When performing the market surveillance checks referred to in Directive 2005/32/EC, Article 3 (2), Member State authorities shall apply the verification procedure set out in Annex II of this implementing measure.

Review

A review of this implementing measure shall be presented to the Consultation Forum depending on technological progress and not later than 5 years after its entry into force.

Annex I: Ecodesign requirements

Fans covered by the implementing measure shall meet the ecodesign requirements set out in this Annex. The requirements specified are related to the fan product as defined, including motor and transmission.

a) Minimum energy efficiency requirement

1 January, 2010 onwards, the minimum energy performance requirements for fans are those described in table 1.

Table 1: Minimum energy performance requirements for fans on 2010

Fan Category	Power Range		
	0.125-1 kW	**1-10 kW**	**10 -500 kW**
MEL1 - Axial <=300Pa	$3.42*\ln(P_{el}) + 27.12$		=35
MEL2 - Axial > 300Pa	$2.28*\ln(P_{el}) + 29.75$		=35
MEL3 - Cetrifugal forw w housing	$2.74*\ln(P_{el}) + 28.69$		=35
MEL4 - Centrifugal backw free wheel	$4.68*\ln(P_{el}) + 47.23$		=58
MEL5 - Centrifugal backw w housing	$4.56*\ln(P_{el}) + 44.49$		=55
MEL6 - Box fans	$7.53*\ln(P_{el}) + 25.66$		=43
MEL7 - Roof fans	$3.42*\ln(P_{el}) + 37.12$		=45
MEL8 – Cross-flow fans	=8	$11.73*\ln(P_{el}) + 8$	=35
Results should be rounded to one digit, P_{el} to be entered in kW			

b) Minimum energy efficiency requirement

1 January, 2012 onwards, the minimum energy performance requirements for fans are those described in table 2.

Table 2: Minimum energy performance requirements for fans on 2012

Fan Category	Power Range		
	0.125-1 kW	**1-10 kW**	**10 -500 kW**
MEL1 - Axial <=300Pa	$3.42*\ln(P_{el}) + 27.12$		=35
MEL2 - Axial > 300Pa	$2.28*\ln(P_{el}) + 29.75$		=35
MEL3 - Cetrifugal forw w housing	$2.74*\ln(P_{el}) + 28.69$		=35
MEL4 - Centrifugal backw free wheel	$4.68*\ln(P_{el}) + 47.23$		=58
MEL5 - Centrifugal backw w housing	$4.56*\ln(P_{el}) + 44.49$		=55
MEL6 - Box fans	if $(7.53*\ln(P_{el}) + 25.66) < 20$ then MEP[1] =20; if $(7.53*\ln(P_{el}) + 25.66) \geq 20$ then MEP = $(7.53*\ln(P_{el}) + 25.66)$		=43
MEL7 - Roof fans	$3.26*\ln(P_{el}) + 37.5$		=45
MEL8 - Cross-flow fans	$2.74*\ln(P_{el}) + 28.69$		=35
Results should be rounded to one digit, P_{el} to be entered in kW			

[1] MEP = Minimum energy performance requirement.

c) Minimum energy efficiency requirement

1 January, 2020 onwards, the minimum energy performance requirements for fans are those described in table 3.

Table 3: Minimum energy performance requirements for fans on 2020

Fan Category	Power Range		
	0.125-1 kW	**1-10 kW**	**10 -500 kW**
MEL1 - Axial <=300Pa	$3.42*\ln(P_{el}) + 31.12$		=39
MEL2 - Axial > 300Pa	$2.28*\ln(P_{el}) + 33.75$		=39
MEL3 - Cetrifugal forw w housing	$2.74*\ln(P_{el}) + 32.69$		=39
MEL4 - Centrifugal backw free wheel	$4.68*\ln(P_{el}) + 51.23$		=62
MEL5 - Centrifugal backw w housing	$4.56*\ln(P_{el}) + 49.49$		=59
MEL6 - Box fans	if $(7.53*\ln(P_{el}) + 29.66) < 24$ then MEP =24; if $(7.53*\ln(P_{el}) + 29.66) \geq 24$ then MEP = $(7.53*\ln(P_{el}) + 29.66)$		=47
MEL7 - Roof fans	$3.26*\ln(P_{el}) + 41.5$		=49
MEL8 - Cross-flow fans	$2.74*\ln(P_{el}) + 32.69$		=39
Results should be rounded to one digit, P_{el} to be entered in kW			

c) Product information requirement

January, 2010 onwards, overall static efficiency of the product, including motor and transmission, must be indicated in the product catalogues according to ISO 5801, including the test standard and tolerance levels in accordance with ISO 13348:2006.

Noise level of the product must be indicated according to ISO 13347.

Annex II: Measurement and calculation method for ventilation fans

The measurement standard for the measurement of the efficiency of the fan is ISO 5801. Tolerance classes shall be used according to ISO 13348:2006: AN1 P> 500 kW, AN 2 P>50 kW, AN 3 P>10 kW, AN 4 P≤10 kW.

When a fan product includes the fan, transmission and motor, the product shall be measured in taking into account the overall static efficiency of the actual product.

When a fan is sold alone (without the motor), product efficiency must be calculated with default values as follows:

Motor:

- Motor efficiency η_M to be assumed, when the motor is not included in the fan product:
  - If P_{el} > 1.1 kW use motor efficiency η_M as required to achieve EFF2 rating. The rating to be replaced by IE1 after the new IEC 60034-30 Ed. 1 efficiency classes have come into force.
  - If P_{el} < 1.1 kW calculate motor efficiency η_M by the following formula: $\eta_M = 0{,}0629*\ln(P_W) + 0{,}653$ (P_W = shaft power). This equation is based on the typical efficiencies of single phase motors with capacitor.

Transmission:

- if the fan has a direct drive, transmission efficiency η_T of 100 % is to be assumed,
- If the fan has a belt drive:
  - for P_{el} < 1 kW: assumed transmission efficiency η_T of 75 %;
  - for 1 kW < P_{el} < 5 kW: assumed transmission efficiency η_T of 83 %;
  - For P_{el} > 5 kW: assumed transmission efficiency η_T of 90 %.

Controls:

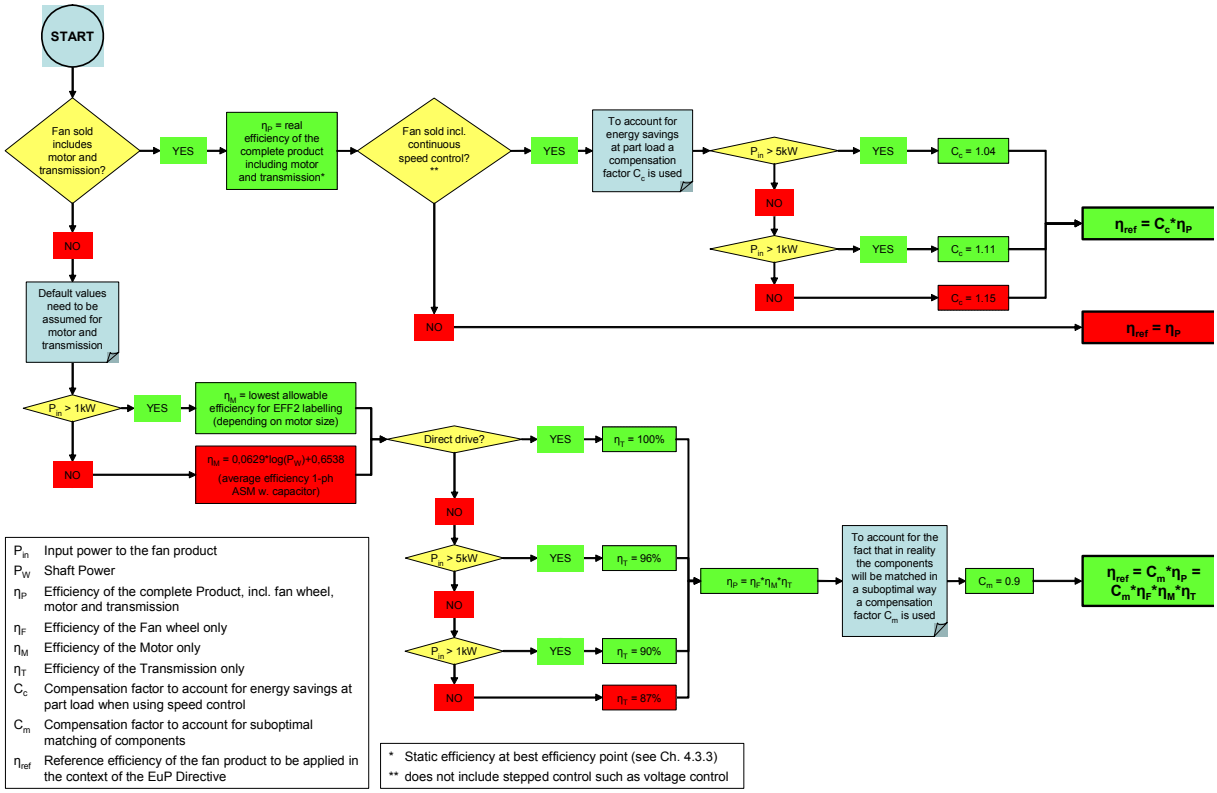
- for P_{el} < 1 kW: assumed control compensation factor C_c of 1.15;
- for 1 kW < P_{el} < 5 kW: assumed control compensation factor C_c of 1.11;
- for P_{el} > 5 kW: assumed control compensation factor C_c of 1.04.

Losses:

- Assumed compensation factor for losses is (C_m = 0.9).

The Chart 1 shows the calculation procedure for fans sold without the drive.

Chart 1: Calculation procedure for fans without drive.



P_{in}	Input power to the fan product
P_W	Shaft Power
η_P	Efficiency of the complete Product, incl. fan wheel, motor and transmission
η_F	Efficiency of the Fan wheel only
η_M	Efficiency of the Motor only
η_T	Efficiency of the Transmission only
C_c	Compensation factor to account for energy savings at part load when using speed control
C_m	Compensation factor to account for suboptimal matching of components
η_{ref}	Reference efficiency of the fan product to be applied in the context of the EuP Directive

* Static efficiency at best efficiency point (see Ch. 4.3.3)

** does not include stepped control such as voltage control

Explanatory Notes

The implementing measure is meant to contribute to achieving the requirements of Article 16.2 of Directive 2005/32/EC in relation to "ventilation fans".

Form of the implementing measure

The intention is to give to the implementing measure the form of a directly applicable decision or regulation.

Scope

The scope of the implementing measure includes ventilation fans with power range 125 W – 500 kW, as specified above under 'Definitions'. Fans under 125 W will be covered by an implementing measure based on Lot 10 preparatory study.

On top of the proposed eco-design requirements the Commission recommends complementary measures to be taken at national, regional and local authorities: in their public procurement procedures, they would be encouraged to require for fans the minimum energy efficiency values of the third introduction already from the beginning of this measure.

Exclusions

Special purpose ventilation fans are excluded from the scope of the implementing measure including fans for smoke and emergency smoke extraction, and fans as defined in the ATEX Directive 94/9/EC[2].

Ecodesing requirements

The implementing measure sets specific ecodesing requirements in form of minimum energy efficiency requirements. The preparatory study also identified the need to make generic requirements for the provision of information by manufacturers.

Depending on changes in ventilation fan markets and technological development, it is proposed to consider possible tighter ecodesing requirements no later than 5 years from the entry into force of this measure.

Energy efficiency levels

The Lot 11 preparatory study has shown that the proposed energy efficiency levels lead to reduction in least life cycle cost to the consumer under average operating conditions of 4000

[2] Directive 94/9/EC of the European Parliament and of the Council of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres, OJ L 100 of 19.4.1994.

hours pa over 15 years of average life time and with 0,075 euros/kWh electricity price for industry. As the impact of the electricity price dominates in the total life cycle cost, possible increase in electricity prices would lead to increased least life cycle cost savings from the proposed minimum energy efficiency requirements.

Benchmarks

Ventilation fans cover a broad range of fan sizes, types and power ranges, which make it unpractical to specify benchmark values for the best products on the market. Instead of one benchmark value per product group, hundreds of values would have to be defined.

Definitions

For ventilation fans covered by this implementing measure, definitions are restricted to commonly agreed technical parameters such as power rate, pressure increase or velocity of the flow. The Lot 11 preparatory study classifies ventilation fans in eight categories, as shown in Table 1, based on relevant Prodcom classifications and European and international measurement standards. Fans belonging to these categories are used in all types of applications, although some fan types may be preferred in certain applications.

Table 1: Definition of product categories for ventilation fans 125 W – 500 kW

Product Category	Direction of flow	Type	Typical Sizes [mm]	Example
1	Axial	<= 300 Pa (static pressure)	200 - 1,400	 Source: Helios
2		> 300 Pa (static pressure)	200 - 1,400	
3	Centrifugal	forward curved blades (with casing)	120 - 1,600	 Source: Nicotra
4		backward curved blades (no casing)	120 - 1,600	 Source: ebmpapst
5		backward curved blades (with scroll housing)	120 - 1,600	 Source: Ziehl-Abegg
6	Other	Box fans	100 - 1,000	 Source: Fläktwoods
7		Roof fans	250 - 1,000	 Source: Gebhardt
8		Cross-flow fans	60 - 120	 Source: ebmpapst

Measurement method

The measurement standard for the measurement of the efficiency of the fan is ISO 5801, which currently is under revision. As the non-revised standard does not set the level of

uncertainty for the motor, which is part of the product to be analysed, an assumed uncertainty level of 4 % must be used, except if the revised standard sets this level specifically.

The Tolerances to be used in the measurement tests are those specified in ISO 13348:2006 standard as indicated in Annex II. An additional calculation method is included for the measurement of the efficiency of fans, which are sold without motor, transmission and drives in order to ensure level playing field in the measurement tests.

Market structure

The lot 11 preparatory study has shown that the total European sales volume for ventilation fans covered by this implementing measure is about 1.2 Billion Euro, with an increasing sales trend and decreasing average prices. Most ventilation fans are traded within the EU27 but important trading between the EU and third countries takes place, that is, the ventilation market is global.

International dimension

Ventilation fan market is global in nature. Given that minimum energy efficiency requirements only exist in China, the proposed implementing measure could lead to similar measures in other third countries with beneficial global environmental impacts, particularly in the light of the existing Energy Star programme on residential ventilation in the US.

Impact on other EU legislation

The proposed ecodesign requirements will support the objective of the Energy Performance of Buildings Directive 2002/91/EC (EPBD) in helping to increase the efficiency of the building's ventilation system.

Voluntary agreements

There are no EU wide voluntary agreements. There is a national level voluntary agreement in Denmark and the Energy Star programme for residential fans (P_{el} < 125 W) in the US.