WORKING DOCUMENT (DRAFT)

Draft elements, for consideration by the Consultation Forum, of a possible future Commission Regulation implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for fans driven by motors with an electric input power between 125 W and 500 kW and repealing Regulation No 327/2011

Article 1

Subject matter and scope

1. This Regulation establishes ecodesign requirements for the placing on the market or putting into service of fans with an electric input power ≥125 W and ≤500 kW at their best efficiency point, including where they are integrated in other products.

2. This Regulation shall not apply to:

   (a) fan-impellers mounted on the shaft of electric motors with the sole purpose of cooling the motor itself;

   (b) fans integrated in laundry and washer dryers with maximum electric input power ≤ 3kW;

   (c) fans integrated in kitchen hoods with total maximum electric input power attributable to the fan(s) <280 W;

   (d) fans with a best energy efficiency point at 8000 revolutions per minute or more;

   (e) jet fans with maximum electric input power <5 kW.

3. This Regulation shall not apply to fans which are specified to operate exclusively and are clearly marketed as such:

   a) in potentially explosive atmospheres as defined in Directive 94/9/EC[1];

   b) for emergency use with regard to fire safety requirements as set out in Regulation (EU) No 305/2011[2], capable of short-time duty operation of 1 hour or more at temperatures of 300 °C and above;

   c) in nuclear installations, as defined in Article 3 of Directive 2009/71/EURATOM[3]

   d) in military establishments (bunkers) and civil defence establishments (bomb-shelters);

1 OJ L 100, 19.4.1994, p. 1
2 OJ L 88, 4.4.2011, p. 5.
3 OJ L 172, 2.7.2009, p. 18.

e) in wind-turbines;

f) where operating temperatures of the gas being moved are higher than 100 °C or lower than – 40 °C;

g) where operating ambient air temperatures for the motor driving the fan, if located outside the gas stream, are higher than 60 °C or lower than – 30 °C;

h) with a supply voltage > 1 000 V AC or > 1 500 V DC;

i) handling toxic, highly corrosive or flammable gases or vapours as set out in Regulation (EC) No 1272/2008[4];

j) handling abrasive substances with a hardness of at least 5 Mohs with a concentration of at least 100 mg/m³;

k) handling gases containing bio-hazardous substances of risk groups 2, 3 and 4 as set out in Directive 2000/54/EC[5];

l) handling gases containing carcinogens or mutagens as set out in Directive 2004/37/EC[6];

m) handling gases with a solid particle concentration equal or above 200 mg/m³ and/or particles with an average diameter of 1 mm or more;

n) handling gases with a compressibility factor, rounded to the nearest 2 decimal places, in the designated pressure and temperature range of the scope that is not equal to 1,00;

o) in cordless or battery-powered equipment;

p) in hand-held equipment whose weight is supported by hand during operation;

q) as a replacement for identical fans integrated in products that are no longer compliant with the minimum requirements in this regulation, for a period of 7 years after the implementation date of the tier, whose requirements could not be met by the identical fan to be replaced, to the extent that the corresponding compliant fan is not fit to be used as a replacement e.g. because its size exceeds the available physical space;

and where packaging and product information clearly indicate that the fan shall only be used for the purpose for which it is specified.

Article 2

Definitions

In addition to the definitions set out in Directive 2009/125/EC, the following definitions shall apply:

(1) ‘fan’ means a rotary-bladed machine made of several significant elements, that receives energy and utilizes it by means of one or more impellers to maintain a continuous flow of air or other gas passing through it and, with a pressure-increase ratio lower than 1.1 and an output air velocity lower than 65 m/s, which is an axial fan, centrifugal fan, cross

4 OJ L 353, 31.12.2008, p. 1.
5 OJ L 262, 17.10.2000, p. 21.
6 OJ L 158, 30.4.2004, p. 50.

flow fan, mixed flow fan or jet fan, and includes an impeller and any other significant elements that are supplied with the fan.

(2) 'significant elements' of a fan means the elements that contribute to the continuous conversion of electric power into air volume flow rate and pressure, or that influence the efficiency of that conversion, i.e. :

- impeller(s), including all rotating parts which have an aerodynamic influence;
- electric motor;
- housing (stationary part that interacts with the air stream passing through the impeller and affecting the air power of the fan);
- other stationary aerodynamic parts improving the performance of the fan may be included, for example:
  a. inlet cone, also known as venturi inlet, inlet bell, inlet radius;
  b. inlet or outlet guide vanes;
  c. diffuser.
- other stationary parts influencing the performance of the fan:
  a. mechanical transmission (aerodynamic influence and influence on efficiency);
  b. electrical transmission (aerodynamic influence and influence on efficiency, e.g. cable conduits, frequency inverter, VSD in air stream, terminal box, AC/DC converter);
  c. structural components that hold the assembly in place and may interfere with the airflow (e.g. brackets supporting the motor or the bearings); and
  d. protective grids, when they cannot be removed without making the fan ineffective.

(3) 'best efficiency point' (bep) is the best energy efficiency point for fan operation, as declared by the manufacturer and specified by the fan speed, expressed in revolutions per minute (rpm);

(4) 'impeller' means the rotating part of the fan, that is imparting energy into the gas flow and is also known as the fan wheel;

(5) 'stator' is the stationary part of the fan which interacts with the air stream passing through the impeller and, within the geometrical air-stream envelope between defined fan inlet- and outlet sections, includes any part that may increase, and excludes any non-fan component that may decrease, the fan efficiency;

(6) 'drive system' means electric motor, transmission or direct drive and possibly a variable speed drive;

(7) 'direct drive' means a driving arrangement for a fan where the impeller is fixed to the motor shaft, either directly or with a co-axial coupling, and where the impeller speed is identical to the motor's rotational speed;

(8) 'variable speed drive' (VSD) means an electronic power converter that continuously adapts the electric power supplied to a single motor to control the motor's mechanical power output according to the torque-speed characteristic of the load driven by the motor, by adjusting the power supply to a variable frequency and voltage supplied to the motor. It includes all protection devices and auxiliaries which are integrated in the VSD;

(9) 'specific ratio' means the stagnation pressure measured at the fan outlet divided by the stagnation pressure at the fan inlet at nominal flow rate;

(10) ‘fan flow angle’ is the angle between incoming and outgoing gas flow direction of the fan-impeller, as described in Annex III;

(11) ‘axial fan’ means a fan with a fan flow angle <20°, ‘centrifugal fan’ means a fan with a flow angle ≥70° and ‘mixed flow fan’ means a fan with a flow angle ≥20° and <70°, as described in Annex III;

(12) ‘centrifugal blade angle’ means the blade angle β_2 of a centrifugal fan, expressed in degrees, as described in Annex III;

(13) ‘forward curved fan’ means a centrifugal fan with a fan blade angle β_2 >90°, as described in Annex III;

(14) ‘backward curved fan’ means a centrifugal fan with a fan blade angle β_2 where 0°> β_2 ≤50°, as described in Annex III;

(15) ‘backward inclined fan’ means a centrifugal fan with a fan blade angle β_2 where 50°> β_2 ≤90°, as described in Annex III;

(16) ‘cross flow fan’ means a fan in which the gas path through the impeller is in a direction essentially at right angles to its axis both entering and leaving the impeller at its periphery;

(17) ‘jet fan’ means a fan that produces a high velocity jet of air in a space (thrust), unconnected to any ducting, where the jet of air entrains movement of the surrounding air, creating an overall air flow through the space. It is designed for operation with open inlets and outlets rather than operating against pressure and is capable of achieving at least an efficiency of 35%, assessed in accordance with Annex IV, point 3;

(18) ‘declared values’ means the values provided by the manufacturer, importer or authorised representative for the stated, calculated or measured technical parameters in accordance with Article 4, for the verification of compliance by the Member State authorities.

(19) Complete fan: a fan in scope of this Regulation, that has all the significant elements needed for its operation, that complies with the ecodesign requirements set out in annex II point 1, and has been subject to a conformity assessment referred to in article 4.

(20) Incomplete fan: a fan, that is a subset of a one or more well identified complete fan(s), that does not have all the significant elements needed for its operation and/or that does not comply with the ecodesign requirements set out in Annex II point 1, that comprises at least an impeller, but without one or more of the significant elements of the complete fan(s) that were taken into consideration when performing the conformity assessment(s) referred to in article 4.

Article 3

Ecodesign requirements

The ecodesign requirements for fans that are not incomplete fans are set out in Annex II and shall apply from the dates indicated therein.

Incomplete fans shall not be put into service, shall not bear the CE marking and shall meet the information requirements set out in Annex II bis when placed on the market.

Fans other than complete or incomplete fans shall not be placed on the EU market.

Article 4

Conformity assessment

1. The conformity assessment procedure referred to in Article 8 of Directive 2009/125/EC shall be the internal design control system set out in Annex IV to that Directive or the management system for assessing conformity set out in Annex V to that Directive.

2. For the purposes of the conformity assessment pursuant to Article 8 of Directive 2009/125/EC, the technical documentation shall contain a copy of the product information provided in accordance with point 2 of Annex II to this Regulation, and the details and results of calculations set out in Annex III to this Regulation, and where applicable Annex II.1.

3. As an alternative, when an incomplete fan is transformed into the corresponding complete fan following the instructions referred to in Annex II bis (4), the technical documentation may contain the evidence showing that these instructions have been followed, accompanied with the product information supplied with incomplete fan as in Annex II bis (4).

4. Where the information included in the technical documentation for a particular model has been obtained:

   (a) from a model that has the same technical characteristics relevant for the technical information to be provided but is produced by a different manufacturer; or

   (b) by calculation on the basis of design or extrapolation from another model of the same or a different manufacturer, or both,

   the technical documentation shall include the details of such calculation, the assessment undertaken by the manufacturer to verify the accuracy of the calculation and, where appropriate, the declaration of identity between the models of different manufacturers.

   The technical documentation shall include a list of all equivalent models, including the model identifiers.

Article 5

Verification procedure for market surveillance purposes

Member State authorities shall apply the verification procedure laid down in Annex IV when performing the market surveillance checks referred to in Article 3 point 2 of Directive 2009/125/EC.

Article 6

Circumvention and software updates

1. Economic operators shall not place on the market or put into service for their own purposes products designed to alter their behaviour or properties when they are tested in order to reach a more favourable result for any of the parameters regulated in the relevant delegated act referred to in Article 5(1). This shall include, but is not limited to, products designed to be able to detect they are being tested and automatically alter their performance in response and products pre-set to alter their performance at the time of testing.

2. Economic operators shall not prescribe instructions specific to testing that alter the behaviour or the properties of products in order to reach a more favourable result for any of the parameters regulated in the relevant delegated act referred to in Article

5(1). This shall include, but is not limited to, prescribing a manual alteration of the product before a test that alters the performance of the product.

3. Economic operators shall not place on the market or put into service for their own purposes products designed to alter their behaviour or properties within a short period after putting the product into service leading to a worsening of their performance in relation to any of the parameters regulated in the relevant delegated act referred to in Article 5(1) or their functional performance from the perspective of the user.

4. Software or firmware updates shall not worsen product performance in relation to any of the parameters regulated in the relevant delegated act referred to in Article 5(1) or the functional performance from the perspective of the user when measured with the original testing method, except with explicit consent of the end-user prior to the update. No performance change shall occur as a result of rejecting the update.

5. Software or firmware updates shall not worsen performance referred to in the first subparagraph to the extent that the product becomes non-compliant with the requirements set out in delegated acts referred to in Article 5(1) applicable at the time of the placing on the market or putting into service of the product

Article 7
Indicative benchmarks

The indicative benchmarks for the best-performing fans available on the market at the time of adopting this Regulation are set out in Annex V.

Article 8
Review

The Commission shall review this Regulation in the light of technological progress and shall present the results of this assessment, including, if appropriate, a draft revision proposal, to the Consultation Forum no later than 5 years after entry into force. This review shall in particular address the appropriateness of:

- Revising the metrics with extended and technology-neutral product approach;
- New efficiency limits in line with the new metrics and technological progress;
- Resource efficiency, re-use and recycling, e.g. not allowing the use of halogenated flame retardants for non-electric parts, e.g. in plastic impellers;
- Relevance of the exemptions.

Article 9
Repeal

Commission Regulation (EU) No 327/2011 is repealed as from one year after entry into force of this regulation.

Article 10
Entry into force and application

This Regulation shall enter into force on the 20th day following its publication in the *Official Journal of the European Union*.

It shall apply from one year after entry into force of this Regulation. However, the first paragraph of Article 6 shall apply from 8 months after entry into force of this Regulation.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels, [date] .

For the Commission
The President
Ursula VON DER LEYEN

Annex I
Definitions applicable for the Annexes

(1) ‘Measurement category’ means a test, measurement or usage arrangement that defines the inlet and outlet conditions of the fan under test;

(2) ‘Measurement category A’ means an arrangement where the fan is measured with free inlet and outlet conditions and a partition between inlet and outlet zone;

(3) ‘Measurement category B’ means an arrangement where the fan is measured with a duct fitted to its inlet and outlet and a partition between inlet and outlet zone;

(4) ‘Measurement category C’ means an arrangement where the fan is measured with free inlet conditions and a duct fitted to its outlet and a partition between inlet and outlet zone;

(5) ‘Measurement category D’ means an arrangement where the fan is measured with a duct fitted to its inlet and outlet and a partition between inlet and outlet zone;

(6) ‘Measurement category E’ means an arrangement where the fan is measured with free inlet and outlet conditions and without a partition between inlet and outlet zone;

(7) ‘Efficiency category’ means the fan gas output energy form used to determine the fan energy efficiency, with a distinction between 'static' or 'total' efficiency depending on whether the fan gas power has been determined with respectively the static or total pressure difference between fan in- and outlet;

(8) ‘Fan efficiency’ (η_f) is the ratio of the fan gas power output P_u and the electric input power P_e, both expressed in W and determined at bep, multiplied with correction factors for power conversion C_p and part load compensation C_c, following the expression:

$$\eta_f = C_p \cdot C_c \cdot P_u / P_e$$

with a distinction between 'static' or 'total' efficiency depending on whether the fan gas power P_u has been determined with respectively the static or total pressure difference between fan in- and outlet;

(9) 'Fan gas power' (P_u), in W, is the product of the fan volume flow rate q_v, in m^3/s, and the pressure difference between fan in- and outlet Δp, in Pa, both determined at bep, following the expression:

$$P_u = q_v \cdot \Delta p$$

with a distinction between 'static' or 'total' fan gas power depending on whether the fan gas power has been determined with respectively the static or total pressure difference Δp between fan in- and outlet;

(10) 'Electric input power' P_e, in W, is the electric input power at bep, measured at main terminals of motor or, when present, variable speed drive;

(11) 'Power conversion correction' C_p, is a correction factor for power conversion losses with a default value of 0,9 for fans equipped with a DC current motor with a rated voltage lower than 100 V;

(12) 'Part load compensation' C_c is a correction factor with one of the following values:

C_c=1 for a fan without a variable speed drive;

C_c=1,04 for a fan equipped or supplied with a motor, and a variable speed drive and P_e ≥5 kW;

$C_c = 0{,}0812\ (P_e)^{-0,5}$ for a fan equipped or supplied with a motor, and with a variable speed drive and P_e <5 kW;

(13) 'Fan flow rate' q_v, in m³/s, is the gas volume displaced per unit of time by the fan and is typically derived from assessment of the fan dynamic pressure difference, air velocity or measured thrust, calculated using the gravitational gas density ρ at default 1.2 kg/m³ and the fan outlet surface area;

(14) 'Fan static pressure' (p_{fs}), in Pa, is the omnidirectional force per unit surface area exerted at the fan outlet and is typically assessed by measuring the stagnation pressure in a (cylindrical) hole of appropriate geometry and dimensions, in duct wall or appropriate measurement instrument perpendicular to the direction of the gas flow;

(15) 'Fan total pressure' (p_f), in Pa, is the directional force per unit surface area exerted at the fan outlet and is typically assessed by measuring the stagnation pressure in a (cylindrical) hole of appropriate geometry dimensions facing the direction of the gas flow or, for jet fans, by measuring the reactive thrust force exerted on the fan by the gas flow per unit fan outlet surface area;

(16) 'Stagnation pressure' means the pressure measured at a point in a flowing gas if it were brought to rest via an isentropic process;

(17) 'Efficiency grade' is a parameter in the calculation of the target energy efficiency of a fan of specific electric input power at its bep (expressed as parameter '*N*' in the calculation of the fan energy efficiency);

(18) 'Minimum fan efficiency' (η_{min}) is the fan efficiency to be achieved in order to meet the requirements, calculated as the outcome of the appropriate equation in Annex II, Table 1, using the applicable integer *N* of the efficiency grade and the electric input power P_e of the fan expressed in kW at its bep;

(19) 'Test gas' is the working fluid for the purpose of compliance testing, and independent of the actual gas used in the fan, is clean air at standard inlet conditions of 20 °C and 101325 Pa;

(20) 'Jet-fan efficiency' η_r(T) is the fan gas power output derived from the measured thrust of a jet fan divided by the mechanical power supplied to the impeller of the fan, in accordance with Annex III, point 3;

(21) 'Specific speed σ_{bep}' describes the ratio between flow rate and total fan pressure (total) as dimensionless characteristic number determined at bep, in accordance with Annex III, point 5;

(21) ‘Low noise fan’ means an axial fan with an electric input power of 10 kW or more with a maximum characteristic noise emission value C ≤32 dB(A);

(22) ‘Dual use fan’ means a fan designed for both ventilation under normal conditions and emergency use as set out in Art. 1, 3 (b);

(23) ‘Reversible fan’ means a fan capable of reaching at least 80% of the nominal forward air flow in the reverse direction.

(24) ‘custom fan’ means a fan having a custom design for a specific client and/or contract, and an operating point or range specified by the client. These fans are only sold to that client. Details are not presented in catalogues, on-line media or general selection programs. The performance details are specific to the application and the client.

(25) ‘Safety Critical Fan’ means a fan that has been designed, verified, certified, and manufactured under the scope of either the Construction Product Regulation 305/2011 or Directive 2014/34 relating to equipment and protective systems intended for use in potentially explosive atmospheres.

(26) ‘Independent repair service provider’ means a self-employed professional or a legally established organisation providing repair services

(27) ‘Manufacturer-authorised repair service provider’ means a service provider authorized by the product manufacturer to offer repair services.

(28) ‘Wearing Parts (sacrificial elements)’ are parts that are intentionally designed to wear to meet the requirements of the intended use. For example, where a fan is used in a abrasive environment the fan can quickly become damaged by the abrasion. Some parts are designed as sacrificial elements to protect other critical areas and are designed to be replaced more frequently.

(29) ‘Proprietary tool’ is tool that is not commonly available and is specifically designed for a function that cannot be safely and/or reliably achieved by a commonly available tool.

ANNEX II

Ecodesign requirements for fans that are not incomplete fans

1. MINIMUM FAN EFFICIENCY REQUIREMENTS

The minimum fan efficiency (η_{min}) values of all fans in scope are a function of the electric input power P_e (in kW) and efficiency grade N following the equations:

- for fans with P_e <10 kW, except cross flow fans: $\eta_{min} = 0{,}0456\ \mathrm{LN}(P_e) - 0{,}105 + N$
- for fans with P_e ≥10 kW and all cross flow fans: $\eta_{min} = 0{,}011\ \mathrm{LN}(P_e) - 0{,}026 + N$

where values of efficiency grade N are set out in Table 1 below per fan type, efficiency category (static or total pressure) and measurement category (A to E) as appropriate, with the

- Tier 1 efficiency grades applicable one year after entry into force of the regulation and
- Tier 2 efficiency grades applicable three years after entry into force

subject to the following conditions:

- The calculation of the efficiency grade N for mixed flow fans involves the fan flow angle α, in degrees rounded to the nearest integer, assessed in accordance with the measurement method in Annex III, point 1.
- For non-reversible dual use fans designed for both ventilation under normal conditions and emergency use as set out in Art. 1, 3 (b), the values of the minimum efficiency grades set out in Table 1 will be multiplied by a factor 0,90.
- For reversible fans, for dual use or not, the values of the minimum efficiency grades set out in Table 1 will be multiplied by a factor 0,85.
- For low noise fans the values of the minimum efficiency grades set out in Table 1 will be multiplied by a factor 0,90.
- For centrifugal fans with specific speed σ_{bep} <0,12, electric input power P_e <10 kW, measurement category B or D and efficiency category 'total' (pressure) the minimum fan efficiency (η_{min}) is a function of σ_{bep} as follows:

  $$\eta_{min} = 2{,}95 * \sigma_{bep} + 0{,}2$$

- Minimum requirements for jet fans ≥5 kW apply only in Tier 2. For jet fans the efficiency parameter is the jet-fan impeller efficiency ηr(T) and instead of the electric input power Pe the equations above shall use the mechanical power supplied to the impeller of the fan Pr (in kW). Note that the jet fan limit only applies from 5 kW upwards, but in order to prove that a fan <5kW is a jet fan it should achieve a jet-fan impeller efficiency of 35%, or otherwise it will be classified as an axial fan that needs to comply with axial fan minimum requirements as appropriate.
- Under tier 1, it is allowed to consider a protective grid that cannot be removed without making the fan ineffective as a non-significant element.

*Table 1 — **Minimum efficiency grades***

Fan type	**Measure-ment category**	**Efficiency category (pressure)**	**Minimum efficiency grades (*N*)**	
			Tier 1: ***1 years after entry into force***	***Tier 2:*** ***3 years after entry into force***
Axial fans	A, C	static	0,40	0,50
	B, D	total	0,58	0,64
Forward curved <5kW and backward inclined centrifugal fans	A, C	static	0,44	0,52
	B, D	total	0,49	0,57
Other centrifugal fans,	A, C	static	0,61	0,64
	B, D	total	0,64	0,67
Mixed flow fans	A, C	static	0,50	0,57+0,07·(α −45)/25
	B, D	total	0,62	0,67
Cross flow fans	B, D	total	0,21	0,21
Jet fans ≥5 kW	E		-	0,50

2. PRODUCT INFORMATION REQUIREMENTS ON FANS

1. One year after entry into force, the information on fans set out in points 2(1) to 2(15) below shall be visibly displayed on:

(a) the technical data sheet or user manual supplied with the fan, unless an internet link or a QR code to that information is supplied with the product, and

(b) the technical documentation for the purposes of conformity assessment pursuant to Article 4, and

(c) free access websites of the manufacturer of the fan, its authorised representative or the importer, and,

(d) where relevant the technical data sheet supplied with products in which the fan is incorporated.

The following information shall be displayed:

(1) fan efficiency (η_f), rounded to the closest value in 3 decimal places, with specification of the type of fan (axial, jet, mixed flow, centrifugal or cross flow) or in the case of a jet fan, the jet-fan impeller efficiency η_r(T) and specification 'jet fan';

(2) measurement category used to determine the fan efficiency (A-E);

(3) efficiency category (static or total), except for jet fans;

(4) efficiency grade *N* at bep;

(5) the electric motor input power P_e (in kW), flow rate q_v (in m^3/h rounded to the closest integer value when <1 m^3/s, else in m^3/s rounded to the closest value in 2 decimal places) and applicable pressure difference Δp (in Pa, rounded to the closest integer value) at bep;

(6) DC voltage lower than 100 V (yes/no)?;

(7) list of all the significant elements provided with fan;

(8) specific speed σ_{bep}, only for centrifugal fans with specific speed σ_{bep} <0,12, electric input power P_e < 10kW, measurement category B or D and efficiency category 'total' (pressure);

(9) fan speed in revolutions per minute (rpm, rounded to the closest integer value) at bep;

(10) the 'specific ratio', rounded to the closest value in 2 decimal places;

(11) manufacturer's name, registered trade name or registered trademark, and the address at which the manufacturer can be contacted;

(12) product's model number or other codes and marks sufficient for it to be unequivocally and easily identified;

(13) information relevant for facilitating disassembly, recycling or disposal at end-of-life;

(14) information relevant to minimise impact on the environment and ensure optimal life expectancy as regards installation, use and maintenance of the fan;

(15) In case the fan is a replacement for an identical no-longer compliant fan in the sense of Art. 1, sub 3), sub o) the identifiers and characteristics of the fan to be replaced.

The information in the technical documentation shall be provided in the order as presented in points 2(1) to 2(14). The exact wording used in the list does not need to be repeated. It may be displayed using graphs, figures or symbols rather than text.

2. The information referred to in points 2(1), 2(2), 2(3), 2(4) and year of manufacture shall be durably marked on or near the rating plate of the fan.

3. Manufacturers shall provide information in the manual of instruction on specific precautions to be taken when fans are assembled, installed or maintained, including cleaning.

3. INFORMATION REQUIREMENTS ON PARTIAL LOAD OR AT SPECIFIED DUTY

(1) For all fans, except custom fans:

Three years after entry into force, the partial-load operational performance of the fan shall be provided for all fans, except custom fans. This shall be described by a minimum of three performance curves at different speeds: one at the stated inherent speed, one at the minimum recommended speed, plus an additional one between the other two. More than three curves can be provided.

Performance curves shall comprise a sufficient number of test points to permit the characteristic curve to be plotted over the normal operating range.

The information on the curves can be in digital form such as selection software or online catalogue. However the values of volume flow, pressure, energy consumption and efficiency shall be provided for the individual test points.

This information shall be available on:

(a) the technical data sheet or user manual supplied with the fan, unless an internet link or a QR code to that information is supplied with the product, and

(b) the technical documentation for the purposes of conformity assessment pursuant to Article 4, and

(c) the free access websites of the manufacturer of the fan, its authorised representative or the importer.

(2) For custom fans:

18 months after entry into force, the performance of custom fans at the specified operating point(s) or operating range(s) shall be provided. A sufficient number of test points shall be selected to properly describe the duty range. The values of volume flow, pressure, energy consumption and efficiency shall be provided for the individual test points.

This information shall be available on:

(a) the technical data sheet or user manual supplied with the fan, unless an internet link or a QR code to that information is supplied with the product, and

(b) the technical documentation for the purposes of conformity assessment pursuant to Article 4, and

4. MATERIAL EFFICIENCY PRODUCT INFORMATION REQUIREMENTS

Instruction manuals for installers and end-users, and free access websites of manufacturers, importers and authorised representatives shall include the following information:

(1) access to professional repair;
(2) relevant information for ordering spare parts, directly from the manufacturer or through other channels;
(3) the minimum period during which spare parts, necessary for the repair of the appliance, are available;
(4) the minimum duration of the guarantee of the fan in years;
(5) details of any proprietary tool required for repair.

5. RESOURCE EFFICIENCY REQUIREMENTS:

Three years after entry into force, fans shall meet the following requirements:

1. Availability of spare parts:

(1) Manufacturers, importers or authorised representatives of fans other than safety critical fans shall make available to independent repair service providers at least the following spare parts if part of the fan:

a) motors;

b) impellers;
c) stator elements (casing/housing/inlet ring);
d) mechanical drive components;
e) variable speed drives;
f) sensors; and
g) wearing parts (sacrificial elements);

for a minimum of seven years after placing the last unit of the model on the market.

(2) Manufacturers, importers or authorised representatives of safety critical fans shall make available to manufacturer-authorized repair service providers at least the following spare parts if part of the fan:

a) motors;
b) impellers,
c) stator elements (casing/housing/inlet ring);
d) mechanical drive components;
e) variable speed drives;
f) sensors; and
g) wearing parts (sacrificial elements);

for a minimum of seven years after placing the last unit of the model on the market.

Only spare parts provided by the original manufacturer, importer, or authorised representative shall be used, and the repair undertaken by a manufacturer-authorized repair service provider to continue the principle of the original safety certification (reference: EN 45554, Table A.7, Class C).

(3) The list of spare parts concerned by points (1) and (2), and the procedure for ordering them, shall be publicly available on the free access website of the manufacturer, importer or authorised representative, at the latest two years after the placing on the market of the first unit of a model and until the end of the period of availability of these spare parts.

2. Maximum delivery time of spare parts

During the period mentioned under point (a) (1) and (2), the manufacturer, importer or authorised representatives shall ensure the delivery of the spare parts with the following timeframe:

– for fans incorporated into another product covered by another ecodesign regulation: the period defined in the end-product regulation;
– if not, as specified in a contract, where a contract exists between the manufacturer and the end user of the fan;
– if not, as defined in the product information of the fan and made available on free access websites;
– if not, then 8 weeks after having received the order;

3. Access to repair and maintenance information (RMI) requirements

The available repair and maintenance information shall include:

- the unequivocal appliance identification;
- a disassembly map or exploded view;
- technical manual of instructions for repair;
- list of necessary repair and test equipment;
- component and diagnosis information (such as minimum and maximum theoretical values for measurements);
- wiring and connection diagrams;
- diagnostic fault and error codes (including manufacturer-specific codes, where applicable);
- instructions for installation of relevant software and firmware including reset software; and
- information on how to access data records of reported failure incidents stored on the product (where applicable).

4. Requirements for dismantling for material recovery and recycling while avoiding pollution:

   (1) manufacturers, importers or authorised representatives shall ensure that fans are designed in such a way that the materials and components referred to in Annex VII to Directive 2012/19/EU can be removed with the use of commonly available tools;

   (2) manufacturers, importers and authorised representatives shall fulfil the obligations laid down in Point 1 of Article 15 of Directive 2012/19/EU.

Annex II bis

Product information requirements for incomplete fans

The product information below shall be visibly displayed on:

(a) the technical data sheet or user manual supplied with the fan. Points (3), (4) and (5) may be omitted if an internet link or a QR-code to that information is supplied with the product.

(b) free access websites of the manufacturer of the fan, its authorised representative or the importer.

(1) manufacturer's name, registered trade name or registered trademark, and the address at which the manufacturer can be contacted;

(2) product's model number or other codes and marks sufficient for it to be unequivocally and easily identified;

(3) information relevant for facilitating disassembly, recycling or disposal at end-of-life;

(4) Detailed information on the significant elements and their relevant characteristics, including stator, drive system (including motor, possible transmission and possible variable speed drive or other controller), accompanied with instructions, needed to transform the incomplete fan into one or more complete fan(s). The information shall be sufficient for the purchaser or market surveillance authorities to procure or develop the missing elements in such a way to achieve the same performance as the complete fan(s), within the tolerances specified in Annex IV. For instance, in case the incomplete fan is placed on the market without the complete fan's stator, the manufacturer has to provide the purchaser or market surveillance authorities with the geometrical contour design of the stator.

(5) The technical data sheet of the complete fan(s), comprising at least points (1) to (10) referred to in Annex I point 2, as well as the information on partial load or at specified duty of the complete fan, as referred to in Annex I point 6.

(6) If applicable: the total weight per fan of the permanent magnets, if any, used in the motor, in kg with 2-digit precision.

On request of the market surveillance authorities, the manufacturer of the incomplete fan, its authorised representative or importer shall provide the full technical documentation of corresponding complete fan(s) as referred to in Annexes IV and V to Directive 2009/125/EC.

Technical documentation and promotional material of incomplete fans shall be accompanied by a warning of the need to add certain significant elements in order to meet the ecodesign requirements and the declared performance of the complete fan. It shall specify that meeting ecodesign requirements can be achieved in two ways: following the instructions of the supplier of the incomplete fan as referred to in Annex II bis (4), or through a complete conformity assessment under the full responsibility of the buyer of the incomplete fan.

A specific warning about motor efficiency shall be provided in case the complete fan is equipped with:

– a motor with a class level higher than IE2[7] for fans below 0,75 kW electric input power;
– a motor with a class level higher than IE3 for fans having electric input power greater or equal to 0,75 kW and smaller than 75 kW, or greater than 200 kW;
– a motor with a class level higher than IE4 for fans having electric input power between 75 kW and 200 kW.

[7] As defined in Annex I of Commission regulation (EU) 2019/1781 laying down ecodesign requirements for electric motors and variable speed drives.

ANNEX III

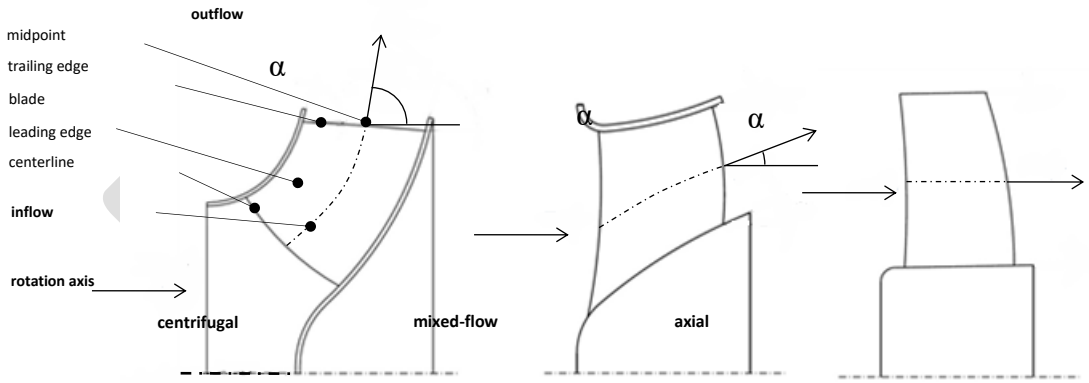
Measurements and calculations

1. For the purposes of compliance and verification of compliance with the requirements of this Regulation, measurements and calculations shall be made using harmonised standards the reference numbers of which have been published for this purpose in the *Official Journal of the European Union*, or using other reliable, accurate and reproducible methods that take into account the generally recognised state-of-the-art methods. They shall meet the conditions and technical parameters set out in points 2 to 5.

   In the absence of existing relevant standards and until the publication of the references of the relevant harmonised standards in the Official Journal, the transitional testing methods set out in Annex III a or other reliable, accurate and reproducible methods, which take into account the generally recognised state of-the-art, shall be used.

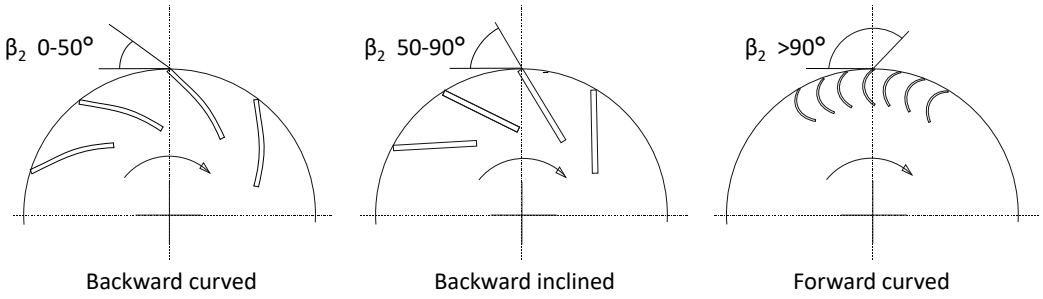
2. **Fan flow angle**

'Fan flow angle α' means the angle of the center-line of the air-conducting surface of a fan blade, measured at the midpoint of its trailing edge with the center-line of the rotation axis, in a plane through the rotation axis and the midpoint of the trailing edge. An impeller defined as 'axial' if $\alpha < 20°$, 'mixed-flow' if $20° \leq \alpha < 70°$ and 'centrifugal' if $\alpha \geq 70°$.



3. **Centrifugal blade angle**

'Centrifugal blade angle β_2 means the angle between the tangent to the outer circumference of the outer circle, as defined by the trailing edge of the blades, and a line bisecting the trailing edge of the blade. To consider blade designs that have a rapid change of angle at the trailing edge, the angle is the arithmetic mean along 50% of the trailing length of the blade. The trailing edge of the blade is the edge at the tip of the blade at the outlet of the impeller. A centrifugal impeller is defined as 'backward curved' if $0° < \beta_2 \leq 50°$, 'backward inclined' if $50° < \beta_2 \leq 90°$ and 'forward-curved' if $\beta_2 > 90°$.



4.

4. **Jet fan efficiency**

Jet-fan efficiency η_r(T) is calculated as:

$$\eta_r(T) = q_v(T) \cdot \Delta p(T) / P_r = 0{,}5[\ T_m /(\rho \cdot A_2)\ ]^{0,5} \cdot T_m / P_r$$

where:

q_v(T) is flow rate at thrust T, in m³/s;

Δp(T) is pressure difference at thrust T, in Pa;

P_r mechanical power supplied to the impeller of the fan, in W

ρ is the standard air density (1,2 kg/m³);

A_2 is the gross fan outlet area in m²;

T_m is fan thrust measured, in N, assessed according to measurement category E.

5. **Characteristic noise emission value C**

The characteristic noise emission value C, in dB(A) is defined as

$$C = PWL_{\text{ impeller}} - 30 \log u_{tip} - 10 \log (0{,}001 \cdot q_v \cdot p_{fs}) + 5 \log D_{impeller}$$

where

$PWL_{\text{ impeller}}$ is impeller sound power level, in dB(A);

u_{tip} is impeller tip speed, in m/s;

q_v is air flow rate, in m³/s;

p_{fs} is fan static pressure, in Pa;

$D_{impeller}$ is impeller diameter, in m;

6. **Specific speed** σ_{bep}

The specific speed σ_{bep} of centrifugal fans with electric input power P_e <10kW, measurement category B or D and efficiency category 'total' (pressure) is defined as

$$\sigma_{bep} = n \cdot \frac{2 \cdot \sqrt{\pi \cdot q_{v,bep}}}{\left(2 \cdot \frac{p_{f,bep}}{\rho}\right)^{0,75}}$$

where

σ_{bep} is specific speed;

n is fan speed in revolutions per second (rps);

ρ is air density 1.2 kg/m³;

$q_{v,bep}$ is volume flow rate at bep, in m³/s;

$p_{f,bep}$ is total fan pressure at bep, in Pa;

π is the number pi (3.14…).

ANNEX IIIa

References and qualifying notes for fans

(The source of all references is CEN unless otherwise indicated)

Parameter	Reference/ Title	Notes and short description
	FprEN 17166:2020 Fans – Procedures and methods to determine the energy efficiency for the electric input power range of 125 W up to 500 kW	
Measurement category	§ 4.3 Identification of an appropriate measurement category.	The measurement category means a test, measurement or usage arrangement that defines the inlet and outlet conditions of the fan under test, used to determine the energy efficiency. Categories included are numbered A through E, according to EN ISO 13349:2010 and EN ISO 5801:2017 § 6.2, 6.3, 6.4, 6.5 (categories A though D) and EN ISO 13350:2015 (category E – jet fans).
Efficiency category	§ 3.15.1 and § 3.15.3 Definitions of fan (total) pressure and fan static pressure.	The fan gas output energy form used to determine the fan energy efficiency, defined by fan total or static pressure.
Efficiency grade	§ 6.1 and § 6.2 Method of comparison between efficiency grades.	Parameter in the calculation of the minimum fan energy efficiency is denoted in this Regulation as '*N*'. In FprEN 17166:2020 the minimum required efficiency grade is denoted N_g.
Fan efficiency	§ 5.5.2.5 Testing of jet fans § 5.5.2.2 to 5.5.2.4	Jet fan overall efficiency is calculated following EN ISO 13350:2015. For all other fan types in accordance with the provisions of EN ISO 5801:2017. Where scaling is necessary it shall be carried out in accordance with

		the requirements of ISO 13348:2007 subclause 7.1.6. Full-size testing on-site will be carried out in accordance with the test and calculation methods in EN ISO 5802:2008/A1:2015.
	§ 5.6 Calculation method for not final assembly.	Denoted η_f in this Regulation. Reference efficiency (η_{ref}) in the standard is defined as the fan efficiency value which is used to verify compliance,being either the fan overall efficiency referred to the drive input power, (η_{ed}), or the fan overall efficiency referred to the motor input power (η_e), depending on whether a VSD is used or not.
Flow rate q_v	§ 3.18 Volume flow rate	Volume flow rate q_{v1} is the mass flow rate divided by the density at fan inlet: $q_{v1} = q_m / \rho_1$. EN ISO 5801:2017 § 11.2 and Annex A for mass flow rate measurement and calculation, whereby the volume flow rate can be calculated according to § 15.1.8.
Specific speed σ_{bep}	§ 3.15.1	The ratio between flow rate and total fan pressure (total) as dimensionless characteristic number determined at bep, which can be calculated according to Annex III, 6. The needed total fan pressure can be calculated according to FprEN 17166:2020 § 3.15.1.
	EN ISO 5801:2017 Fans – Performance testing using standardized airways	
Pressure difference Δp (in Pa) at bep	§ 12.8.9 Method of measurement	Describes how to measure pressure difference between fan in- and outlet, which following the Regulation has to be measured at bep.
Fan speed (rpm)	§ 7.2 and § 12.3 Rotational speed	
Specific ratio	§ 15.1.6 Fan pressure	The stagnation pressure measured at the fan outlet divided by the

		stagnation pressure at the fan inlet at nominal flow rate. The specific ratio can be calculated from EN ISO 5801:2017 § 3.35 where it is defined as fan pressure ratio (r), where $r = p_{sg2} / p_{sg1}$.
	EN 60034-2-1:2014 Rotating electrical machines - Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)	
Electric motor input power P_e (in kW)	§ 6.1.2 Direct measurement of input (P_1) and output (P_2)	The electric input power at bep, measured at main terminals of motor or, when present, variable speed drive. EN 60034-2-1:2014 for the electric input power of electric motors fed directly from the grid, EN IEC 61800-9-2:2017 for the electric input of electric motors combined with and fed by a CDM).
	EN 45550 – 45559 series on Energy-related products - Material efficiency aspects for Ecodesign	
Disassembly, recycling or disposal at end-of-life	EN 45553:2020 EN 45555:2019 EN 45558:2019 EN 45559:2019	Disassembly aspects. Assessing the recyclability and recoverability of an energy related product. Critical raw material (CRM) content. Methods for providing information relating to material efficiency.

ANNEX IV

Verification procedure for market surveillance purposes

The verification tolerances defined in this Annex relate only to the verification by Member State authorities of the declared values and shall not be used by the manufacturer, importer or authorised representative as an allowed tolerance to establish the values in the technical documentation or in interpreting these values with a view to achieving compliance or to communicate better performance by any means.

Where a model has been designed to be able to detect it is being tested (e.g. by recognising the test conditions or test cycle), and to react specifically by automatically altering its performance during the test with the objective of reaching a more favourable level for any of the parameters specified in this Regulation or included in the technical documentation or included in any of the documentation provided, the model and all equivalent models shall be considered not compliant.

As part of verifying the compliance of a product model complies with the requirements laid down in this Regulation pursuant to Article 3(2) of Directive 2009/125/EC the authorities of the Member States shall apply the following procedure for the requirements referred to in Annex II:

(1) The Member State authorities shall verify one single unit of the model.

(2) The model shall be considered to comply with the applicable requirements if:

(a) the values given in the technical documentation pursuant to point 2 of Annex IV to Directive 2009/125/EC (declared values) and where applicable the values used to calculate these values are not more favourable for the manufacturer, importer or authorised representative than the results of the corresponding measurements carried out pursuant to point (g) thereof; and

(b) the declared values meet any requirements laid down in this Regulation and any required product information published by the manufacturer, importer or authorised representative does not contain values that are more favourable for the manufacturer, importer or authorised representative than the declared values; and

(c) when the Member State authorities test the unit of the model, the determined values (the values of the relevant parameters as measured in testing and the values calculated from these measurements), including the total losses (1-η) as decisive criterion for the efficiency, comply with the respective verification tolerances as given in Table 2.

(3) If the results referred to in points 2(a) or (b) are not achieved, the model and all equivalent models shall be considered not to comply with this Regulation.

(4) If the result referred to in point 2(c) is not achieved:

(a) for models that are produced in quantities of less than five per year including equivalent models, the model and all equivalent models shall be considered not to comply with this Regulation;

(b) for models that are produced in quantities of five or more per year including equivalent models, the Member State authorities shall select three additional

units of the same model for testing. As an alternative, the three additional units selected may be one or more of equivalent models.

(5) The model shall be considered to comply with the applicable requirements if, for these three units the arithmetical mean of the determined values, including the total losses (1-η) as decisive criterion for the efficiency, complies with the respective verification tolerances given in Table 2.

(6) If the result referred to in point (5) is not achieved the model and all equivalent models shall be considered not to comply with this Regulation.

(7) The Member State authorities shall provide all relevant information to the authorities of the other Member States and to the Commission without delay after a decision is taken on the non-compliance of the model according to points (3) or (6).

The Member State authorities shall use the measurement and calculation methods set out in Annex III.

The performance curves referred to in Annex I (2) (3) shall be verified by checking a minimum of two declared test points for each of the characteristic curves.

The performance of incomplete fans is tested in at least one configuration of the corresponding complete fan(s), using the information instructions referred to in Annex II bis, point (4).

Given the weight and size limitations for the transportation of fans with electric input power of 250 to 500 kW Member States authorities may decide to undertake the verification procedure at the premises of manufacturers, authorised representatives or importers before the products are put into service. The Member State authority can do this verification using its own testing equipment.

If factory acceptance tests are planned for such fans, which will test parameters laid down in Annex II of this Regulation, the Member State authorities may decide to use witnessed testing during these factory acceptance tests to gather test results which can be used to verify compliance of the fan under investigation. The authorities may request a manufacturer, authorised representative or importer to disclose information on any planned factory acceptance tests relevant for witnessed testing.

In the cases mentioned in the two paragraphs above, the Member States authorities only need to verify one single unit of the model. If the result referred to in point 2(c) is not achieved, the model and all equivalent models shall be considered not to comply with this Regulation.

The Member State authorities shall only apply the verification tolerances set out in Table 2 and shall only use the procedure described in points (1) to (7) for the requirements referred to in this Annex. For the parameters in Table 2, no other tolerances such as those set out in harmonised standards or in any other measurement method shall be applied.

*Table 2 — **Verification tolerances***

Parameters	*Verification tolerances*
Fan efficiency (η_f)	The determined value shall not be lower than the value representing 93 % of the corresponding declared value.

For the purpose of compliance testing the manufacturer:

- may remove the elements that are not significant as defined in article 2 (2) and that are not part of the complete fan
- may conduct the tests with the geometrical equivalent of the stator inner surface;
- may conduct the tests with a scale model and calculate the results for the real-size product if the latter has an impeller diameter above 1 m for jet fans or 0,5 m for other fans;
- may conduct the tests at customer's or manufacturer's site if the latter has an impeller diameter above 1 m for jet fans or 0,5 m for other fans.

provided that reliable, accurate and reproducible test- and calculation methods are used and modifications, test conditions and calculations are meticulously reported as prescribed in Annex II, section 2.

ANNEX V

Indicative benchmarks

The maximum values relate to the achievable efficiency grade *N* (see minimum efficiency formulas in Annex II) with clean air and no space and/or noise restrictions. The minimum values apply to contaminated air (some dust load) and space, noise and/or other operational restrictions at the limit of what is still in scope according to the exemptions in Article 1.

Table 3

Indicative benchmarks for fans

Fan type	**Measurement category**	**Pressure**	***N*** **minimum**	***N*** **maximum**
Axial	A, C	static	0,50	0,75
	B, D	total	0,64	0,85
Forward curved <5 kW and backward inclined	A, C	static	0,52	0,65
	B, D	total	0,57	0,70
Forward curved ≥5kW, backward curved	A, C	static	0,64	0,80
	B, D	total	0,67	0,85
Mixed flow	A, C	static	$0{,}57+0{,}07\cdot(\alpha-45)/25$	0,77
	B, D	total	0,67	0,85
Cross flow	B, D	total	0,21	0,21

An indicative benchmark for jet fan efficiency is 0,60.