Deliverable 4.1:
Final Methodology on market surveillance of large fans

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About the INTAS project

The aim of the INTAS project is to provide technical and cooperative support, as well as capacity building activities, to Market Surveillance Authorities (MSAs). The need for the INTAS project arises from the difficulty that MSAs and market actors face in establishing and verifying compliance with energy performance requirements for large industrial products subject to requirements of the Ecodesign Directive, specifically transformers and industrial fans. Therefore, the project aims to:

- Support European Member State MSAs deliver compliance for large products (specifically for transformers and large fans);
- Support industry to be sure of what their obligations are under the Ecodesign Directive and to deliver compliance in a manner that will be broadly accepted by MSAs;
- Foster a common European approach to the delivery and verification of compliance for these products.

List of project partners:

WIP Renewable Energies	Europe
European Environmental Citizens' Organisation for Standardisation	Europe
European Copper Institute	Europe
Engineering Consulting and Design	Europe
Waide Strategic Efficiency	Europe
Austrian Energy Agency	Austria
Federal Public Service Health, Foodchain, Safety and Environment	Belgium
SEVEn Energy Efficiency Center	Czech Republic
Danish Technological Institute	Denmark
Finnish Safety and Chemicals Agency	Finland
The Polish Foundation for Energy	Poland
Directorate General of Energy and Geology	Portugal
Romanian Regulatory Authority for Energy	Romania
Foundation for the Promotion of Industrial Innovation	Spain
Italian National Agency for New Technologies, Energy and Sustainable Economic Development	Italy
Food and Economic Safety Authority	Portugal

Executive summary

This document contains a step-by-step guide about the market surveillance process for industrial fans aimed mainly at market surveillance authorities.

The methodology described in this guide has been designed by the partners of the INTAS project with information obtained in WP2, WP3 and WP4, altogether with the inputs of the main stakeholders, both at national and European level, that will be reflected in deliverable 6.3, and has been implemented satisfactorily by the MSAs that are part of INTAS consortium in a pilot exercise.

The INTAS WP 4 included a pilot exercise for the validation of that methodology proposed. This validation stage used the draft methodology and guide applying it at least in one test case. The respective outcome has been reported back to the project, including a description and evaluation of each case, stressing in particular the usability and validity of the methodology developed in WP3.

Partners involved in this practical pilot were: ASAE (Portugal) with the support of DGEG (Portugal), ENEA (Italy), ANRE (Romania), BHTC (Belgium) and TUKES (Finland). This evaluation phase was not expected to include – though if feasible would include the physical testing of industrial fans. The main focus was the documentation inspection, including when applicable - according to the MSA formal status, a theoretical selection of a model and the most appropriate test method. The feedback from the pilot exercise enables to highlight the actual usability and validity of the whole methodology and has been taken into account in the preparation of this deliverable.

The guide describes the different steps for the compliance assessment methodology by MSAs adapted to the particular case large industrial fans (>10 kW):

- General information
- Product screening / sample selection
- Documentation inspection
- Testing

It also introduces a new concept: “the mandatory notification”, that will make possible for the MSAs to know if a fan has been installed (or produced) in their region/country. This new concept is considered very necessary and useful for market surveillance purposes, as it will described in section 2.2.1 of this document.

1. Introduction to step-by-step guide for MSAs

This step-by-step guide is presenting the final INTAS methodology on market surveillance of large fans. Large fans are considered fans with electric input power larger than 10 kW. The following steps are addressed in the guide:

- General information
- Product screening / sample selection
- Documentation inspection
- Testing

1.1 Objectives

WP3 outlined the individual tools for verifying the compliance of industrial fans under the Eco-design Directive.

Task 4.1 allows for the methodology to be assembled, tested, and validated by MSAs and industry stakeholders. This system of review has enabled adjustments and corrections to be made where necessary, and has also validated the defined methodology for industrial fans. The various inputs that will make this possible are as follows:

Collection of relevant data and outcomes from work packages 2, 3, and 6:

- Comments and input from stakeholders through the national focal point meetings. These have included contributions from national energy agencies or other interested departments/agencies, manufacturers, NGOs as well as other associated stakeholders.
- European-level stakeholders have been given the opportunity to comment on the draft methodology as appropriate via the EU-level focal point consultation.

Real-world application and piloting phase:

- There has been be a ‘validation phase’ by partners in the project consortium who have been able to secure the time and resources to carry out this pilot action. This phase has taken the draft methodology and guide and applied it at least in one test case within their region. Partners have then made comments and reported back on the usability and validity of the methodology. The validation phase has not included physical testing of fans (this action was undertaken under WP3) but has focused more on the documentation inspection and other stages of the verification process as preliminarily proposed in WP3, including the theoretical selection of a product and the most appropriate test method.

Feedback from the pilot and outcomes of other work packages has been used to complete the final deliverable of this task. The outcome of this task has taken the form of a step-by-step guide aimed mainly at market surveillance authorities and has included a graphical flowchart. This task culminates in the deliverable 4.1.

2. Step by Step guide

This section includes the full explanation of each of the different steps included within the INTAS methodology for the compliance assessment of industrial fans (see section *3. Final flowchart*).

2.1 General information

Ecodesign requirements have entered into force for a number of large industrial products including large fans and power transformers.

Manufacturers, including small and medium sized enterprises, typically do have knowledge about how to cope with other product regulation e.g. regarding safety or health. However, they may not know about the product specific Ecodesign requirements or they got unanswered questions about the implementation of the Ecodesign directive or regulations. As prerequisite for compliant products, it is important to ***create awareness*** among manufacturers, importers, procurers and other stakeholders about specific Ecodesign regulations.

As some of the products are complex and the regulations may be as well, market surveillance authorities (MSAs) would typically need to ***build capacity*** internally or externally to support awareness creation as well as enforcement activities.

Compared to consumer products, large industrial products are mostly sold business-to-business (B2B) and are not advertised which makes it difficult for market surveillance authorities to identify market actors and products placed on the market. To accommodate that it is proposed to perform ***market research,*** which besides the identification will also support the awareness creation and capacity building.

A pro-active role of the MSA can be an effective instrument prior to effectuating the enforcement activities laid down in the Ecodesign Directive and the product specific regulations.

2.1.1 Create awareness

Awareness can be created through various activities:

- National webpage in national language on Ecodesign regulations for different products
- Newsletters in national language
- Guidelines for industry in national language
- Product focussed national information meetings for industry and other stakeholders
- Participation in national industry events

2.1.2 Build capacity

Capacity building can be re realised through:

- Exchange of knowledge with other national market surveillance authorities and legislators (including market surveillance authorities focussing on other product related EU-legislation)

- Exchange of knowledge with other EU market surveillance authorities and legislators
- Identifying/consulting technical experts in the field of the specific products which could be:
  - Participants of the national standardisation mirror groups of the product relevant standards
  - Specialists at consultancies, technical institutes, test laboratories or universities
  - Secretary members of engineering, industry, trade or end-user associations

Annex A is listing relevant documents to establish a minimum knowledge base.

2.1.3 Research the market

Due to the B2B-market for large industrial products, extra effort is foreseen identifying the relevant market actors. The identification is beneficial for awareness creation but will also be beneficial for the screening and selection of products for verification process (see section 2.2). Relevant market actors are mainly:

- Manufacturers (local/national)
- International manufacturers/suppliers with local/national representation
- Main end-users (local/national)
- Main procurers (local/national)
- Main contractors with local/national representation

The fan procurer can be the end-user (direct sale), the machine builder or the contractor e.g. in case, a specific facility is built on Engineering, Procurement and Construction contract (EPC).

Large industrial fans are typically applied in the business segments:

- Industrial processes (pharma, paint, chemical, drying, ovens, kilns etc.)
- Tunnels and metros
- Mining
- Power plants

2.2 Product screening and sample selection

Having created awareness, built capacity and identified the market actors, screening for products and selection of samples is the next step.

Large industrial products such as industrial fans are poorly suited to the product selection techniques that MSAs established and deployed for Ecodesign conformity verification targeted for smaller mass-produced products.

Given the very specific nature of the large industrial fan sector MSAs are likely to need to apply a tailored screening methodology for the selection of such industrial fans for conformity verification.

Before the product is placed on the market this could entail selecting products for the tests at manufacturer's premises (see section 2.4.4).

After the product has been placed on the market this could entail:

a) a broader selection for technical documentation checks (see section 2.3)

b) a potentially slightly narrower selection for visual inspection checks (mainly checking the rating plate information)

c) a smaller sample for laboratory verification testing. (see section 2.4.4)

2.2.1 Mandatory notification

One of the major problems detected during the development of the INTAS project is that, in general, the MSAs do not have a procedure that allows them to know if an industrial fan has been imported, manufactured or installed in their country / region. This situation greatly hinders market surveillance.

INTAS project proposes a mandatory ([1]) notification from the manufacturer/importer to MSA (either that which has a mandate where the product is first placed on the market, and/or that which has the mandate where the product is put into service) to know that the industrial fan has been placed on the market.

If the notification is not made by the manufacturer or importer, this notification could be done by the end user or installer.

This notification could be done:

-before placing the large fan on the market or

-after placing the large fan on the market and before the putting into service.

This notification can be combined with the existing legal requirements of the different Member States.

In the following cases it will be necessary to explore the possibility of collaboration between different MSAs:

1) When the MSAs of the place where the industrial fan is produced and where it is put into service are different.

   In this case, the MSA of the place where the industrial fan will be installed can contact the MSA of the place where the manufacturer is located to manage the possibility of undertaking the market surveillance verification.

2) When the industrial fan is manufactured outside the EU.

[1] *INTAS is exploring the possibility of a mandatory notification for the MSAs to know if an industrial fan has been placed on the market (either by importing or producing) and installed in their territory, but currently there is no obligation for manufacturers, importers or their authorised representatives to inform MSAs that they have placed products on the market. Due to the variety of fan types and models and the wide range of fan sizes encompassed in Commission Regulation (EU) No 327/2011 such mandatory notification may be limited to specific subsets or situations.*

In this case, the customs authorities can contact the MSA of the place where the industrial fan will be installed to check if the notification has been made.

2.2.1.1 Advantages of the mandatory notification

As it will be discussed later in this report (section 2.4.4), the physical tests on an already installed industrial fans are problematic; therefore, knowing the existence of an industrial fan prior to its installation will facilitate market surveillance verification.

The manufacturer has an incentive to inform the MSA in any case, because if the MSA were to conduct conformity verification testing after the product was placed on the market, it would be very costly for the industrial fan client in terms of lost operational time or delays. Thus, in general producers would not wish to develop a reputation of putting their clients at risk due to failings in cooperating with MSAs responsible for Ecodesign conformity verification.

2.2.2 Market intelligence

Before the selection of the sample, we propose to make a “Market Intelligence” exercise to gather knowledge of the market and begin to use this to establish profiles of the market actors and their importance. This can be done by contacting national manufacturer’s associations and conducting web-searches to find suppliers to the local market including local and international manufacturers of large industrial fans.

The initial profiling process should aim to identify the following:

- any local manufacturers, the main characteristics of their product offer, revenues and market shares (on the local market)
- ditto for the other manufacturers supplying the local market
- importers/traders
- the contractors that install industrial fans, the sectors they work with, their size and importance
- the end-use sectors with some approximate data on their likely levels of use of industrial fan by classification.

Once this has been done it should be possible to liaise with the economic operators (especially the principal ones) and take steps to better understand their business, competences and practices with regard to industrial fans.

2.2.3 Establishing non-conformity risk profiles of economic operators

Once sufficient details regarding economic operators have been established MSAs can begin to simultaneously take steps which will establish risk of non-conformity profiles and help to increase compliance among economic operatives.

As any local producers are likely to be most accessible and also to have an important position in the local market this process is likely to begin with site visits to the local producers (see 2.2.3.1). In addition, it will entail measures to address imported products from either within the EEA or from outside.

2.2.3.1 Site visits of local producers

At this stage an MSA could choose to make site visits of local producers which could be used to serve any of the following purposes:

- clarify information on the producer's products and markets
- ensure that the producer is familiar with the Ecodesign requirements
- gain understanding of and appraise the conformity management systems and procedures that the producer is using for conformity assessment of its products.

Additionally, such site visits could be used as a first form of informal conformity verification via:

- provisional screening of conformity assessment records for products previously placed on the market, including review of their technical documentation
- assessment of the quality of the testing facilities and calibration procedures being used
- conduct of visual inspections of available finished products for plausibility and rating plate requirements
- assessment of the design software used and checking whether the technical data from randomly selected finished products within the finished product database is likely to be in line with the Ecodesign requirements.

Most probably, it would be important for the MSA to assure the economic operator that these checks are not going to be used, at least in the first instance, for formal conformity verification checks, but rather are intended to understand the likelihood that the economic operator's products do conform to the requirements. If issues and non-conformity risks are identified via these checks then the MSA could alert the economic operator to these deficiencies and agree a process wherein they would remedy them prior to a potential future site visit and check.

Note, in many countries MSAs are likely to have the authority they need to oblige economic operators within their territory to cooperate with them; however, in some jurisdictions this may not be the case. If an economic operator does not wish to cooperate with an MSA, especially if the offer of a non-disclosure agreement is in place, then it could be indicative of bad-faith and imply that there is an elevated risk of non-conformity. This could be explained to the economic operator and if they still wish not to cooperate the MSA could set their

risk profile at high and consider taking more proactive measures to sample their products for conformity verification purposes.

2.2.3.2 Addressing products from elsewhere within the EEA

In this case, it is an option for the MSA to contact the MSA(s) with direct jurisdiction over the site(s) where these products are produced and ask them to either conduct the same type of checks they would have done and/or to supply them with information on what they know about the operations and likely conformity of the producer in question. If this information is not forthcoming the requesting MSA may consider requesting the same access to that producer as they would for a locally based one or raising the risk profile of the producer in question.

If the product is not placed on the market, MSAs can invite manufacturers to sign a voluntary agreement to allow market surveillance verification at their premises (see section 2.2.5.2).

2.2.3.3 Addressing products made outside the EEA

Customs can identify manufacturers of large industrial fans based outside the EEA and MSAs could still seek to contact these and propose them, as in the case of manufacturers based in the EEA, to sign a voluntary agreement to allow market surveillance verification at their premises. This agreement will avoid problems that could occur if the industrial fan is found non-compliant after being placed on the market.

Furthermore, products imported from outside the EEA will all be passed through a hard trade border at customs and thus MSAs should have the opportunity to be informed by customs that they have been placed on the market and to deploy conformity verification actions prior to them being put into service. The risk profiling of these products could be informed by market intelligence but also by plausibility checks based on documentation and visual inspection.

Regarding the relationship between MSAs and customs, the 'Blue Guide' on the implementation of EU products rules 2016 states the following:

Regulation (EC) No 765/2008 on checks for conformity with Union harmonisation legislation in the case of products imported from third countries requires the customs authorities to be closely involved in the market surveillance activities and information systems provided for under EU and national rules. Article 27(2) of Regulation (EC) No 765/2008 foresees the obligation for cooperation between customs officers and market surveillance officers. Obligations for cooperation are also included in Article 13 of the Community Customs Code which establishes that controls performed with customs and other authorities are undertaken in close cooperation between each other. In addition, the principles of cooperation between the Member States and the Commission established in Article 24 of the Regulation are extended to authorities in charge of external controls, when relevant (Article 27(5)).

2.2.4 Selecting products for conformity verification checks

Based on the risk profiling activities set out above it should be possible for MSAs to progressively establish risk profiles for the economic actors serving the local market. In a simple risk profiling system there could be 4 classes of non-conformity risk per economic operator:

- low
- medium
- high
- unknown.

As more information on the economic operators becomes available the share of unknowns would decrease. Also, as higher risk economic operators are seen to take measures to improve their conformity their risk status could be amended downwards. Risk profile status of economic operators would also be adjusted in the light of outcomes from any conformity verification processes undertaken on their products.

When the MSA becomes aware that a product has been placed on the market and the supplier is known they can match it to their risk profile database to ascribe a risk status (with unknown being the default when the supplier is unknown or has no risk profile).

Based on this simple set of risk profiles the MSA can then apply a sampling algorithm to decide which products to select from a sample of potential candidates, and/or to decide whether to conduct conformity verification on a product which has just come to their attention. The weightings applied in the algorithm could take into account:

- the relative risk
- the desire to ensure there is a possibility that any product could be selected, not just the highest risk ones
- any pre-set intention to do conformity verification on a minimum or maximum number of the product type in question within a given period or given conformity verification budget envelope.

More information about how to apply the sampling algorithm and the screening process can be found in the INTAS deliverable 3.8 “Report about the screening techniques available for product/supplier targeting”

2.2.5 Product identification

When selecting a product, the following situations can be found:

- the product is already placed on the market or

- the product is not placed on the market.

This is the analysis of both situations:

2.2.5.1 The product is already placed on the market

2.2.5.1.1 The product is not put into service

In this case, the market surveillance will consist in document inspection (see chapter 5) plus the following options for physical testing:

- Testing at independent lab (see clause 2.4.4)
- Testing at manufacturer premises (see clause 2.4.4)

2.2.5.1.2 The product is already put into service.

In this case, the market surveillance will consist in document inspection (see clause 2.3) plus testing in situ (see clause 2.4.4)

2.2.5.2 The product is not placed on the market

In this case, the manufacturer has not performed the conformity assessment yet, and the assessment includes a test, this can be used for market surveillance purposes if there is an agreement ([2]) between the manufacturer and the MSA. Please see clause 2.4.5.3.

The documentation inspection can be done only after the manufacturer conformity assessment has been performed.

2.2.6 Product classification

Once the sample is selected, it is necessary to check if it is in the scope of the Commission Regulation (EU) No 327/2011. The regulation outlines different exemption criteria mainly related to operating environment and application. The exemptions are included in the checklist of Annex B to this guideline.

2.2.6.1 Fan size

The regulation does not define large industrial fans as a separate category, but large industrial fans are usually considered fans with input power of 10 kW or more. However, the limit is not strictly set and the considerations in this guide may also apply for fans with input power of less than 10 kW. According to the regulation, the upper limit is an input power of 500 kW. In order to be able to address the influence that the fan size can have on the choice of methodology, the fans above 10 kW are divided into two sub categories: Large fans covering the range 10-100 kW and Extra-Large fans covering the range 100-500 kW, see the figure below.

[2] *voluntary agreement between manufacturer/supplier and MSA, or between MSA and client, to allow market surveillance verification at manufacturer/supplier premises. This agreement can be a general agreement for a fixed period of time (for example, a year) or agreement only for a sample and could be similar to existing agreements between fan manufacturers and clients for witnessing FATs*

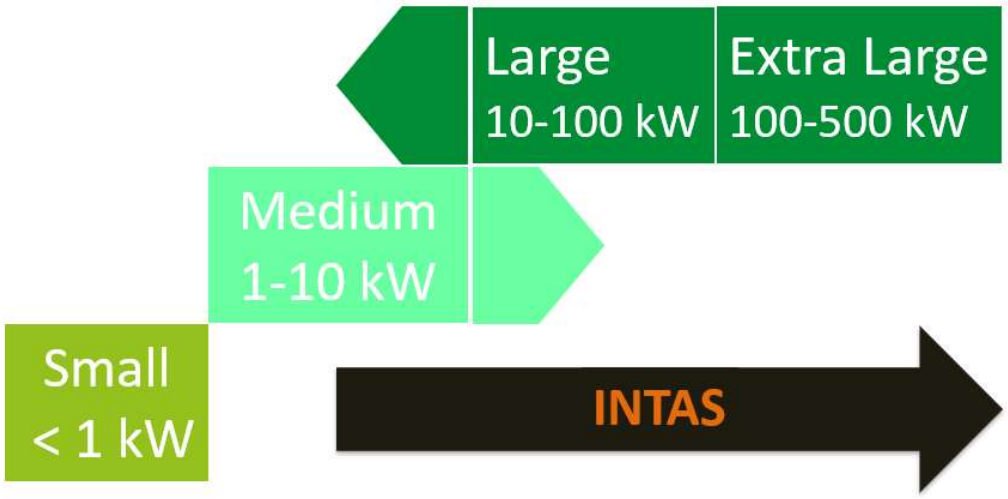

Figure 2-1 Overview of the fan size terms used in the INTAS project

2.2.6.2 Fan type

Commission Regulation (EU) No 327/2011 specifies different fan types where the most prevailing industrial fan types are:

- Axial fans
- Centrifugal backward curved fan with housing

The standard prEN 17166:2017 is providing sketches and explanations of the different fan types. The Standard defines fan type as:

Fan of specific and typical design primarily distinguished by the geometry of the impeller and the gas path through the fan

Commission Regulation (EU) No 327/2011 defines impeller as:

Impeller means the part of the fan that is impacting energy into the gas flow and is also known as the fan wheel

and defines housing as:

Housing means a casing around the impeller which guides the gas stream towards through and from the impeller

The housing is sometimes called the *stator*, where the impeller is then considered the *rotor*.

2.2.6.3 Fan drive system

Attached to the impeller there is a fan drive system. The simplest fan drive system is the direct drive system that Commission Regulation (EU) No 327/2011 defines as:

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 motors rotational speed.

In opposite to this definition is the transmission drive fan system that Commission Regulation (EU) No 327/2011 defines as:

Transmission means a driving arrangement for a fan which is not direct drive as defined above. Such driving arrangements may include transmissions using belt-drive, gearbox or slipping coupling.

Further, a fan drive system may include a variable speed drive (VSD) that Commission Regulation (EU) No 327/2011 defines as:

Variable speed drive (VSD) means an electronic power converter integrated – or functioning as one system – with the motor and the fan, that continuously adapts the electrical power supplied to the electric motor in order to control the mechanical power output of the motor according to the torque-speed characteristic of the load being driven by the motor, excluding variable voltage controllers where only the supply voltage for the motor is varied.

Figure 2-2 gives an overview of the fan drive system including the components causing losses.

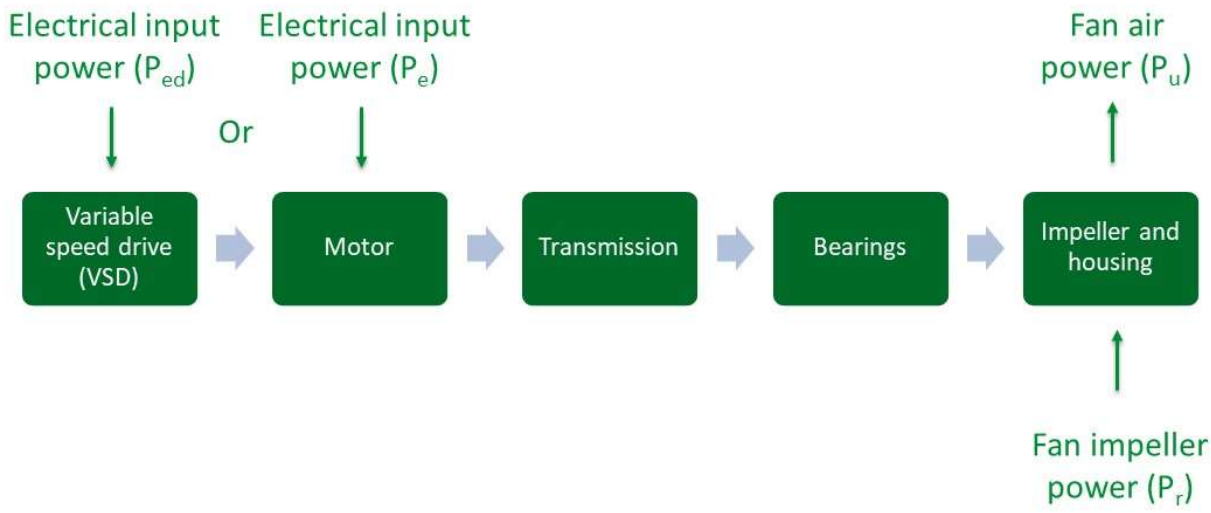

Figure 2-2 Overview of the fan drive system

The minimum Ecodesign requirements are based on the overall fan energy efficiency which is fan air power divided by electrical input power:

$$\eta_e = \frac{P_u}{P_e}$$

In case, the fan is equipped with VSD a compensation factor is applied. The factor takes into account the difference of P_e and P_{ed} due to losses of the VSD, see Figure 2-2.

The fan impeller efficiency is the fan air power divided by the fan impeller power (mechanical), see Figure 2-2:

$$\eta_r = \frac{P_u}{P_r}$$

The combination of impeller/housing and fan drive system, as is the basis of Commission Regulation (EU) No 327/2011, is also known as an *extended product* [16]. For industrial fans, the electric motor is likely to be

in scope of Commission Regulation (EC) No 640/2009 which is setting independent Ecodesign requirements for electric motors.

2.2.6.4 Types of assembly

The Commission Regulation (EU) No 327/2011 introduces two types of fan assembly in scope defined as:

Final assembly means a finished or assembled on-site assembly of a fan that contains all the elements to convert electric energy into fan gas power without the need to add more parts or components

Not final assembly means an assembly of fan parts, consisting of at least the impeller, which needs one or more externally supplied components in order, to be able to convert electric energy into fan power

In case of the *not final assembly*, Commission Regulation (EU) No. 327/2011 provides a calculation method that is used to calculate the fan overall efficiency at the impellers optimum energy efficiency point/best efficiency point. In the simplest case where the impeller is fixed to the motor shaft (direct drive) and there is no VSD, the fan overall energy efficiency is calculated as the fan impeller efficiency multiplied with the nominal motor efficiency (η_m). The motor efficiency is determined in accordance with Commission Regulation (EC) No 640/2009 or by other methods specified in Commission Regulation (EU) No 327/2011. In case of more complex fan drive systems all other components must be taken into account as well. The standard prEN 17166:2017 provides a graphical chart to guide the user through the calculations.

2.2.6.5 Series produced >< purpose-designed

Fans can be series-produced or purpose-designed. Series-produced fans are not defined specifically in Commission Regulation (EU) No 327/2011, but is according to standard ISO 13348 [11] defined as:

Fan whose detailed performances is widely available in a catalogue (electronic or printed), and which is frequently manufactured in significant quantities and available on short delivery

Opposite to this definition is purpose-designed fans to suit a specific purpose. If industrial fans are series-produced, this does not necessarily mean they are produced to stock. They can be produced on order just as the purpose-designed fans are.

In terms of the fan sizes, purpose-designed fans are produced in the whole range subject to INTAS: 10-500 kW (large and extra-large), where series-produced fans are more likely for the range 10-100 kW (large).

2.3 Documentation inspection

The document inspection is described in detail in Annex A and B including a checklist template.

2.3.1 Ecodesign Directive (2009/125/EC) requirements

The Annex IV to the directive states the following:

1. This Annex describes the procedure whereby the manufacturer or its authorised representative who carries out the obligations laid down in point 2 ensures and declares that the product satisfies the relevant requirements of the applicable implementing measure. The EC declaration of conformity may cover one or more products and must be kept by the manufacturer.

2. A technical documentation file making possible an assessment of the conformity of the product with the requirements of the applicable implementing measure must be compiled by the manufacturer.

The documentation must contain, in particular:

(a) a general description of the product and of its intended use;

(b) the results of relevant environmental assessment studies carried out by the manufacturer, and/or references to environmental assessment literature or case studies, which are used by the manufacturer in evaluating, documenting and determining product design solutions;

(c) the ecological profile, where required by the implementing measure;

(d) elements of the product design specification relating to environmental design aspects of the product;

(e) a list of the appropriate standards referred to in Article 10, applied in full or in part, and a description of the solutions adopted to meet the requirements of the applicable implementing measure where the standards referred to in Article 10 have not been applied or where those standards do not cover entirely the requirements of the applicable implementing measure;

(f) a copy of the information concerning the environmental design aspects of the product provided in accordance with the requirements specified in Annex I, Part 2; and

(g) the results of measurements on the ecodesign requirements carried out, including details of the conformity of these measurements as compared with the ecodesign requirements set out in the applicable implementing measure.

3. The manufacturer must take all measures necessary to ensure that the product is manufactured in compliance with the design specifications referred to in point 2 and with the requirements of the measure which apply to it.

Further, the following applies for manufacturers:

- *The assessment of the products conformity shall be carried out before placing a product covered by implementing measures on the market and/or putting such a product into service*
- *Documentation must be available for inspection by Member States for a period of 10 years after the last of that product has been manufactured.*
- *Documentation shall be made available within 10 days of receipt of a request by the competent authority of a Member State.*

It is important as part of the awareness creation (Section 2.1.1) to introduce these basic requirements to manufacturer/ and importers as well.

2.3.2 Commission Regulation (EU) No 327/2011 requirements

The points 3 and 4 of Annex I to the regulation state the following:

2.3.2.1 Product information requirements (Point 3, Annex I)

The product information requirements on fans and how they must be displayed are as set out in Annex I, Section 3. These requirements shall apply from 1 January 2013.

This includes a list of 14 points (points 2(1) to 2 (14) to be displayed.

2.3.2.2 Technical documentation (Point 4, Annex I)

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.

Considering having a list of 14 points it is important the information comes in the right order to facilitate the work of the MSA.

2.3.3 Minimum content of the documentation

The manufacturer, or the representative office in each country as intermediary, could be requested to send the MSAs responsible for Commission Regulation (EU) No 327/2011 the following documentation:

2.3.3.1 Technical file

According point 2 of Annex IV to Ecodesign Directive (see section 2.3.1 of this report) the manufacturer must compile a technical documentation file. In general, the technical file includes the following documents:

2.3.3.2 EC conformity declaration

EC declaration of conformity of the manufacturer or his authorised representative established within the EU according Annex VI to Directive 2009/125/EC

It is important to stress that existing EC declaration of conformity e.g. in relation to the Machinery Directive is not sufficient. EC declaration of conformity must also be made according to the Ecodesign provisions of Annex VI to Directive 2009/125/EC.

2.3.3.3 Test report

The test report should contain the measured values used for the determination of the rated values, according to point 2.g of Annex IV to Directive 2009/125/EC (see section 2.3.1 of this report)

2.3.3.4 Calculations

Commission Regulation (EU) No 327/2011 is more than 7 years old and do not like more recent Ecodesign regulations include provisions on the specific documentation of calculations and extrapolations. However, this documentation is important in cases where the technical documentation is not solely based on tests.

2.3.3.5 Rating plate

According to point 3 of Annex I to Commission Regulation (EU) No 327/2011, some product information shall be included in the rating plate.

2.3.3.6 Free access website address

According to point 3 of Annex I of Commission Regulation (EU) No 327/2011, some product information shall be included in free access websites of manufacturers.

2.3.4 Commission Regulation (EC) No 640/2009 requirements

In case, the electric motor, which is part of the fan, is covered by Commission Regulation (EC) No 640/2009 requirements, the following applies:

2.3.4.1 Product information requirements (Point 2, Annex I)

The product information requirements on motors are as set out in Annex I. From 16 June 2011, the information on motors shall be visibly displayed.

This includes a list of 12 points to be displayed at further specified media.

2.3.4.2 Technical documentation (Point 2, Annex I)

As regards to the technical documentation, the information must be provided in the order as presented in points 1 to 12. 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.

Considering having a list of 12 points it is important the information comes in the right order to facilitate the work of the MSA.

2.3.5 Checklist for documentation inspection according to Commission Regulation (EU) No 327/2011 and Commission Regulation (EC) No 640/2009

Taking into account, all the above, a checklist has been developed and is included in Appendix B. It contains the following sections:

2.3.5.1 Identify fan type

In order to check the overall efficiency and the measurement category used to determine the energy efficiency, it is necessary to identify the fan type.

2.3.5.2 Check if the fan is exempted

Before selecting a fan, it is important to study if the fan is exempted.

2.3.5.3 Check if the fan is only subject to product information

Before searching for energy efficiency requirements of a fan, it is important to study if the fan is only subject to product information.

2.3.5.4 Check the fan product information/technical information

If a fan is covered by the regulation, the fan product information/technical information has to be studied to see if it meets the requirements.

2.3.5.5 Check the fan rating plate/product label information

If a fan is covered by the regulation, the fan rating plate/product label information has to be studied to see if it meets the requirements.

2.3.5.6 Identify the electric motor type

In order to check the efficiency it is necessary to identify the motor type.

2.3.5.7 Check if the electric motor is exempted

Before selecting a motor, it is important to study if the motor is exempted.

2.3.5.8 Check the electric motor product information/technical information

If a motor is covered by the regulation, the motor product information/technical information has to be studied to see if it meets the requirements.

2.3.5.9 Check the electric motor rating plate/product label information

If a motor is covered by the regulation, the motor rating plate/product label information has to be studied to see if it meets the requirements.

2.3.5.10 Do the documentation values comply with energy efficiency requirements?

The previous sections are designed to check if the product documentation and the technical file contain all the requested information but this section is intended to check if those values are valid according to the regulation energy efficiency requirements.

Annex III to Commission Regulation (EU) No 327/2011 and Commission Regulation (EC) No 640/2014 are amended in accordance with respectively Annex X and IV to Commission Regulation (EU) No 2016/2282 that states:

"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 or importer than the results of the corresponding measurements carried out pursuant to paragraph (g) thereof; and

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

2.3.6 Fan design and selection software

Design of fans is generally based on the fan laws:

1. Flow varies as speed (rpm)
2. Pressure varies as speed (rpm) to the second power
3. Impeller power varies as speed (rpm) to the third power

Similarity of design makes it possible to scale up a design of impeller and housing for a smaller fan to a larger. It is common for manufacturers to have a fan selection software where the fan performance is calculated based on these laws. By changing impeller diameter, width of impeller wheel, angles of blades etc. the manufacturer can design the fan that suits the customer's requirements best.

The fan selection software is by some manufacturers made directly available for the customers. In this case, its function is equivalent to a catalogue and the customer may be able to order a specific fan based on the selection software. In other cases, the manufacturer is providing the service to design and select the fan for the customer, and the software is not directly available. This may be the case both for series-produced and purpose-designed fans.

2.3.6.1 Documentation of calculations

The use of a design and selection software also means that the performance characteristics of large and extra-large fans to a wide extent are calculated rather than measured/tested. Though, as part of the documentation of the selection software, the manufacturer may have test results available which have been conducted by the manufacturer or by an independent party.

In case of documentation of the fan drive system efficiency, the manufacturer typically relies on data of the electric motor manufacturer or other manufacturers of fan drive system components. This documentation must be available as well if relevant for the specific fan.

2.3.6.2 Datasheet

The fan selection software will typically generate a datasheet with all information relevant for the customer of the specific fan (including fan curves, sound figures, etc.). The datasheet may include data for different operational points requested by the customer and does not necessarily include the best efficiency point. Furthermore, the datasheet may not present the overall efficiency of the fan, but rather the fan impeller efficiency.

2.3.6.3 Declared values

The calculation of declared values and the product information requirements according to Commission Regulation No (EU) 327/2011 have typically been integrated or put on top of the existing fan selection software. It is relevant to ask for documentation of the additional calculation procedures related to the declared values.

2.4 Testing

The testing options will mainly incorporate the issues related to testing of large industrial fans. However, where relevant, also considerations about the testing of fan drive systems will be included.

2.4.1 Fan characteristics

In order to find an applicable test facility there are a few important parameters that must be clarified for the product in question. Appendix A presents the background for identifying and categorizing fans.

2.4.1.1 The physical characteristics

For the practical handling of the fan, the total weight and main dimensions must be identified. Typically, information on weight is divided in two:

- Fan weight without motor [kg]
- Motor weight [kg]

Weight will be available in datasheets and on nameplates of the respective products. Total weight combined with impeller diameter will typically be enough for laboratories or logistics providers to evaluate if there are any handling constraints.

Laboratories may also need dimensions and form of fan inlet/outlet (rectangular/circular).

2.4.1.2 Measuring category and efficiency category

The measuring category (A, B, C, D) which is part of the product information requirements, is an important information for the laboratory as this defines which test rig and standardised airways are to be used. The

laboratory may provide testing according to all four measuring categories, but not necessarily for all sizes of fans.

The measuring categories are defining what efficiency category is used: 'static' or 'total'.

2.4.1.3 Optimum/best efficiency point (BEP) and nominal power

The best efficiency point (BEP) or the optimum energy efficiency point of a fan - both terms used equally - is defined by:

- Air volume flow rate [m³/s] or [m³/h]
- Pressure [Pa]
- Rated motor power input [kW]
- Rotational speed [rpm]

The parameters are relevant for the laboratory to assess if they have the capacity to test the specific product. They are all included in the product information, which the fan supplier must specify.

2.4.2 Standards

There are no EU-harmonised standards yet for measuring energy efficiency of fans and no transitional methods specified by the European Commission. However, internationally widely accepted test standards exist:

- **EN ISO 5801:2017** ***Fans – Performance testing using standardized airways [9]***
- **EN ISO 5802:2009** ***Industrial fans – Performance testing in situ [10]***

In addition, based on a mandate from the European Commission, a candidate EU-harmonised standard is available in a draft version:

- **prEN 17166:2017** ***Fans – Procedures and methods to determine the energy efficiency for the electrical input power range of 125 W up to 500 kW***

This standard refers to the test standards EN ISO 5801 and EN ISO 5802. In case of scale testing/scaling the standard referred to is:

- **ISO 13348:2007** ***Industrial fans - Tolerances, methods of conversion and technical data presentation***

Other notable standards are:

- **EN ISO 13349:2010** ***Fans - Vocabulary and definitions of categories***

- **EN ISO 12759:2015** ***Fans - Efficiency classification for fans***
- **EN ISO 13350** ***Fans – Performance testing of jet fans***

2.4.3 Significant elements

In order to be able to test the fan correctly, the manufacturer must specify the exact boundary of the fan for which the values are declared. This boundary encompasses all significant elements that affect the conversion of power into air volume flow rate and pressure. Examples of fan boundaries and significant elements are described in more details in prEN 17166:2017.

The manufacturer shall provide a complete description of the fan boundary and the significant elements as part of product information and/or the technical documentation file.

MSAs must make sure that the fan to be tested is delivered with all significant elements and that they correspond to the complete description in the technical documentation file.

2.4.4 Testing options

The standard prEN 17166:2017 specifies different testing options. Most of these require standardised airways as specified in EN ISO 5801:2017. Standardised airways are designed according to the fan sizes. Thus, in order to cover a full product range as well as different measuring categories, various standardised airways are required.

2.4.4.1 Full size, real speed testing on a standardized airway

If a suitable standardized airway exists, the fan efficiency is tested straight ahead at declared speed, in best efficiency point and in accordance with EN ISO 5801.

Pros:
- The unit of the model to be verified is the real size fan (in accordance with Commission Regulation (EU) No 2016/2282, Annex X [8])
- The real size fan is tested at declared conditions.

Cons:
- In case of larger and very large fans, standardised airways and measuring equipment may not be available due to their high costs and space requirements.

2.4.4.2 Full size testing, at modified speed, on a standardized airway

When a suitable standardized test airway is not available, the real size fan can be tested at a speed being different from the declared one. In this case, the fan drive system efficiency must be determined separately. The fan impeller efficiency is then calculated at real speed. Multiplied with the fan drive system efficiency at real speed, the overall fan energy efficiency is determined.

Pros:

- Can be used to avoid exceeding the maximum capacity of the standardized airway available
- Can be used to avoid exceeding the maximum electric power capacity of the testing laboratory
- The unit of the model to be verified is the real size fan (in accordance with Commission Regulation (EU) No 2016/2282, Annex X [8])

Cons:

- Is typically only applicable down to a certain reduced speed e.g. 70% and thus, does not solve all problems as it still requires a standardized airway accordingly suitable.
- Requires the determination of the fan drive system efficiency at full speed by other means.

2.4.4.3 Scaled model/sub-scale testing on a standardised airway

Scaled model or sub-scale model testing is a method to determine the performance of a larger fan based on the testing of a geometrically similar smaller fan. It is applicable, when there is no suitable standardised airway available for the larger fan. The smaller fan is tested on a suitable standardised test rig, in the best efficiency point and in accordance with EN ISO 5801 and EN ISO 13348. When performance is scaled, it will usually be the fan impeller efficiency that is scaled. When the overall energy efficiency of the larger fan is calculated, it must use the fan drive system efficiency of the larger fan. It is important that an assessment of the geometrical similarity of the smaller and larger fan is made.

Pros:

- A scaled fan can be tested by an independent accredited laboratory as it can be selected to fit to the capacity of such laboratories (see section 2.4.5.1).
- Can be cheaper than testing the real size fan
- A smaller fan is easier to handle and transport which keeps the costs down.
- If acquisition is required, the scaled fan is affordable compared to a larger fan

Cons:

- It requires some extra time to specify, and later on check that the smaller fan design is geometrically similar to the larger fan design.
- The delivery time of an order-made smaller/scaled fan may be 4-6 weeks or even longer.
- In case the scaled fan does not comply with the minimum requirements of the regulation (or is close to not complying), there may be situations, where the tolerances of the calculations cannot justify the decision to reject the larger fan as non-compliant if such an approach is taken.

2.4.4.4 Full-size testing, on site.

When a suitable standardized test airway is not available, and the other testing methods presented cannot be used or the product has already been put into service, the only option may be to test on site. The test is carried out with the provisions of EN ISO 5802.

Pros:

- Can be the only testing option available
- Certainty about the product has been placed on the market and/or put into service
- No delays in delivery of the fan to the customer related to testing

Cons:

- Difficult technical aspects of testing on-site compared to testing on standardised airways

- From an MSA perspective there will be a number of critical issues on on-site testing concerning e.g. legal aspects that goes beyond the uncertainty of the measurements:
    - Lack of corrective actions when first the customer's investment is made, and the product is installed
    - Problems related to getting access to the site
    - Covering economical losses related to interruption of production

2.4.4.5 Fan drive system testing synergies

The asynchronous motor of a fan is part of the *extended product* with its own Ecodesign requirements according to Commission Regulation (EU) No 640/2009. This means, that for fans selected for testing, there may be some synergies by checking or testing at the same time the requirements of the fan.

Pros:

- Documentation check or nameplate inspection can easily be done alongside similar checks of the fan
- In case of converting from overall fan efficiency to fan impeller efficiency, for instance when using the scaling or reduced speed approach, the efficiency of the electric motor must be measured anyway

Cons:

- When motors are getting large (up to 375 kW), some of the same challenges on testing facilities as seen for other large products will be there as well

2.4.5 Selection of laboratory

The selection of a suitable laboratory will depend on the fan characteristics (section 2.4.1) and the testing options (section 2.4.4) including the availability of standardised airways and the electric power capacity. Further, there will be additional conditions e.g. on accreditation issues, practicality and timing that can impact the choice of laboratory.

2.4.5.1 Independent laboratory

There exist a reasonable number of accredited laboratories in Europe capable of testing fans. Many of these are targeting fans used for ventilation of buildings or in machine building, where the majority of products are specified for pressures below 1,000 Pa and electric power input below 10 kW. Fans for industrial application and in scope of the Commission Regulation (EU) No 327/2011 may be specified for pressures beyond 10,000 Pa and electric input power up to 500 kW.

In the INTAS project a survey was made among European accredited laboratories on their testing capabilities in terms of pressure, flow rate, electric power capacity, max weight and impeller diameter among others. Based on a non-exhaustive list of answers and combining the input, the indicative overview table below was established, see Table 1. The table shows for different flow rates and pressures, the indicative electric power input assuming a drive system efficiency of 90%. The likelihood of finding a laboratory of a certain capacity is indicated with different colours. According to the survey and the table, it is unlikely to find independent European accredited test facilities that can handle industrial fans with electric power input above 50-60 kW.

Electric power [kW]	Flow rate [m³/h]					
Pressure [Pa]	5,000	15,000	25,000	35,000	50,000	75,000
2,500	3.9	11.6	19.3	27.0	38.6	57.9
5,000	7.7	23.1	38.6	54.0	77.2	115.7
7,500	11.6	34.7	57.9	81.0	115.7	171.6
10,000	15.4	46.3	77.2	108.0	154.3	231.5

Widely available	Drive system efficiency = 0.9
Available	
Less available	
Unlikely	

Table 1 Indicative likelihood of independent laboratory capacity. The electric power input is shown at different flow rates and pressures.

Pros:

- The use of accredited laboratories supports the requirements on using reliable, accurate and reproducible methods.
- Scaled model/sub-scale testing and/or reduced speed testing may fit to the fan sizes the laboratories are able to handle

Cons:

- The indicative fan sizes that independent laboratories can handle are limited (one tenths of scope range (50 kW/500 kW).

2.4.5.2 Manufacturer laboratory, manufacturer measuring equipment

The landscape of manufacturer test facilities is more diverse ranging from manufacturers having complete facilities covering their full product range (even up to 500 kW) to manufacturers having limited facilities which are mainly used for R&D and thus not necessarily strictly follow the specifications of e.g. EN ISO 5801. Another experience is that the overall fan efficiency cannot always be measured, if the manufacturer focuses on measuring the fan impeller efficiency (mechanically) only.

In case the manufacturer laboratory, including the manufacturer equipment, is to be used for verification test at least the following must be checked:

- Suitable standardised airway available
- Electric power capacity available
- Measuring equipment/calibration certificates/other documentation
- Data acquisition and conversion formulas

Factory acceptance testing (FAT) at manufacturers premisses is not very common in the industrial fan business – at least not for fans in scope of Commission Regulation (EU) No 327/2011. However, for those manufacturers doing FATs on a regular basis, there is the option that the MSA can participate a witness test, where the performance of the fan is demonstrated along with the customer. Alternatively, the witness test can take place just before or after the customers FAT, to avoid any disturbance of the customer relationship with the manufacturer. In this case the MSA and fan manufacturer should agree on the conditions of the test which could be based on commercial practice, e.g. with reference to EN ISO 13348, but with the use of tolerances according to Commission Regulation (EU) No 327/2011. The conditions may also include agreements on the test report content/design which may be based on VDI 2044 [15].

Pros:

- Relatively low costs if conducted along with an ongoing FAT

Cons:

- The use of manufacturer measuring equipment may not support the requirements on using reliable, accurate and reproducible methods.

- Planning of the test can be difficult

2.4.5.3 Manufacturer laboratory, independent laboratory measuring equipment

A variant of the above procedure is testing by independent laboratory using own measuring equipment instead of the manufacturer measuring equipment. Standardised airways, VSDs and other parts of the test rig must still be provided by the manufacturer.

Pros:

- The use of accredited laboratories supports the requirements on using reliable, accurate and reproducible methods.

Cons:

- Higher cost than for the option using manufacturer testing equipment (see section 2.4.5.2).

2.4.5.4 In-situ, independent party measuring equipment

In cases where no other options are available, in-situ testing can be the only way to test a fan. The in-situ testing by independent laboratory using own measuring equipment should be in accordance with EN ISO 5802. The In-situ test may preferably take place in the commissioning phase of the fan.

Pros:

- May be the only option

- The use of independent accredited laboratories supports the requirements on using reliable, accurate and reproducible methods.

Cons:

- Testing method less accurate than when testing on standardised airways
- May not be possible to test the fan in best efficiency point
- In general, difficult to conduct if the fan is already installed and in operation for its dedicated purpose.

2.4.5.5 Selection graphical chart

The selection graphical chart (see

Figure 2-3), shows the combined task of selecting a laboratory and a testing method for a specific fan according to the availability of standardized airways and power capacity.

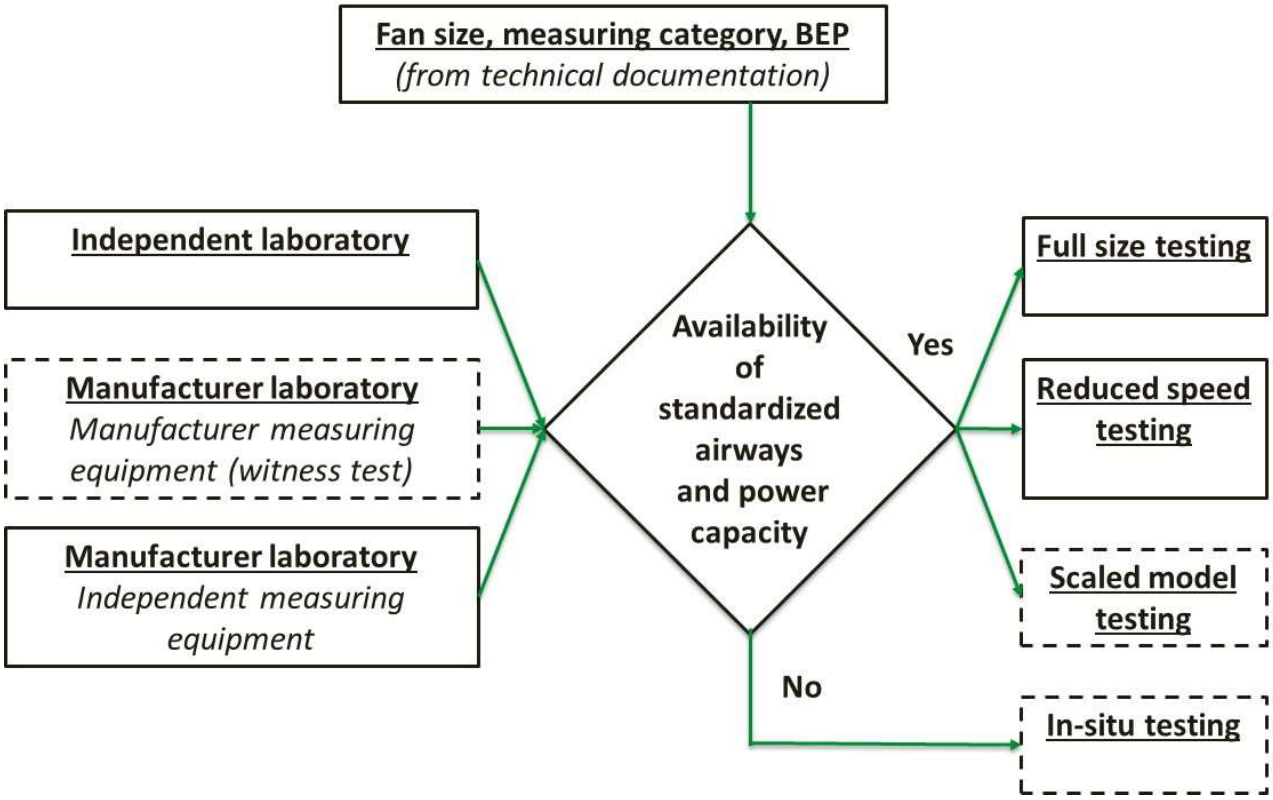

Figure 2-3 Selection graphical chart. Stitched lines indicate options that may be impractical or insufficient within the current market surveillance verification framework, BEP = Best Efficiency Point.

2.4.6 Testing fans that are part of a series

Using the fact that many fans are designed based on geometrical similarity, it can be useful to test a smaller fan which is part of a series of such fans. This fan is selected according to the laboratory facilities available. In this case, the following is obtained:

- The smaller fan of the series is undergoing a verification test itself, full size testing (section 2.4.4.1).
- The test results of the smaller fan are used to scale-up the results to a larger fan of the series (section 2.4.4.3).

This will provide the MSA with results of the scaled fan (normal verification test) and the calculated verification of the larger fan, both performed by independent laboratory. The concept is shown in Figure 2-4.

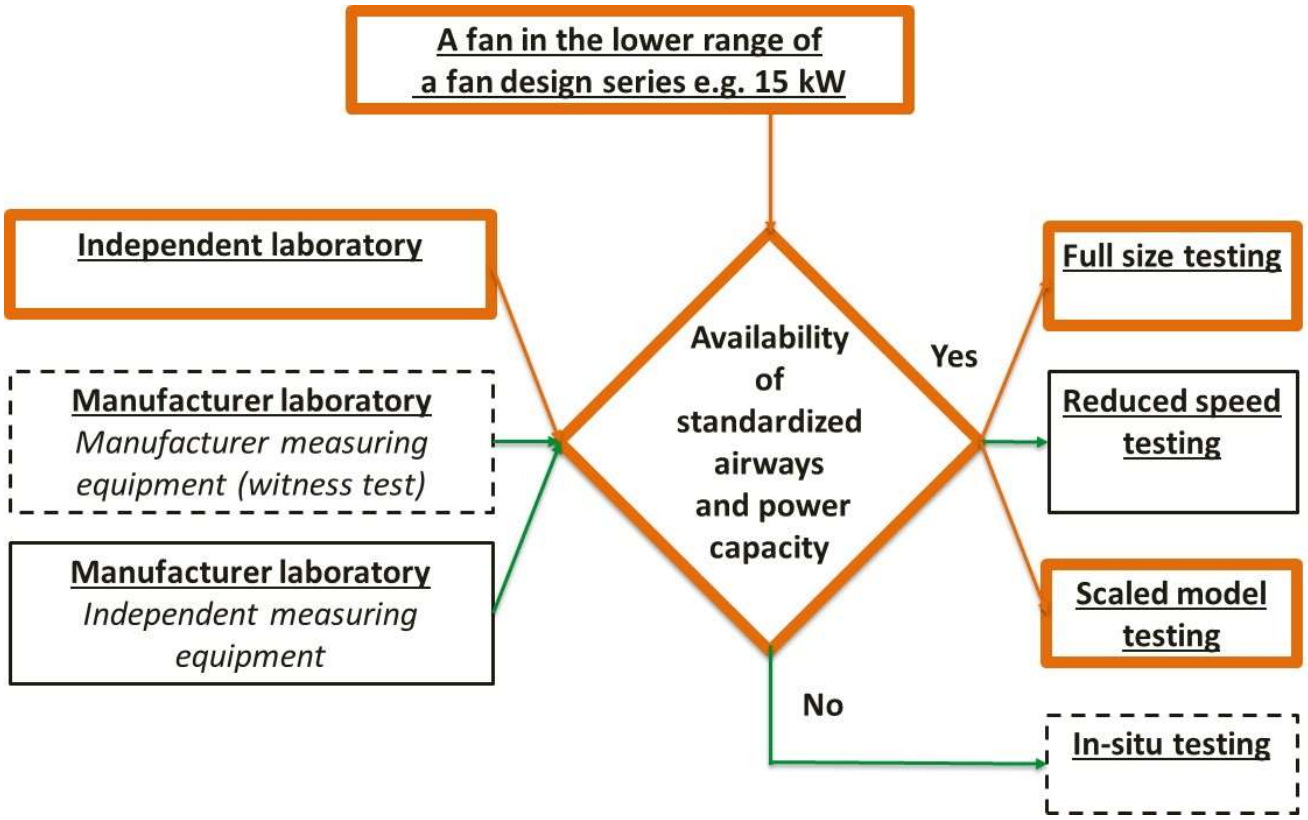

Figure 2-4 Selection graphical chart for the case where a smaller fan of a series is tested. Stitched lines indicate options that may be impractical or insufficient within the current market surveillance verification framework. The highlighted boxes indicate the steps and decisions active when testing a smaller fan of a series.

3. Final flowchart

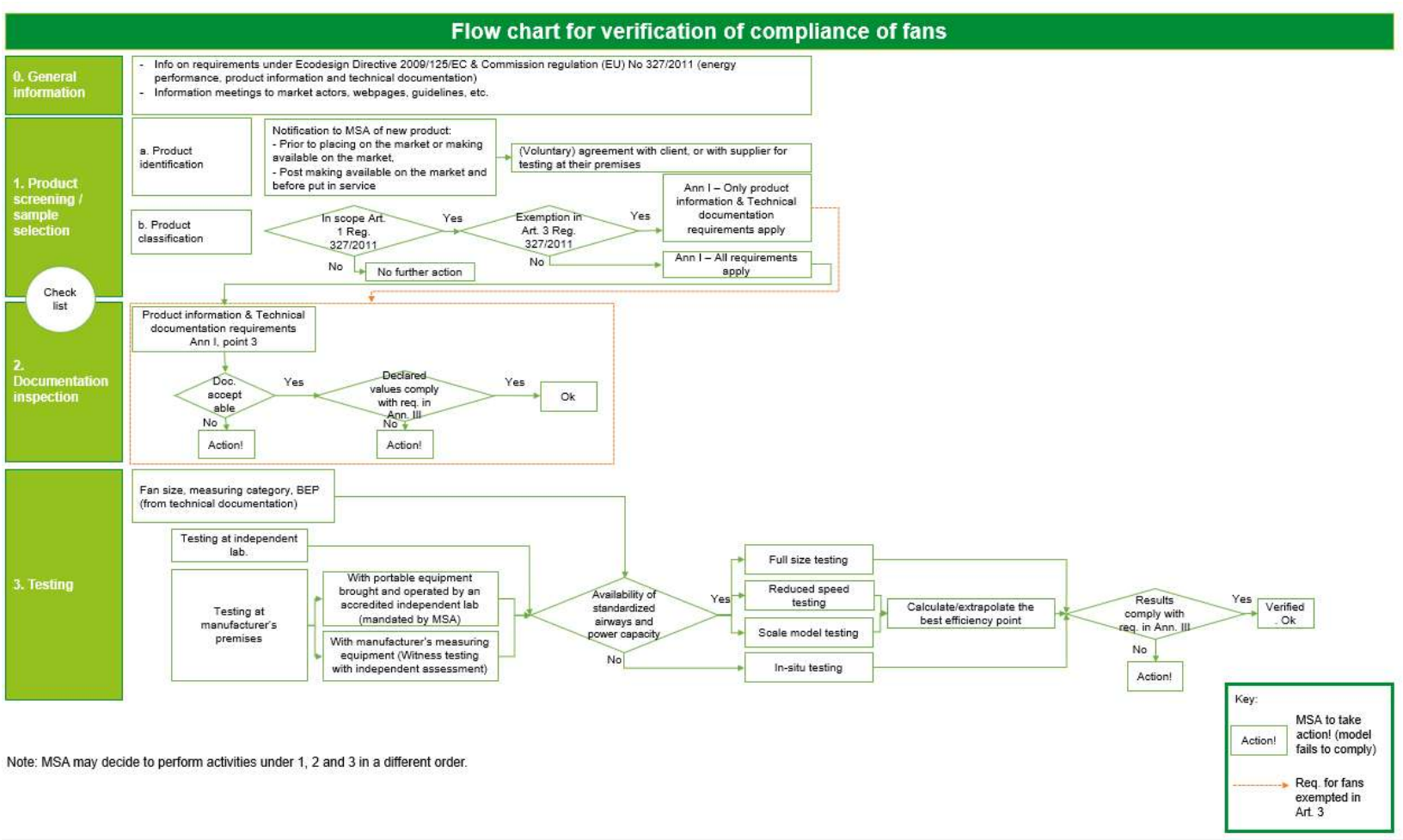

Figure 3-1 Final flowchart of the INTAS methodology

Co-funded by the Horizon 2020 programme
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Appendix A: Identification and categorisation of products

A.1 Knowledge base for identification and categorisation of fans

In order to identify and categorise fans in the scope of Commission Regulation No (EU) 327/2011 the minimum knowledge base for MSAs should be:

1. The fan regulation (Commission Regulation (EU) No 327/2011) [1]
2. Frequently asked questions to Commission Regulation (EU) No 327/2011 document [2]
3. prEN 17166:2017 Fans - Procedures and methods to determine and evaluate the energy efficiency for the electrical power input range of 125 W up to 500 kW, CEN TC156/WG17 [3]
4. Electric motor regulation (Commission Regulation (EC) No 640/2009) [4] and amendment Commission Regulation (EU) No 4/2014 [5]
5. Guidelines accompanying Commission Regulation (EC) No 640/2009 [6]
6. Amendments on verification procedure and tolerances (Commission Regulation (EU) No 2016/2282) [8]
7. The Ecodesign Directive 2009/125/EC [7]

A.2 Commission Regulation (EU) No 327/2011

This regulation establishes ecodesign requirements for the placing on the market or putting into service of fans, including those integrated in other energy-related products as covered by Directive 2009/125/EC. A fan within the scope of this regulation is designed for use with or equipped with an electrical motor having an electrical input power between 125 W and 500 kW (≥ 125 W and ≤ 500 kW) to drive the impeller at its optimum energy efficiency point. The regulation contains specified minimum efficiency grades and labelling and documentation requirements that should apply from 1 January 2013. By 1 January 2015 the minimum energy efficiency requirements were strengthened.

A.3 FAQ to Commission Regulation (EU) No 327/2011

Due to the highly technical nature of the product group and, in consequence, due to the high level of complexity of Commission Regulation No 327/2011 it was deemed necessary to publish a list of "frequently asked questions" for helping all relevant parties transferring the regulation and the requirements into practice

and avoiding open issues in order to facilitate its correct implementation and the achievement of the foreseen energy savings.

The document aims at giving assistance to all actors, including fan industry, installers, original equipment manufacturers (OEMs) and public authorities, for transferring the regulation and requirements into practice.

A.4 prEN 17166:2017 Fans - Procedures and methods to determine and evaluate the energy efficiency

prEN 17166:2017 has been prepared under a mandate M500 given to CEN by the European Commission and the European Free Trade Association (EFTA). In December 2016 the new Work Item (WI) was activated after a vote within the CEN-system. The Work Item will finally lead to a harmonised European Standard. The final standard is expected in 2019, but the pre-standard is already available for purchase.

This harmonised European Standard provides procedures and methods for measuring and/or calculating the energy efficiency and associated characteristics of fans when driven by electric motors.

This is a very essential document which includes explanations, sketches of fan types, drives and fan boundaries, a suggested report format for the technical file documenting compliance etc. The standard has in most aspects incorporated the answers of the previous FAQ.

A.5 Commission Regulation (EC) No 640/2009 and amendment Commission Regulation (EU) No 4/2014

Electric motors are covered by ecodesign requirements according to Commission Regulation (EC) No 640/2009 and Commission Regulation (EU) No 4/2014.

The requirements only apply to electric motors as described in Article 1 and 2 of Commission Regulation (EC) No 640/2009. From July 27, 2014, Article 1 in Regulation (EC) No 640/2009 is replaced by Article 1 in Regulation (EU) No 4/2014.

In case the fan is including an electric motor that falls under Commission Regulation (EC) No 640/2009/ (EU) No 4/2014, the electric motor as a sole product must comply as well.

A.6 Guidelines accompanying Commission Regulation (EC) No 640/2009

The guidelines are intended to be used only for facilitating the implementation of the regulations. They are not intended to replace the regulations or to provide “interpretation” beyond their intent. The guidelines only reflect the opinion of the Commission services and are not legally binding. A finally binding legal interpretation of EU legislation may only be provided by the European Court of Justice. The guidelines are without prejudice to the position the Commission might take should an issue arise in a procedure before the European Court of Justice. The guidelines include a Frequently Asked Questions (FAQ) section.

A.7 Ecodesign Directive 2009/125/EC

The Ecodesign of Energy Related Products Directive 2009/125/EC is the framework directive for both the fan and electric motor regulations. It encompasses rules for setting energy efficiency requirements, but also more specific requirements on conformity assessment such as:

- *The assessment of the products conformity shall be carried out before placing a product covered by implementing measures on the market and/or putting such a product into service*
- *Documentation must be available for inspection by Member States for a period of 10 years after the last of that product has been manufactured.*
- *Documentation shall be made available within 10 days of receipt of a request by the competent authority of a Member State.*

A.8 Commission Regulation (EU) No 2016/2282 amendment with regards to the use of tolerances in verification procedures

Based on the experience of market surveillance authorities' verification of products, the European Commission has issued amendments to various Ecodesign regulations. The main issues of the amendments are:

- *Verification tolerances set out in the implementing measures may only be used by the Member State authorities, for the purpose of verifying compliance*
- *The parameters declared or published by the manufacturer or importer should not be more favourable for the manufacturer or importer than the values contained in the technical documentation*

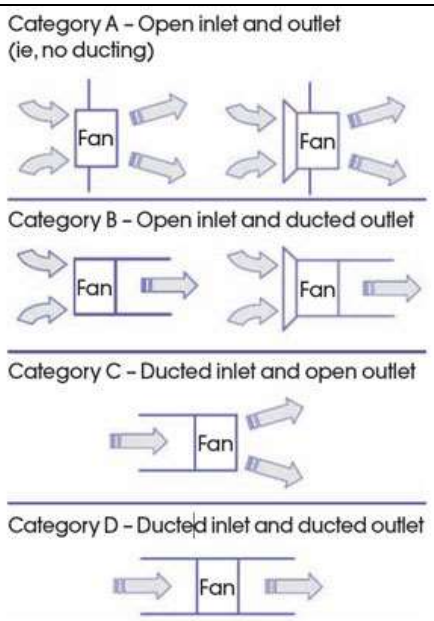
These clarifications also concern Commission Regulation (EU) No 327/2011 and Commission Regulation (EC) No 640/2009 where the complete verification procedures are interchange with the amendments. This is very important to notice.

A.9 Other Characteristics

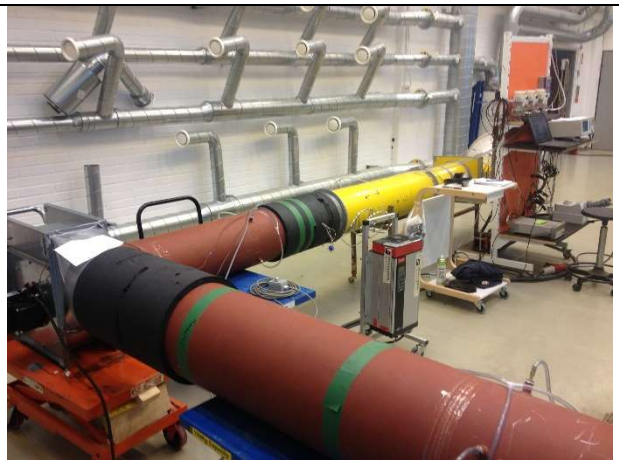
One of the parameters for document inspection is the measurement category.

The methodology for calculating the energy efficiency of a specific fan is based on the ratio of gas power to electrical input power to the motor, where fan gas power is the product of gas volume flow rate and pressure difference across the fan. The pressure is either the static pressure or the total pressure, which is the sum of static and dynamic pressure depending upon the measurement and efficiency category.

Measurement category means a test, measurement or usage arrangement that defines the inlet and outlet conditions of the fan under test. The categories, which are described in the ISO 5801:2017 [9] testing standard for fans, are:

1. Measurement category A means an arrangement where the fan is measured with free inlet and outlet conditions 2. Measurement category B means an arrangement where the fan is measured with free inlet and with a duct fitted to its outlet 3. Measurement category C means an arrangement where the fan is measured with a duct fitted to its inlet and with free outlet conditions 4. Measurement category D means an arrangement where the fan is measured with a duct fitted to its inlet and outlet	

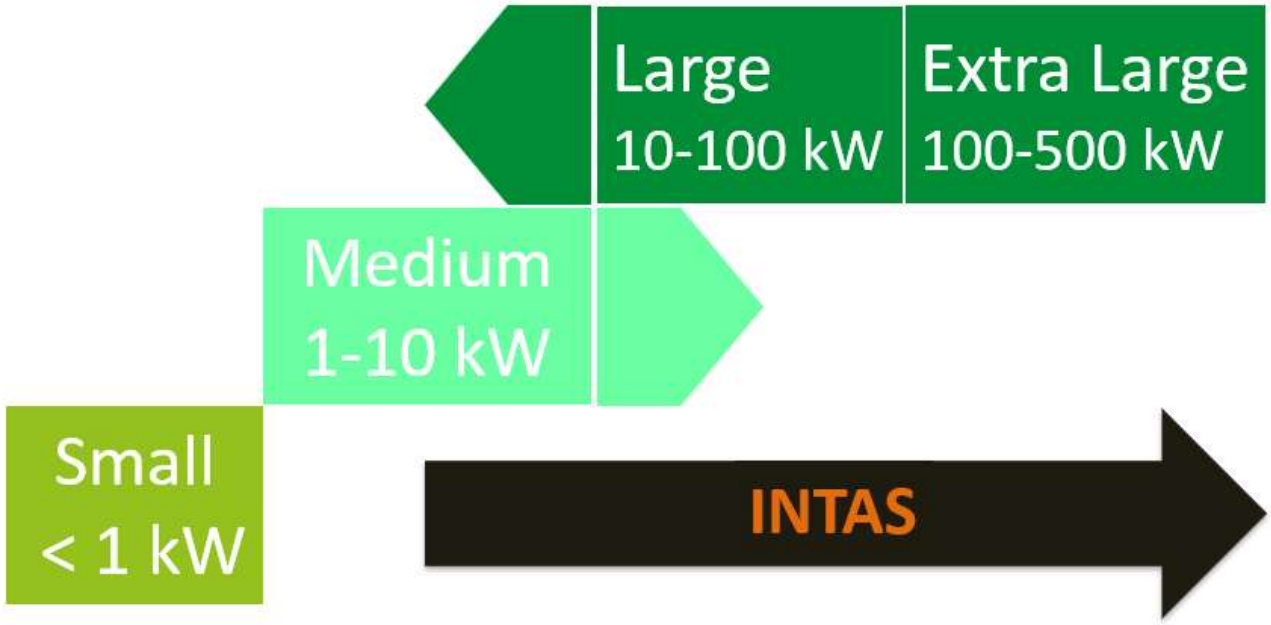
The photos below show test setups for category A and D measurements using standardised airways. The fans on the photos has an input power of less than 10 kW. Accordingly, testing a fan with impeller diameter of e.g. 3 meters will require very large standardized airways.

	
Category A measurement	Category D measurement

A.10 Fan dimensions

Usually large industrial fans are considered to be fans with an input power of 10 kW or more, but in INTAS this limit is not strictly set. A 10 kW fan including electric motor may weigh a few hundred kilograms where a 100 kW fan including electric motor may easily weigh 1.5 tons and equally, a 500 kW fan more than 10 tons.

In general, dimensions (including impeller diameter), weight and drawings of the fans will also be relevant supporting documentation to ask for.



Appendix B: Product information checklist

B.1 Identify fan type

In order to identify the fan type, the standard prEN 17166 Fans - Procedures and methods to determine and evaluate the energy efficiency, Section B.4 can be used. This standard describes the following fans:

1. Axial fan
2. Centrifugal forward curved fan
3. Centrifugal radial bladed fan
4. Centrifugal backward curved fan without housing
5. Centrifugal backward curved fan with housing
6. Mixed flow fan
7. Cross flow fan
8. Jet fan

B.2 Check if fan is exempted

According to Commission Regulation (EU) No 327/2011, Article 1, point 2, a number of exemptions exist.

The Regulation shall not apply to fans integrated in:

- products with a sole electric motor of 3 kW or less where the fan is fixed on the same shaft used for driving the main functionality
- laundry and washer dryers ≤ 3 kW maximum electrical input power
- kitchen hoods < 280 W total maximum electrical input power attributable to the fan(s).

The Regulation shall not apply to fans which are:

(a) designed specifically to operate in potentially explosive atmospheres as defined in Directive 94/9/EC of the European Parliament and of the Council

(b) designed for emergency use only, at short-time duty, with regard to fire safety requirements set out in Council Directive 89/106/EC

(c) designed specifically to operate:

- where operating temperatures of the gas being moved exceed 100 °C
- where operating ambient temperatures for the motor, if located outside the gas stream, driving the fan, exceeds 65 °C
- where the annual average temperature of the gas being moved and/or the operating ambient temperature for the motor, if located outside the gas stream, and lower than – 40 °C
- with a supply voltage > 1 000 V AC or > 1 500 V DC
- in toxic, highly corrosive or flammable environments or in environments with abrasive substances

(d) placed on the market before 1 January 2015 as replacement for identical fans integrated in products which were placed on the market before 1 January 2013; except that the packaging, the product information and the technical documentation must clearly indicate regarding (a), (b) and (c) that the fan shall only be used for the purpose for which it is designed and regarding (d) the product(s) for which it is intended.

B.3 Check if fan is only subject to product information

According to Commission Regulation (EU) No 327/2011, Article 3, point 4, energy efficiency requirements shall not apply for fans which are designed to operate:

- with an optimum energy efficiency at 8 000 rotations per minute or more
- in applications in which the 'specific ratio' is over 1.11
- as conveying fans used for the transport of non-gaseous substances in industrial process applications.

In this case only product information/technical information is required.

B.4 Check fan product information/technical information

According to Commission Regulation (EU) No 327/2011, Annex I, point 3, product information, the technical documentation should display the following information:

1. Overall efficiency (η)
2. Measurement category used to determine the energy efficiency (A – D)
3. Efficiency category (static or total)
4. Efficiency grade at optimum efficiency point
5. Whether the calculation of fan efficiency assumed use of a VSD (variable speed drive/ frequency inverter) and if so, whether the VSD is integrated within the fan or the VSD must be installed with the fan
6. Year of manufacture
7. Manufacturer's name or trade mark, commercial registration number and place of manufacturer
8. Product's model number
9. The rated motor power input(s), flow rate(s) and pressure(s) at optimum energy efficiency
10. Rotations per minute at the optimum energy efficiency point
11. The 'specific ratio'
12. Information relevant for facilitating disassembly, recycling or disposal at end-of-life
13. Information relevant to minimise impact on the environment and ensure optimal life expectancy as regards installation, use and maintenance of the fan
14. Description of additional items used when determining the fan energy efficiency, such as ducts, that are not described in the measurement category and not supplied with the fan

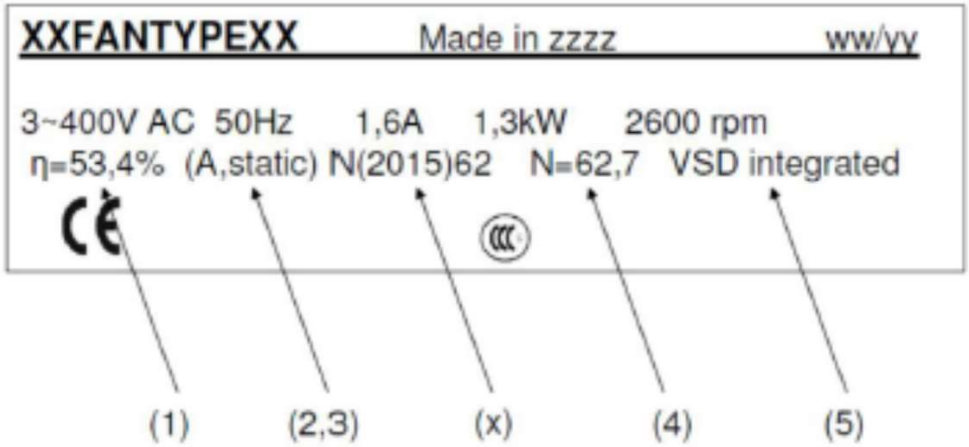
B.5 Check fan rating plate/product label information

According to Annex I, point 4, product information requirements on fans, the data to be show on the rating plate is:

- Overall efficiency (h) rounded to one decimal place.
- Measurement category used to determine the energy efficiency (A – D).
- Efficiency category (static or total).
- Efficiency grade at optimum efficiency point.
- Whether the calculation of fan efficiency assumed use of a VSD and if so, whether the VSD is integrated within the fan or the VSD must be installed with the fan.

An example is shown below where:

- Fan overall efficiency rounded to one decimal place (1)
- Measurement category A, B, C or D (2)
- Efficiency category - static or total (3)
- Efficiency grade at optimum efficiency point related to the fan (not the target efficiency) (4)
- A statement where a VSD (variable speed drive) is integrated or whether it must be fitted to achieve the grade claimed (5)
- (x) is optional – the target efficiency grade for this product and used as comparison to (4)



B.6 Identify electric motor type

According to Commission Regulation (EU) No 640/2009, Article 2, point 1, “motor” means an electric single speed, three-phase 50 Hz or 50/60 Hz, squirrel cage induction motor that:

- has 2 to 6 poles
- has a rated voltage up to 1000 V
- has a rated power output between 0,75 kW and 375 kW
- is rated on the basis of continuous duty operation

The regulation states that motors rated for continuous duty are covered. This means motors are capable of continuous operation at their rated power with a temperature rise within the specified insulation temperature. Apart from motor rated for (S1) continuous operation other duty cycles are to be considered continuous duty: S6 continuous duty with intermittent loads, or S9 continuous duty with non-periodic load and speed variations, or S3 intermittent duty with a continuous duty factor of 80% or more.

B.7 Check if electric motor type is exempted

According to Commission Regulation (EU) No 640/2009, Article 1, point 2, a number of exemptions exist. The exemptions are:

- Motors designed to operate wholly immersed in a liquid
- Motors completely integrated into a product (e.g. pump or fan) where the motor’s energy performance cannot be tested independently from the product
- Motors specifically designed to operate:
    - At altitudes exceeding 4,000 meters
    - Where ambient air temperatures exceed 60°C
    - In maximum operating temperatures above 400°C
    - Where ambient air temperatures are less than –30°C (any motor) or less than 0°C (water-cooled motors)
    - Where the water coolant temperature at the inlet to a product is less than 0°C or exceeds 32°C
    - In potentially explosive atmospheres as defined in Directive 94/9/EC (ATEX)

- Brake motors

However, these motors must still fulfil certain product information requirements.

B.8 Check electric motor product information/technical information

According to Commission Regulation (EU) No 640/2009, Annex I, point 2, product information, the technical documentation should display the following information:

1. nominal efficiency (η) at the full, 75 % and 50 % rated load and voltage (U_N)
2. efficiency level: “IE2” or “IE3”
3. the year of manufacture
4. manufacturer’s name or trade mark, commercial registration number and place of manufacturer
5. product’s model number
6. number of poles of the motor
7. the rated power output(s) or range of rated power output (kW)
8. the rated input frequency(s) of the motor (Hz)
9. the rated voltage(s) or range of rated voltage (V)
10. the rated speed(s) or range of rated speed (rpm)
11. information relevant for disassembly, recycling or disposal at end-of-life
12. information on the range of operating conditions for which the motor is specifically designed:
    - Altitudes above sea-level
    - Ambient air temperatures, including for motors with air cooling
    - Water coolant temperature at the inlet to the product
    - Maximum operating temperature
    - Potentially explosive atmospheres

Exempted motors, see previous section, must still fulfil information requirements regarding point 3-6 and 12.

B.9 Check electric motor rating plate/product label information

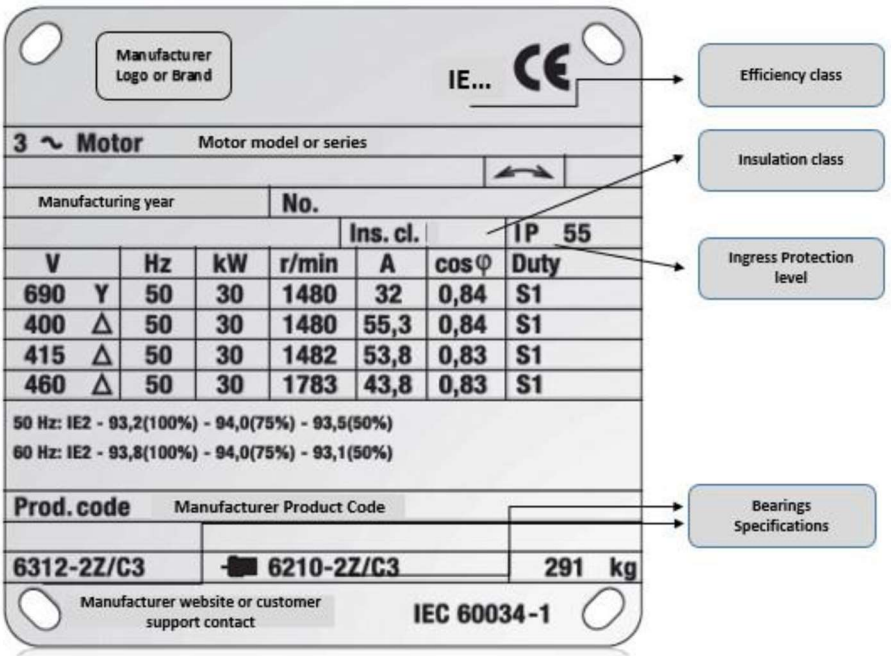
The information referred to in points 1, 2 and 3 (section 3.8 above) shall be durably marked on or near the motors nameplate.

Where the size of the rating plate makes it impossible to mark all the information referred to in point 1, only the nominal efficiency (η) at full rated load and voltage (U_N) shall be marked.

The information listed in points 1 to 12 (section B.8 above) does not need to be published on motor manufacturer's free access website for tailor-made motors with special mechanical and electrical design manufactured on the basis of client request.

Manufacturers also have to provide information in the technical documentation files on any specific precautions that must be taken when motors are assembled, installed, maintained or used with VSDs, including information on how to minimise VSDs electrical and magnetic fields.

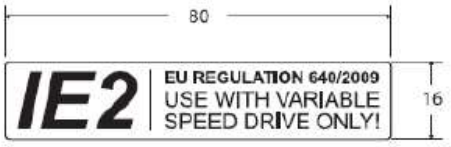
The next figure shows an example of a nameplate.



As it can be noticed the year of manufacture is missing on the nameplate.

Motors, which do not meet the IE3 efficiency level, need to be equipped with a variable speed drive. Information about the obligation of using a VSD shall be visibly displayed on the rating plate or an additional

sticker/plate and on the technical documentation of the motor. Examples of the layout that can be used are shown below.



Dimensions: 80x16mm
Print Color: Black 100%
Label: Transparent

Dimensions: 80x16mm
Print Color: White 100%
Label: Transparent

B.10 Checklist template

Step	Short description	Reference	Check
1. Identify fan type	In order to check the overall efficiency and the measurement category used to determine the energy efficiency it is necessary to identify the fan type	prEN 17166 Fans - Procedures and methods to determine and evaluate the energy efficiency Commission Regulation (EU) No 327/2011 FAQ to Commission Regulation (EU) No 327/2011	
2. Check if the fan is exempted	Before selecting a fan, it is important to study if the fan is exempted	Commission Regulation (EU) No 327/2011 FAQ to Commission Regulation (EU) No 327/2011	
3. Check if the fan is only subject to product information	Before searching for energy efficiency requirements of a fan, it is important to study if the fan is only subject to product information	Commission Regulation (EU) No 327/2011 FAQ to Commission Regulation (EU) No 327/2011	
4. Check the fan product information/technical information	If a fan is covered by the Commission Regulation, the fan product information/technical information has to be studied to see if it meets	Commission Regulation (EU) No 327/2011 FAQ to Commission Regulation (EU) No 327/2011	

	the requirements		
5. Check the fan rating plate/product label information	If a fan is covered by the Commission Regulation, the fan rating plate/product label information has to be studied to see if it meets the requirements	Commission Regulation (EU) No 327/2011 FAQ to Commission Regulation (EU) No 327/2011	
6. Identify the electric motor type	In order to check the efficiency it is necessary to identify the motor type	Commission Regulation (EC) No 640/2009 Guidelines accompanying Commission Regulation (EC) No 640/2009	
7. Check if the electric motor is exempted	Before selecting a motor, it is important to study if the motor is exempted	Commission Regulation (EC) No 640/2009 Guidelines accompanying Commission Regulation (EC) No 640/2009	
8. Check the electric motor product information/technical information	If a motor is covered by the Commission Regulation, the motor product information/technical information has to be studied to see if it meets the requirements	Commission Regulation (EC) No 640/2009 Guidelines accompanying Commission Regulation (EC) No 640/2009	
9. Check the electric motor rating plate/product label information	If a motor is covered by the Commission Regulation, the motor rating plate/product label information has to be studied to see if it meets the requirements	Commission Regulation (EC) No 640/2009 Guidelines accompanying Commission Regulation (EC) No 640/2009	

Abbreviation list

EU	-	European Union
EC	-	European Community
EFTA	-	European Free Trade Association
MSA	-	Market Surveillance Authority
CEN	-	European Committee for Standardization
TC	-	Technical Committee (of CEN)
WG	-	Work Group (of TC of CEN)
NWIP	-	New Work Item Proposal (proposal for new standard to be developed within CEN)
WI	-	Work Item (standard to be developed within CEN)
FAQ	-	Frequently Asked Questions
OEM	-	Original Equipment Manufacturer
VSD	-	Variable Speed Drive
FAT	-	Factory Acceptance Test
EPC	-	Engineering, Procurement and Construction
B2B	-	Business-to-business
EPA	-	Extended product approach
BEP	-	Best Efficiency Point

References

1. Commission Regulation (EU) No 327/2011, *The fan regulation*, European Commission, 30 March 2011
2. Frequently asked questions to Commission Regulation (EU) No 327/2011 document
3. prEN 17166 Fans - Procedures and methods to determine and evaluate the energy efficiency for the electrical power input range of 125 W up to 500 kW, CEN TC156/WG17, Beuth Verlag, October 2017
4. Commission Regulation (EC) No 640/2009, *The electric motor regulation*, European Commission, 22 July 2009
5. Commission Regulation (EU) No 4/2014, Amendment to *the electric motor regulation*, European Commission, 6 January 2014
6. Guidelines accompanying Commission Regulation (EC) No 640/2009, European Commission, December 2014
7. Directive 2009/125/EC, *The ecodesign directive*, European Commission, 21 October 2009
8. Commission Regulation (EU) No 2016/2282, Omnibus amendment with regards to the use of tolerances in verification procedures, European Commission, 30 November 2016
9. EN ISO 5801:2017 *Fans – Performance testing using standardized airways*, CEN, October 2017
10. EN ISO 5802: 2009 *Industrial fans – Performance testing in situ*
11. ISO 13348:2007 *Industrial fans - Tolerances, methods of conversion and technical data presentation*
12. EN ISO 13349:2010 *Fans - Vocabulary and definitions of categories*
13. EN ISO 12759:2015 *Fans - Efficiency classification for fans*
14. EN ISO 13350 *Fans – Performance testing of jet fans*
15. VDI 2044 *Acceptance and performance tests on fans* (VDI code of practice for fans), 2002
16. EC 61800-9-1:2017 Adjustable speed electrical power drive systems - Part 9-1: Ecodesign for power drive systems, motor starters, power electronics and their driven applications - General requirements for setting energy efficiency standards for power driven equipment using the extended product approach (EPA) and semi analytic model (SAM)

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More information
about the INTAS project activities
and all of its results
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www.INTAS-testing.eu

Contact to the project coordinator:
Ingrid Weiss
Ingrid.Weiss@wip-munich.de

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