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Fans — Efficiency classification for fans —

Part 5:
Jet fans

Ventilateurs — Classification du rendement des ventilateurs —

Partie 5: Ventilateurs accélérateurs

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 117, *Fans*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 156, *Ventilation for buildings*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 12759 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The last decade has seen both an escalation in the price and an increasing recognition of the finite life of many of the fossil fuels currently used. There is also a belief by many that climatic change is due to increasing levels of carbon dioxide in the atmosphere. This has led to many nations reviewing methods of energy generation and usage.

To maintain economic growth there is therefore a need to promote energy efficiency. This requires better selection of equipment by users and thus better design of this equipment by its manufacturers.

Fans of all types are used for ventilation and air conditioning, for process engineering (drying, pneumatic conveying and combustion air supply) and agriculture. Indeed, the energy use of fans has been calculated as nearly 20 % of total worldwide energy usage.

The fan industry is of a global nature, with a considerable degree of exporting and licensing. To ensure that the defining fan performance characteristics are common throughout the world, a series of International Standards has been developed. It is the belief of the industry that there is now a need for minimum efficiency standards to be recognized. To encourage their implementation, a classification system is proposed which incorporates a series of efficiency bands. With improvements in technology and manufacturing processes, the minimum efficiency levels can be reviewed and increased over time.

This document is specific to jet fans whose efficiency ratings are based on thrust.

The ISO 12759 series describes a number of different procedures to classify the efficiency of a fan or to apply a minimum efficiency limit (MEL). These procedures are described in:

— ISO 12759-3;

— ISO 12759-4;

— this document (ISO 12759-5);

— ISO 12759-6.

There is no method described to compare these classifications and MELs.

NOTE In this document “air” is the abbreviated term for “air and other gases”.

Fans — Efficiency classification for fans —

Part 5:
Jet fans

1 Scope

This document establishes a classification of fan efficiency for all jet fan types driven by motors with an electrical input power range from 5,5 kW to 155 kW (and this is likely to be in the size range 500 mm to 1600 mm diameter with motors rated between 5,5 kW and 150 kW from IEC 60034-34-1).

This document is not applicable to jet fans for use in enclosed car parks.

This document can be used by legislators or regulatory bodies for defining future energy saving targets.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1 Fans

3.1.1
fan
rotary bladed machine which receives mechanical energy and utilizes it by means of one or more impellers fitted with blades to maintain a continuous flow of air or other gas passing through it and whose work per unit mass does not normally exceed 25 kJ/kg

Note 1 to entry: Fans are defined according to their installation configuration, function, fluid path and operating conditions.

[SOURCE: ISO 13349:2010, 3.1.1. modified — Notes 1 and 3 to entry deleted.]

3.1.2
jet fan
fan used for producing a jet of air in a space and not connected to any ducting

Note 1 to entry: It is type E category or configuration. Performance shall only be expressed as thrust and efficiency is determined from thrust measurement or calculation. Performance characteristics relating to pressure development are not compliant.

3.1.3
drive
<transmission and motor or control system> device used to power the fan, including motor, mechanical transmission and motor or control system

Note 1 to entry: Examples of a motor or control system are variable frequency controller and electronic commutator.

3.2 Calculations

3.2.1
mass flow rate
q_m
mean value, over time, of the mass of air which passes through the specified airway cross-section per unit of time

3.2.2
volume flow
q_v(T)
mass flow rate at the inlet divided by the corresponding mean value, over time, of the average density at the inlet

3.2.3
fan work per unit mass
W_m
increase in mechanical energy per unit mass of fluid passing through the fan

3.2.4
fan air power
P_u
conventional power output at standard conditions; in the particular case of a jet fan, product of inlet volume flow and fan dynamic pressure

3.2.5
fan shaft power
P_a
mechanical power supplied to the fan shaft

3.2.6
motor output power
P_o
shaft power output of the motor or other prime mover

3.2.7
motor input power
P_e
electrical power supplied to the fan's motor

3.3 Fan efficiency

3.3.1
overall efficiency based on thrust
η_e(T)
fan air power divided by the input power for the fan and motor

3.3.2
overall efficiency
η_{ed}
<transmission and motor or control system> fan air power divided by the input power for the fan and motor combination which includes transmission or variable speed controls to take account of all losses within the fan assembly

3.4 Fan efficiency grades

3.4.1
jet fan motor efficiency grade
JFMEG
identifying characteristic of jet fan efficiency

3.4.2
jet fan grade number
JNG
integer of the jet fan motor efficiency grade

4 Fan installation, efficiency and tolerance

4.1 General

Jet fans are specifically designed to create air movement and control by entrainment using a jet. The major criteria of performance is the thrust produced against input power required – and this fundamentally describes the resultant efficiency. The performance standard of jet fans is prescribed in ISO 13350.

4.2 Reference configuration of a jet fan

The reference configuration of a jet fan can be defined as an axial jet fan, complete with a 1× diameter silencer at both inlet and outlet, but with no internal pod in either silencer.

It includes integral inlet devices to optimize performance only such as conical or bell-mouth inlets, but it does not include the addition of accessories such as guards or screens, deflectors or any devices unique to application.

If any appurtenances are included, these shall be clearly recorded.

4.3 Use of installation categories

4.3.1 General

Fan efficiency ratings are frequently specific for each standardized test installation configuration.

If a fan is designed for a single installation configuration, its rated efficiency grade shall refer to that particular test installation configuration and this shall be clearly identified.

The motor input power and motor output power may be measured or determined using the methods given by ISO 13350.

4.3.2 Configuration E installations

The standardized installation configuration used for rating the fan shall be clearly stated.

5 Ratings

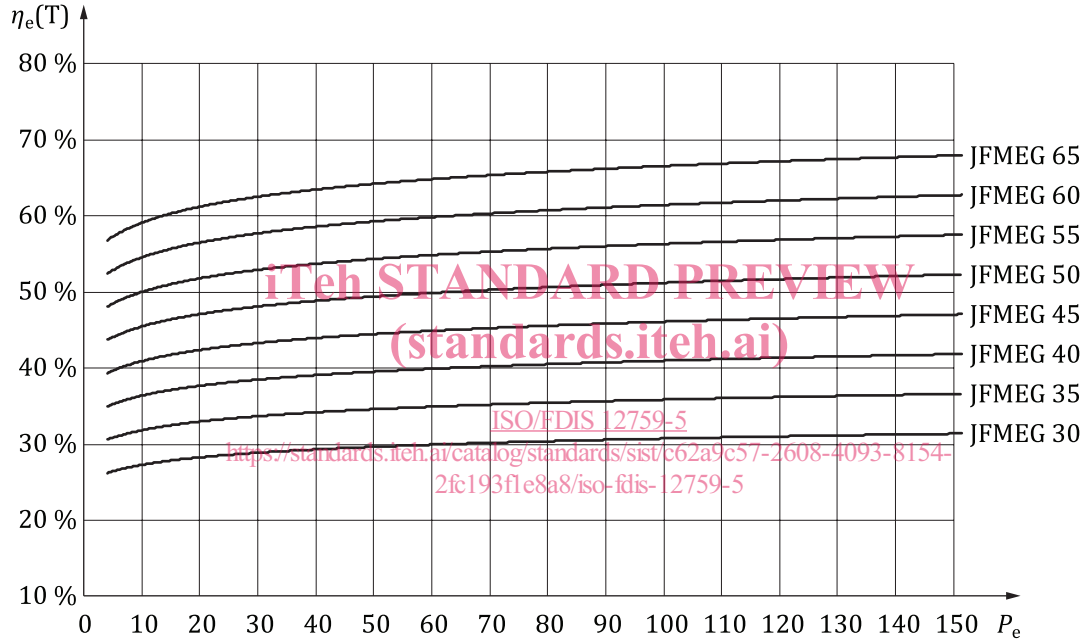
5.1 General

The variation of fan type and drive option leads to efficiency being derived in different ways. For jet fan grading purposes, the efficiency has been defined as a function of the size and the input power.

This clause gives guidance on the optimum efficiency (best efficiency point) levels which are achievable by the fan types addressed in this document. The minimum levels of acceptability are dependent on consultation between regulator and manufacturer's representatives or local legislation, where this exists.

5.2 Jet fans

The efficiency grades for jet fans are shown in Figure 1; the variation of optimum efficiency and JFMEG grade is shown as a function of input power.



Key

P_e motor input power, W

$\eta_e(T)$ overall efficiency based on thrust

Figure 1 — Jet fan motor efficiency grades (JFMEG) for unidirectional jet fans — input power

A fan belongs to a given JFMEG grade (e.g. JFMEG54) if its best efficiency at full speed is equal to or greater than the value calculated according to Annex B.

Jet fans are often used in truly reversible applications where the efficiency is reduced to accommodate equal performance in either direction. In such cases a correction factor is applied as shown in Table 2.

Table 2 — Correction factors for reversible jet fans

Input power kW	Correction factor
5,5 kW < 10 kW	0,88
above 10 kW	0,9

EXAMPLE If a unidirectional, 15 kW input power fan with a JFMEG value of 54 is to be used as a truly reversible option, the resultant JFMEG is 54 × 0,9 = JFMEG49.