
**Fans — Vocabulary and definitions of
categories —**

**Part 1:
Vocabulary**

Ventilateurs — Vocabulaire et définitions des catégories —

Partie 1: Vocabulaire

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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).

This document, along with ISO 13349-2, cancels and replaces ISO 13349:2010, which has been technically revised.

The main changes are as follows:

- document split into two parts: Vocabulary and Categories;
- this document only retains [Clauses 1, 2](#) and [3](#);
- classification of terms in [Clause 3](#) revised;
- positions of the illustrations modified;
- editorial errors corrected.

A list of all parts in the ISO 13349 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

This document reflects the importance of a standardized approach to the terminology of fans.

The need for an International Standard has been evident for some considerable time. To take just one example, the coding of driving arrangements differs from manufacturer to manufacturer. What one currently calls arrangement no. 1 can be known by another as arrangement no. 3. The confusion for the customer is only too apparent. For similar reasons, it is essential to use standardized nomenclature to identify particular parts of a fan.

Wherever possible, in the interests of international comprehension, this document is in agreement with similar documents produced by Eurovent, AMCA, VDMA (Germany), AFNOR (France) and UNI (Italy). They have, however, been built on where the need for amplification was apparent.

Use of this document will lead to greater understanding among all parts of the air-moving industry. This document is intended for use by manufacturers, consultants and contractors.

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Fans — Vocabulary and definitions of categories —

Part 1: Vocabulary

1 Scope

This document defines terms in the field of fans used for all purposes.

It is not applicable to electrical safety.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

— IEC Electropedia: available at <https://www.electropedia.org/>

3.1 General terms and definitions

3.1.1 fan

rotary-bladed machine that 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: The term “fan” is taken to mean the fan as supplied, without any addition to the inlet or outlet, except where such an addition is specified.

Note 2 to entry: Fans are defined according to their installation category, function, fluid path and operating conditions.

Note 3 to entry: If the work per unit mass exceeds a value of 25 kJ/kg, the machine is termed a turbocompressor. This means that, for a mean stagnation density through the fan of $1,2 \text{ kg/m}^3$, the fan pressure does not exceed $1,2 \times 25 \text{ kJ/kg}$, i.e. 30 kPa, and the pressure ratio does not exceed 1,30, since atmospheric pressure is approximately 100 kPa.

3.1.2 non-driven fan

bare shaft fan

fan without motors, drives, attachments or accessories

3.1.3 driven fan

fan driven by an electrical motor

Note 1 to entry: One or more impellers fitted to or connected to a motor with a stationary element, with or without transmission or variable speed drive

3.1.4 stand-alone fan

fan used as a unique entity and not integrated into any other product

Note 1 to entry: The fan can have ducting connected to its inlet and outlet.

3.1.5 standard air

air with a density of 1,2 kg/m³

3.2 Fan installation categories according to the arrangement of ducting

3.2.1 installation category A

installation with free inlet and free outlet with a partition

Note 1 to entry: See [Figure 1](#).

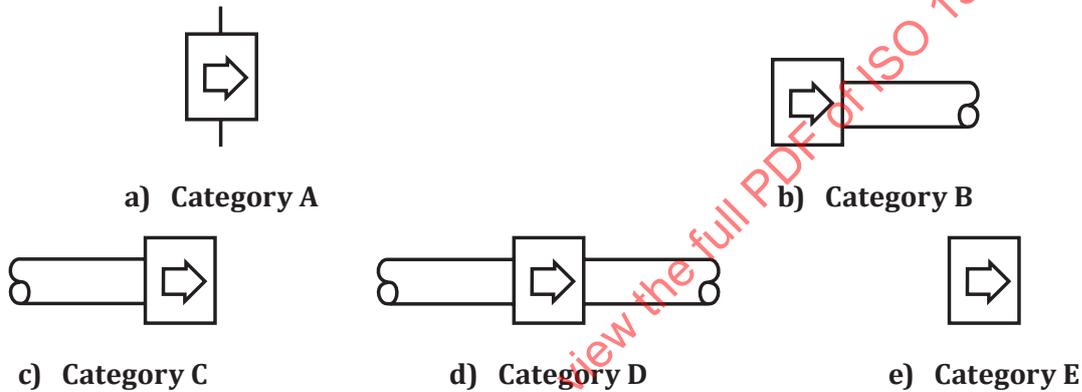


Figure 1 — Installation categories

3.2.2 installation category B

installation with free inlet and ducted outlet

Note 1 to entry: See [Figure 1](#).

3.2.3 installation category C

installation with ducted inlet and free outlet

Note 1 to entry: See [Figure 1](#).

3.2.4 installation category D

installation with ducted inlet and ducted outlet

Note 1 to entry: See [Figure 1](#).

3.2.5 installation category E

installation with free inlet and free outlet without a partition

Note 1 to entry: See [Figure 1](#).

3.3 Classification of fans according to their development and application

3.3.1

custom-designed fan

fan developed and produced for one single application

3.3.2

standardised fan

fan whose detailed performance is widely available in an electronic and/or printed catalogue and which is frequently manufactured in quantity

Note 1 to entry: Sometimes known as a series-produced fan.

3.4 Classification of fans according to their function

3.4.1

ducted fan

fan used for moving air within a duct

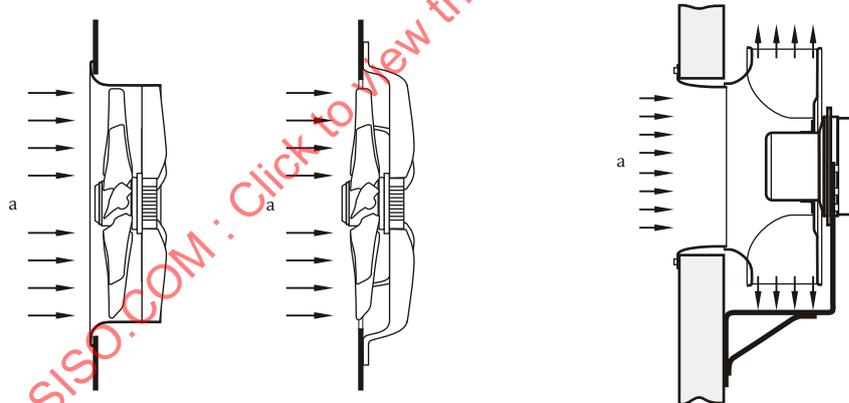
Note 1 to entry: This fan can be arranged in installation category B, C or D.

3.4.2

partition fan

fan used for moving air from one free space to another, separated from the first by a partition having an aperture in which or on which the fan is installed

Note 1 to entry: This fan can be arranged in installation category A (see [Figure 2](#)).



a Flow of air.

Figure 2 — Partition fans

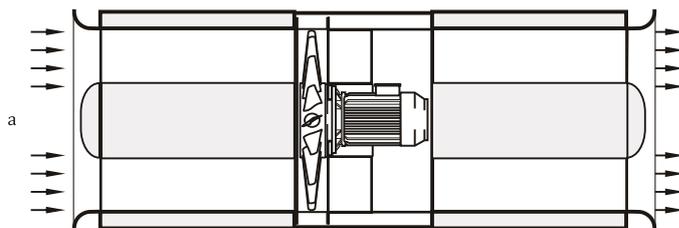
3.4.3

jet fan

fan used for producing a jet of air in a space and unconnected to any ducting

Note 1 to entry: The air jet can be used, for example, for adding momentum to the air within a duct, tunnel or other space, or for intensifying the heat transfer in a determined zone.

Note 2 to entry: See [Figure 3](#).



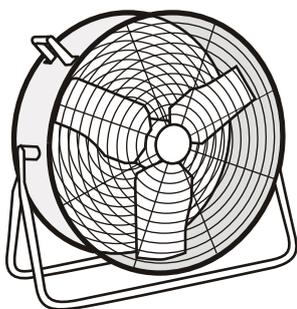
a Flow of air.

Figure 3 — Jet fan

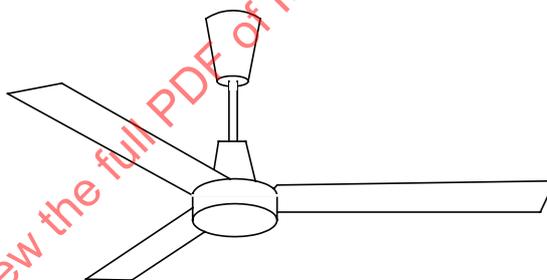
**3.4.4
circulating fan**

fan used for moving air within a space which is unconnected to any ducting in installation category E

Note 1 to entry: See [Figure 4](#).



a) Circulating fan head



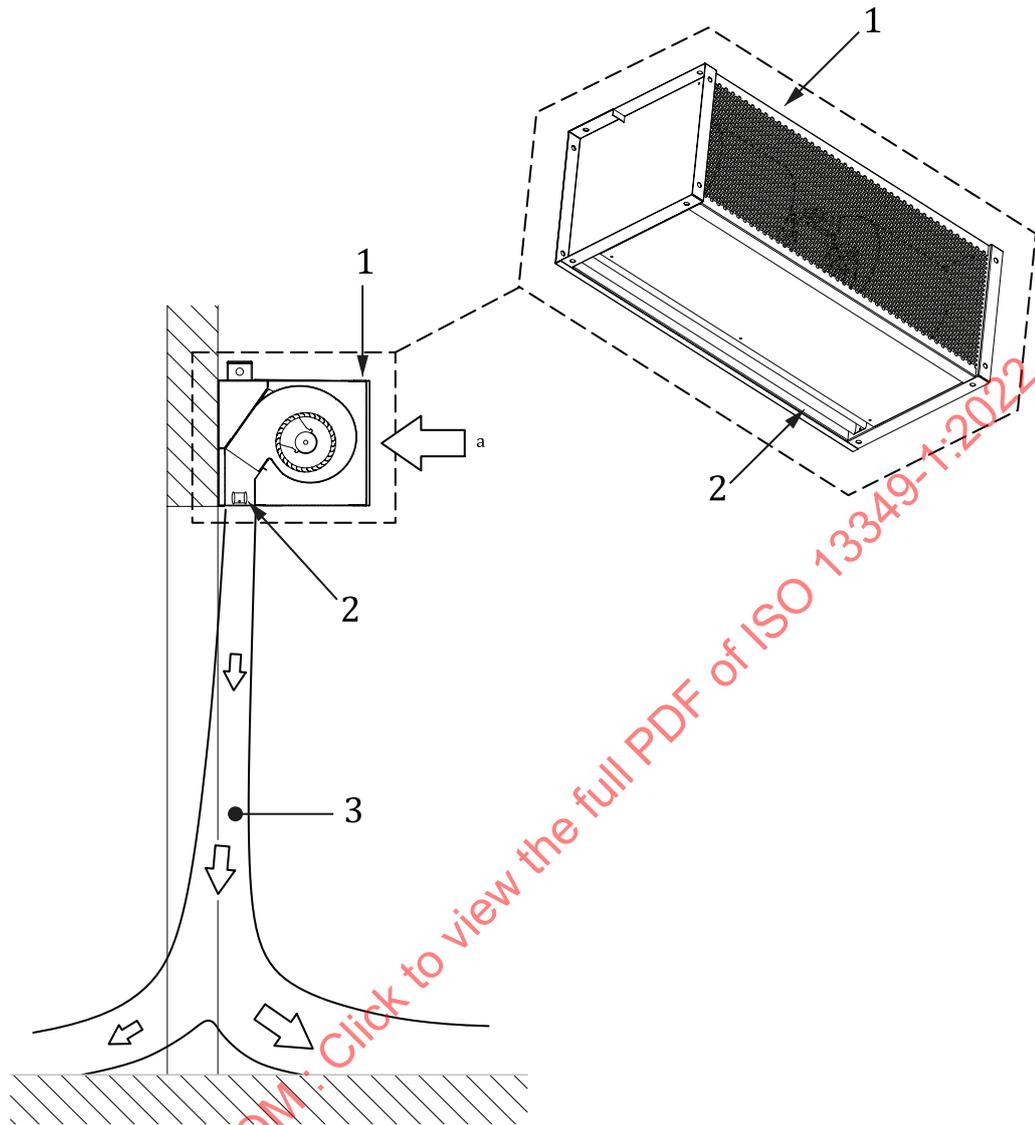
b) Ceiling fan

Figure 4 — Circulating fans

**3.4.5
air curtain unit**

air-moving device which produces an air curtain

Note 1 to entry: See [Figure 5](#).

**Key**

- 1 air curtain unit
- 2 outlet nozzle
- 3 air curtain
- a Flow of air.

Figure 5 — Illustration of an air curtain and air curtain unit

3.4.6**air curtain**

airstream

directionally controlled airstream, moving across the entire height and width of an opening, which can reduce the infiltration or transfer of air from one side of the opening to the other, and inhibits insects, dust or debris from passing through

3.5 Classification of fans according to the fluid path within the impeller

3.5.1

classification of fan type

determination of the type of fan based on the geometry of the impeller and the resulting fluid path through or past the impeller

Note 1 to entry: See [Figure 6](#).

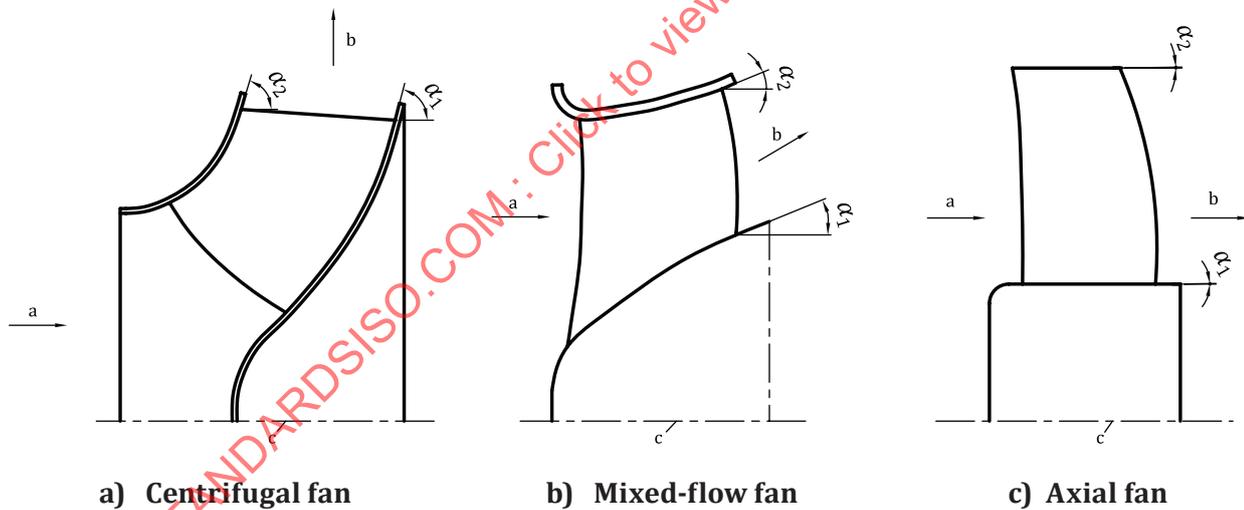
Note 2 to entry: Fan types are identified by the angle α , the average value of the angles α_1 and α_2 (see [Figure 6](#)):

$$\alpha = (\alpha_1 + \alpha_2)/2$$

Note 3 to entry: The angle α_1 is the angle of the tangent at the hub at the intersection of the blade-trailing edge with the hub. The angle α_2 is the angle of the tangent at the shroud or at the outer diameter of the blade at the intersection of the blade-trailing edge with the shroud or with the outer diameter of the blade. If the hub and/or shroud are not axisymmetric, angles α_1 and α_2 are the average values in circumferential direction. The fan types are defined in [Table 1](#).

Table 1 — Fan type defined by the relationship of the blade and the shroud or hub

Fan type	Angle α
Axial fan	$\alpha < 20^\circ$
Mixed-flow fan	$20^\circ \leq \alpha < 70^\circ$
Centrifugal fan	$70^\circ \leq \alpha$



- a Inflow.
- b Outflow.
- c Axis of rotation.

Figure 6 — Differentiation by angles

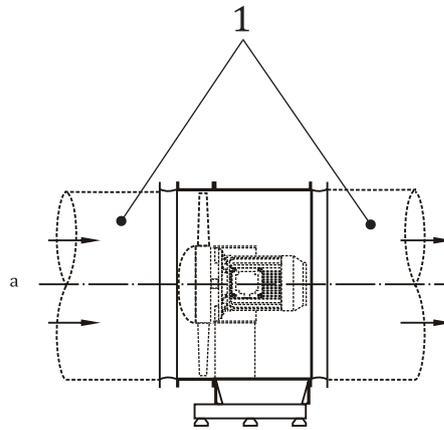
Note 4 to entry: Classification of centrifugal fans includes "centrifugal radial bladed fan" (including radial tip), "centrifugal forward-curved fan" and "centrifugal backward-curved fan" (including backward-inclined and backward-curved aerofoil bladed fans).

3.5.2

axial fan

fan in which the air enters and leaves the impeller along essentially cylindrical surfaces coaxial with the fan

Note 1 to entry: See [Figure 7](#).

**Key**

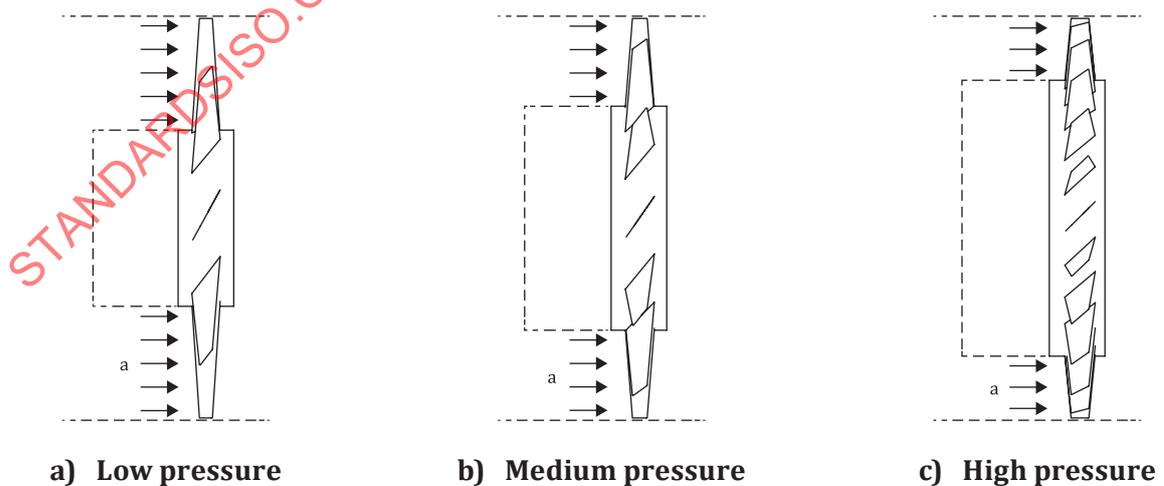
- 1 ducts
- a Flow of air.

Figure 7 — Axial fan

Note 2 to entry: An axial fan can be of the low-, medium- or high-pressure type. These terms indicate that the fan pressure generated at a given flow rate is low, medium or high.

Note 3 to entry: [Figure 8](#) shows a cross-section through a family of impellers having the same outside diameter. Fans with a ratio of hub/outside impeller diameter less than approximately 0,4 are considered “low aspect ratio”; those with a ratio greater than approximately 0,71 are considered “high aspect ratio”. Medium aspect ratio axial fans are intermediate between these two figures.

Note 4 to entry: These categories are also affected by the ability to run at the necessary peripheral speed.



- a Flow of air.

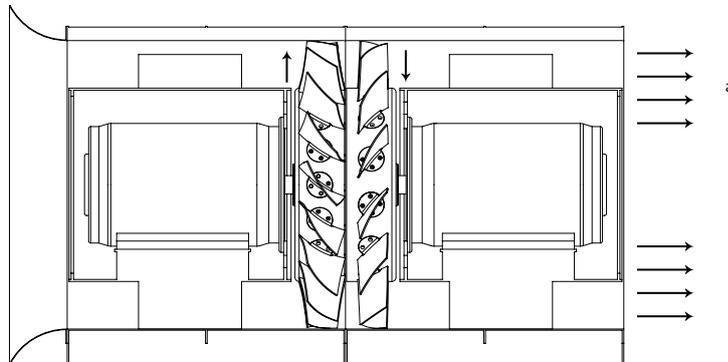
Figure 8 — Impellers of an axial fan

3.5.3

contra-rotating fan

axial fan which has two impellers arranged in series and rotating in opposite directions

Note 1 to entry: See [Figure 9](#).



^a Flow of air.

Figure 9 — Illustration of a contra-rotating fan

3.5.4

reversible axial fan

axial fan that is specially designed to rotate in either direction, regardless of whether or not the performance is identical in both directions

3.5.5

propeller fan

axial fan having an impeller with a small hub-to-tip ratio which results in fewer blades

3.5.6

plate-mounted axial fan

axial fan in which the impeller rotates in an orifice or spigot of relatively short axial length

3.5.7

vane-axial fan

axial fan suitable for ducted applications, which has guide vanes before or after the impeller, or both

3.5.8

tube-axial fan

axial fan without guide vanes, suitable for ducted applications

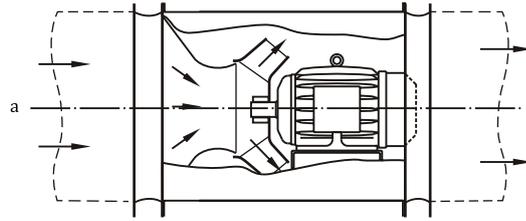
3.5.9

mixed-flow fan

diagonal flow fan

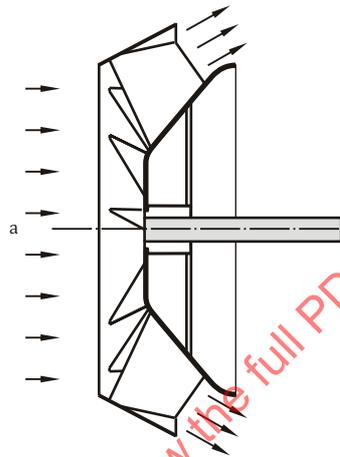
fan in which the fluid path through the impeller is intermediate between the centrifugal and axial-flow types

Note 1 to entry: See [Figures 10](#) and [11](#).



a Flow of air.

Figure 10 — Mixed-flow fan



a Flow of air.

Figure 11 — Impeller of a mixed-flow fan

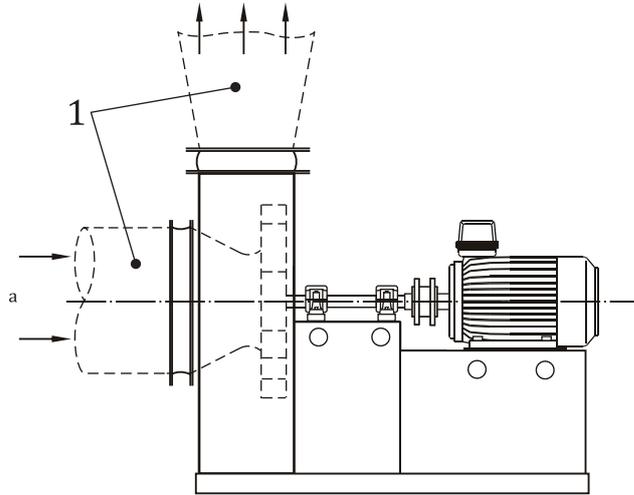
3.5.10

centrifugal fan

radial-flow fan

fan in which the air enters the impeller with an essentially axial direction and leaves it in a direction perpendicular, or nearly perpendicular, to this axis

Note 1 to entry: See [Figure 12](#).



Key

- 1 ducts
- a Flow of air.

Figure 12 — Centrifugal fan

Note 2 to entry: The impeller can have one or two inlet(s) and can include a shroud and/or a backplate (centreplate) (see [Figure 13](#)).

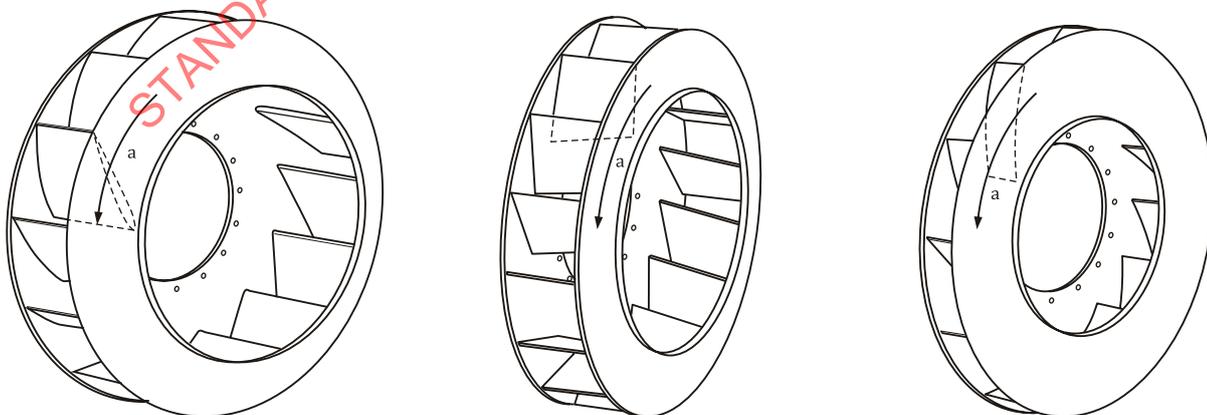
Note 3 to entry: The impeller is defined as “backward-curved or backward-inclined”, “radial” or “forward-curved”, depending on whether the outward direction of the blade at the periphery is backward, radial or forward relative to the direction of the rotation (see [Figure 13](#)).

Note 4 to entry: A centrifugal fan can be of the low-, medium- or high-pressure type. These terms indicate that the fan pressure generated at a given flow rate is low, medium or high (see [Figure 14](#)).

Note 5 to entry: [Figure 14](#) is an example showing a cross-section through a geometrically similar family of impellers having the same inlet diameter. Fans with a ratio of fan inlet/outside impeller diameter greater than approximately 0,63 are considered “low aspect ratio”; those with a ratio lower than approximately 0,4 are considered “high aspect ratio”. Medium aspect ratio centrifugal fans are intermediate between these two.

Note 6 to entry: The impeller diameter and the casing scroll radii increase with the pressure range for which the fan is designed.

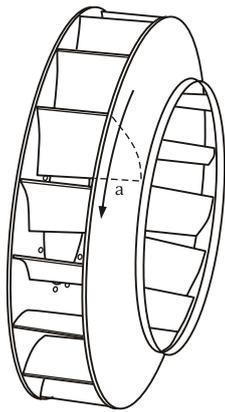
Note 7 to entry: These categories are also affected by the ability to run at the necessary peripheral speed.



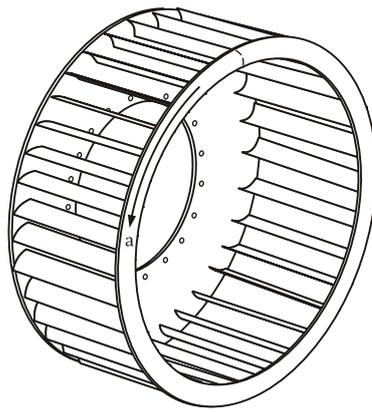
a) Aerofoil blades

b) Backward-inclined blades

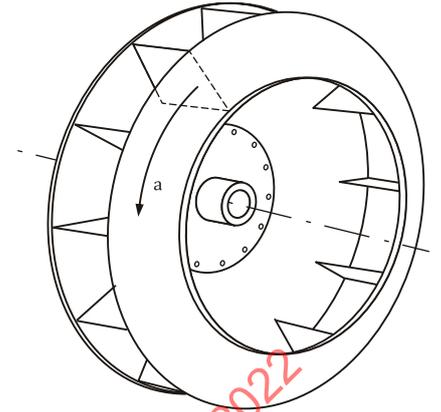
c) Backward-curved blades



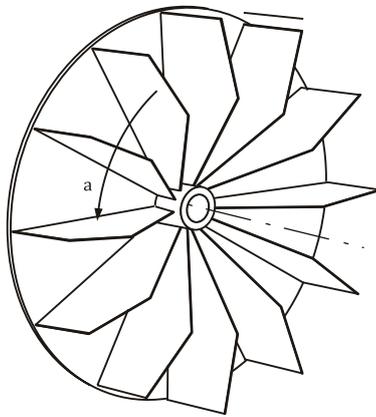
d) Radial-tipped blades



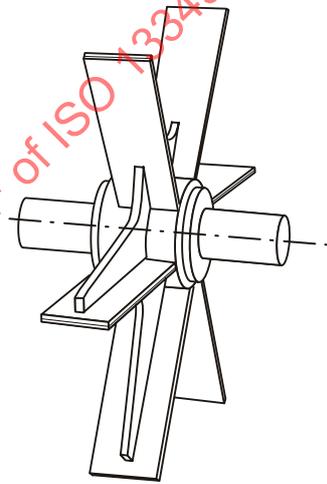
e) Forward-curved blades



f) Radial-shrouded blades



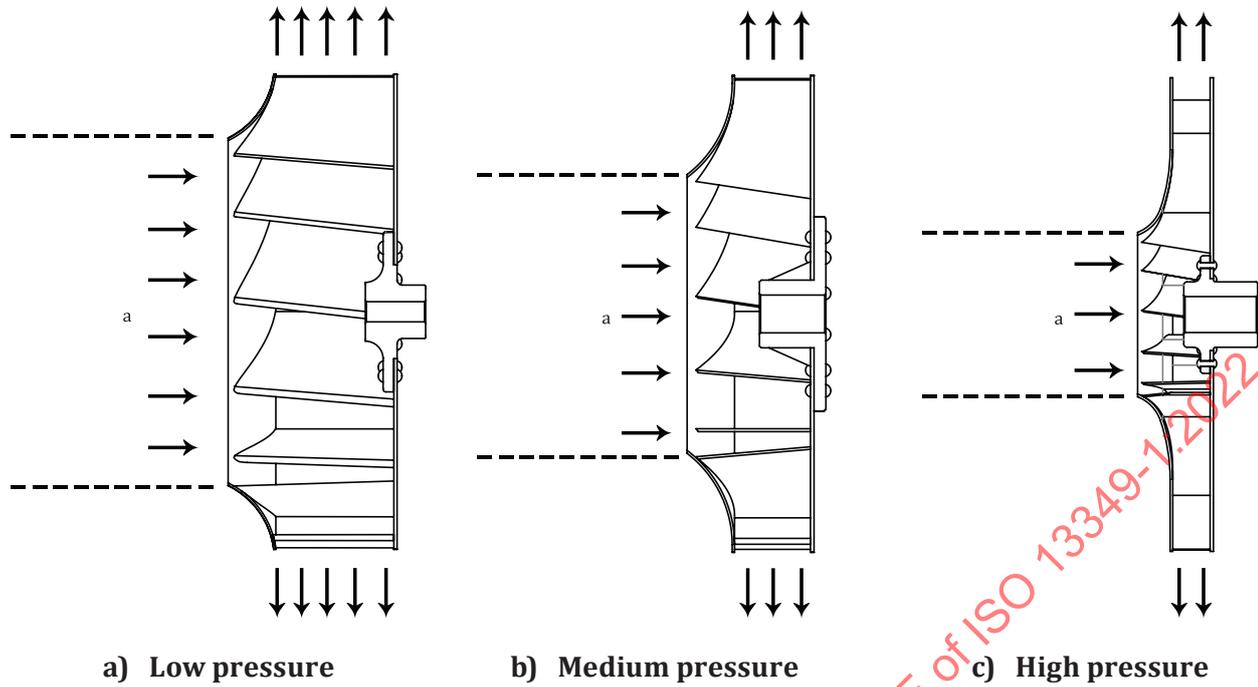
g) Radial-unshrouded blades



h) Radial paddle blades

^a Direction of rotation.

Figure 13 — Blade types of centrifugal impellers



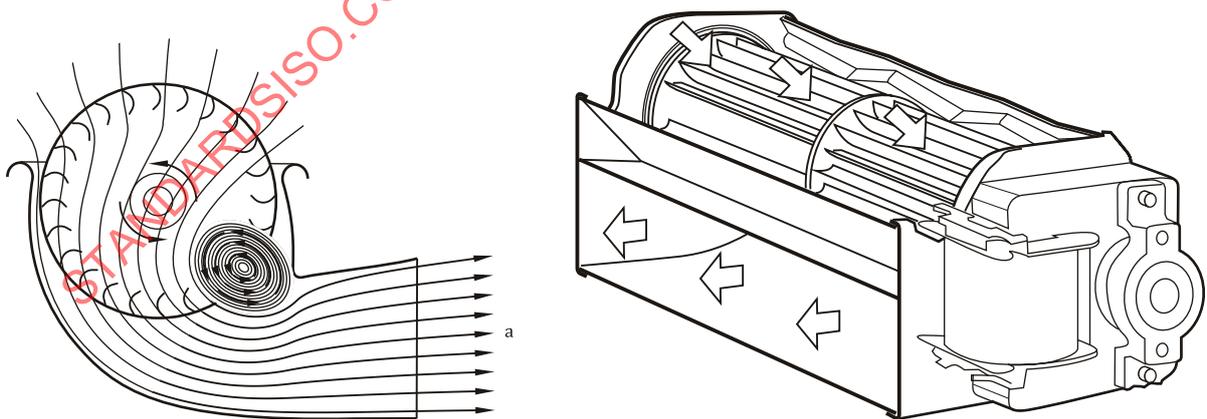
a Flow of air.

Figure 14 — Impellers of centrifugal fans

3.5.11 crossflow fan
 tangential fan

fan in which the fluid path through the impeller is in a direction essentially at right angles to its axis both entering and leaving the impeller at its periphery

Note 1 to entry: See [Figure 15](#).



a Flow of air.

Figure 15 — Cross-flow fan

3.5.12 induced flow fan

housed fan with a nozzle and windband whose outlet airflow is greater than its inlet airflow due to induced airflow

Note 1 to entry: All of the flow entering the inlet will exit through the nozzle; the flow exiting the windband will include the nozzle flow plus the induced flow.

Note 2 to entry: A windband is also referred to as an airflow accelerator or venturi.

3.5.13 peripheral fan

side channel fan

air-moving device for which the circulation of fluid in the toric casing is helicoidal

Note 1 to entry: The rotation of the impeller, which contains a number of blades, creates a helicoidal trajectory, which is intercepted by one or more blades depending on the flow rate. The impeller transfers energy to the fluid (see [Figure 16](#)).

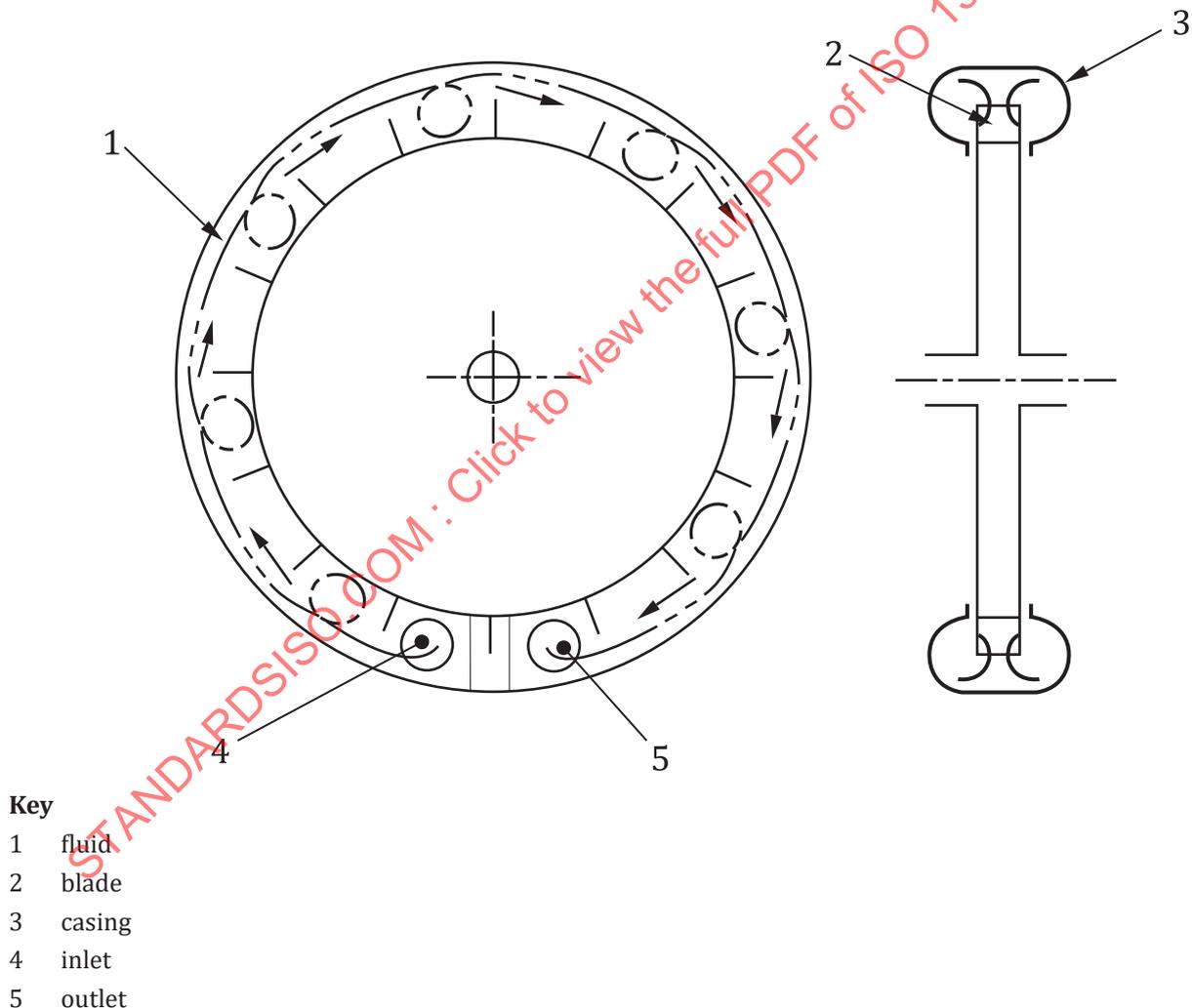


Figure 16 — Impeller of a peripheral fan

3.5.14 multi-stage fan

fan having two or more impellers working in series

EXAMPLE A two-stage fan or a three-stage fan.

Note 1 to entry: Multi-stage fans can have guide vanes and interconnecting ducts between successive impellers.

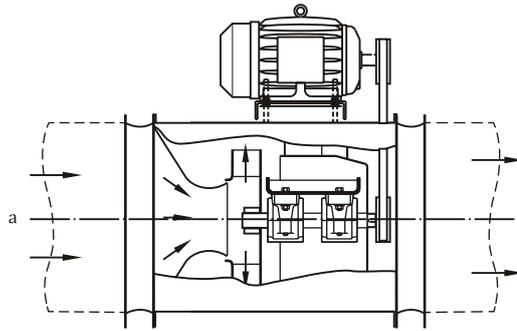
Note 2 to entry: The blades of an impeller can be either of a profiled section (as an aerofoil) or of uniform thickness (see [Figure 13](#)).

3.5.15

in-line centrifugal fan

fan having a centrifugal impeller used in an in-line ducted configuration

Note 1 to entry: See [Figure 17](#).



a Flow of air.

Figure 17 — In-line centrifugal fan

3.5.16

bifurcated fan

fan having an axial-flow, mixed-flow or centrifugal impeller in an in-line configuration where the direct-drive motor is separated from the flowing air stream by means of a compartment or tunnel

Note 1 to entry: See [Figure 18](#).

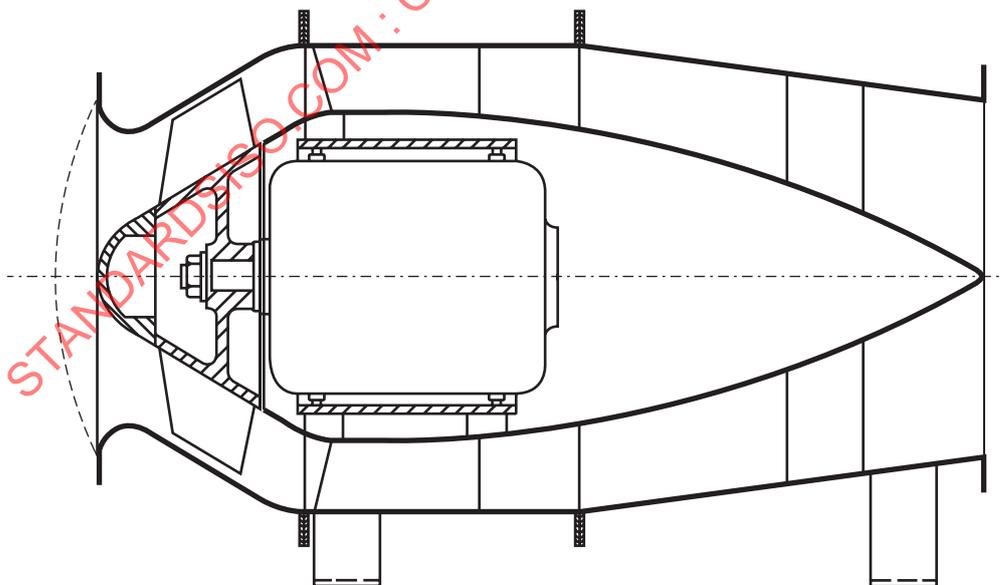


Figure 18 — Illustration of a bifurcated mixed-flow fan

3.5.17 plug fan

fan having an unshoused impeller arranged such that the system into which it is inserted acts as a housing, allowing air to be drawn into the impeller inlet

Note 1 to entry: See [Figure 19](#).

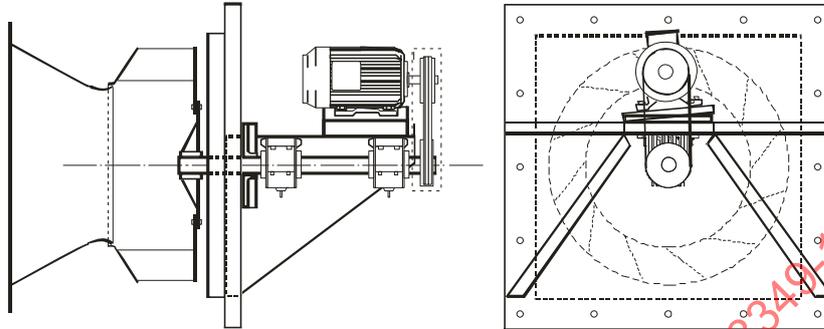


Figure 19 — Plug fan

3.5.18 plenum fan

fan having an unshoused centrifugal impeller which draws air into the impeller through an inlet located in a barrier wall, and having a driver located on the same side of the barrier as the impeller

Note 1 to entry: See [Figure 20](#).

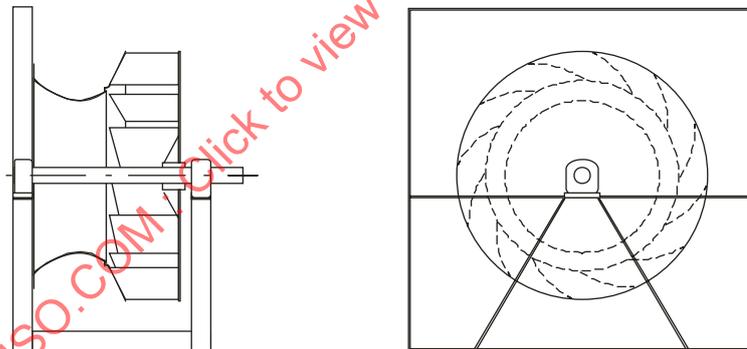


Figure 20 — Plenum fan

3.5.19 in-line box fan

fan that incorporates a centrifugal or mixed-flow impeller

Note 1 to entry: See [Figures 17](#) and [21](#).

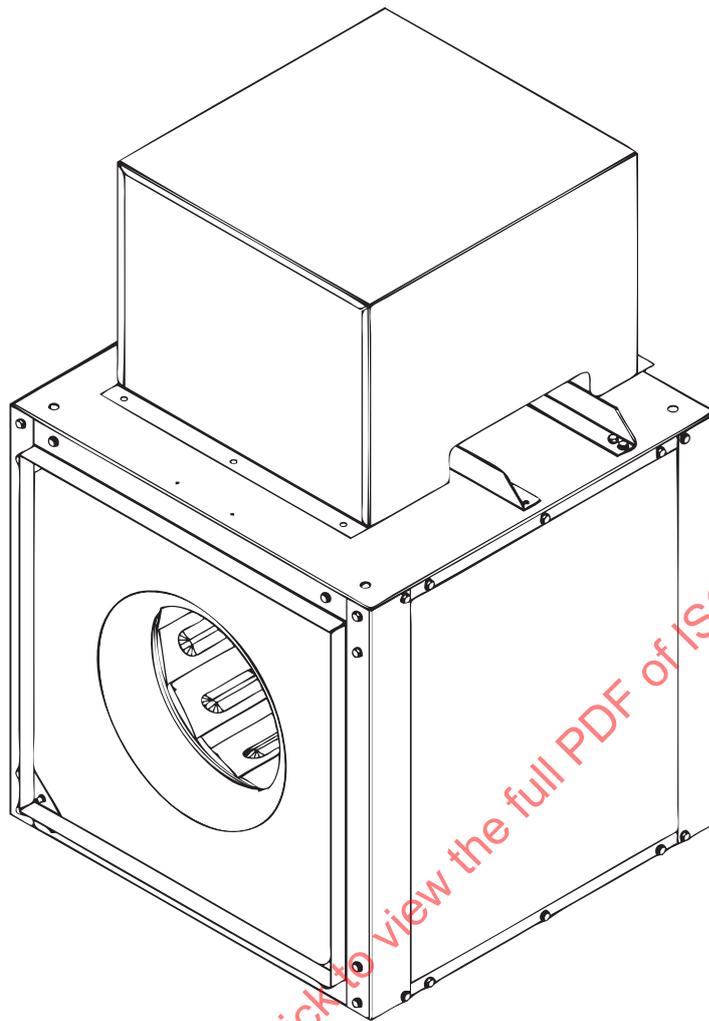


Figure 21.— Illustration of a box fan

3.6 Classification of fans according to operating conditions

3.6.1

general-purpose fan

fan suitable for handling air which is non-toxic, unsaturated, non-corrosive, non-flammable, free from abrasive particles and within a temperature range of -20 °C to $+80\text{ °C}$

Note 1 to entry: For temperatures greater than 40 °C , the motor is especially taken into consideration.

3.6.2

special-purpose fan

fan used for special operating conditions

Note 1 to entry: The fan can have a combination of special features.

Note 2 to entry: The operating conditions stated in [3.6.3](#) to [3.6.14](#) represent a typical range, but the list is not necessarily complete. It is intended that the manufacturer and purchaser agree on other types with special features to suit specific applications.

3.6.3**hot-gas fan**

fan used for handling hot gases continuously

Note 1 to entry: Special materials can be incorporated, as necessary, for the fan, which can have a direct or indirect drive.

Note 2 to entry: The motor on a direct-drive fan can be either in the air stream or separated from it.

Note 3 to entry: Indirect-drive fans can incorporate a means for cooling belts, bearings or other drive components, where necessary.

3.6.4**smoke-ventilating fan**

fan suitable for handling hot smoke for a specified time or temperature profile

Note 1 to entry: Special materials can be incorporated, as necessary, for the fan, which can have a direct or indirect drive.

Note 2 to entry: The motor can be either in the air stream on a direct-drive fan or separated from it.

Note 3 to entry: Indirect-drive fans incorporate a means for cooling belts, bearings or other drive components, where necessary.

3.6.5**wet-gas fan**

fan suitable for handling air containing particles of water or any other liquid

3.6.6**gas-tight fan**

fan with a suitably sealed casing to match a specified leakage rate at a specified pressure

Note 1 to entry: Depending upon the leakage specification, this can involve special attention being paid to all services which penetrate the casing, such as inspection means, lubricator fittings and electrical supply, as well as the details of the connecting flanges.

3.6.7**dust fan**

fan suitable for handling dust-laden air, designed to suit the dust being handled

3.6.8**conveying fan**

transport fan

fan suitable for the conveying of solids and dust entrained in the air stream, designed to suit the material being conveyed

Note 1 to entry: A conveying or transport fan can be of direct or indirect drive type, depending on whether or not the handled material passes through the impeller.

Note 2 to entry: Examples of solids include wood chips, textile waste and pulverized materials.

3.6.9**non-clogging fan**

fan having an impeller designed to minimize clogging by virtue of its detailed shape or by the use of special materials

Note 1 to entry: The fan can also incorporate other features to allow the use of cleaning sprays and facilitate the removal of any material.

3.6.10**abrasion-resistant fan**

fan designed to minimize abrasion, having parts that are especially subject to wear, constructed from suitably abrasion-resistant materials and easily replaceable

3.6.11

corrosion-resistant fan

fan constructed from suitably corrosion-resistant materials or suitably treated to minimize corrosion by specified agents

3.6.12

spark-resistant fan ignition-protected fan

fan with features designed to minimize the risk of sparks or hot spots resulting from contact between moving and stationary parts that can cause the ignition of dust or gases

Note 1 to entry: No bearings, drive components or electrical devices are placed in the air or gas stream, unless they are constructed in such a manner that failure of that component cannot ignite the surrounding gas stream.

3.6.13

powered-roof ventilator

fan designed for mounting on a roof and having exterior weather protection

3.6.14

positive-pressure ventilator

portable fan that can be positioned relative to an opening of a confined space and cause it to be positively pressurized by discharge air velocity

Note 1 to entry: It is principally used by firefighters to mitigate the effects of smoke and is also used to assist in inflating hot-air balloons.

3.7 Fan elements

3.7.1

fan inlet

opening, usually circular or rectangular, through which the air first enters the fan casing

Note 1 to entry: If the fan is provided with an inlet connecting flange or spigot, the fan inlet dimensions are measured inside this connection. The inlet area is the gross area measured inside this flange, i.e. no deductions are made for blockages, such as motors and bearing supports.

Note 2 to entry: When the inlet area is not clearly defined, agreement can be reached between the parties to the contract.

3.7.2

fan outlet

opening, usually circular or rectangular, through which the air finally leaves the fan casing

Note 1 to entry: If the fan is provided with an outlet connecting flange or spigot, the fan outlet dimensions are measured inside this connection. When the fan is delivered with a diffuser and the performance is quoted with this fitted, the area of the fan outlet may be taken as equal to the outlet area of the diffuser.

Note 2 to entry: Fan outlet area is, by convention, taken as the gross area in the outlet plane inside the casing, without deduction for motor, fairings or other obstructions. When the outlet area is not clearly defined, agreement can be reached between the parties to the contract.

Note 3 to entry: For the special requirements of jet fans, see ISO 13350.

Note 4 to entry: For roof ventilators and unhooded fans, the outlet area may be considered as the product of the maximum circumference of trailing edges by the width of the impeller blade or the gross casing area at the impeller for axial types.

3.7.3

impeller

rotating part of the fan that is imparting energy into the gas flow