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Fans — Vocabulary and definitions of categories (ISO 13349:2010)

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National foreword

This British Standard is the UK implementation of EN ISO 13349:2010. It supersedes BS EN ISO 13349:2008 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MCE/17, Fans.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Foreword

This document (EN ISO 13349:2010) has been prepared by Technical Committee ISO/TC 117 "Fans" in collaboration with Technical Committee CEN/TC 156 “Ventilation for buildings” the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2011, and conflicting national standards shall be withdrawn at the latest by January 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

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The text of ISO 13349:2010 has been approved by CEN as a EN ISO 13349:2010 without any modification.

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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.

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ISO 13349 was prepared by Technical Committee ISO/TC 117, *Fans*.

This second edition cancels and replaces the first edition (ISO 13349:1999), which has been technically revised.

Introduction

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

INTERNATIONAL STANDARD ISO 13349:2010(E)

Fans — Vocabulary and definitions of categories

1 Scope

This International Standard defines terms and categories in the field of fans used for all purposes.

It is not applicable to electrical safety.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 1: General principles and requirements*

ISO 5801:2007, *Industrial fans — Performance testing using standardized airways*

ISO 5802:2001, *Industrial fans — Performance testing in situ*

ISO 13351, *Fans — Dimensions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5167-1 and ISO 5801 and the following apply

3.1 Fans

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 The term “fan" is taken to mean the fan as supplied, without any addition to the inlet or outlet, except where such addition is specified.

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

NOTE 3 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 kg/m^3, the fan pressure does not exceed $1{,}2 \times 25$ 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
bare shaft fan
fan without drives, attachments or apperturbances

See ISO 12759.

3.1.3
driven fan
impeller fitted to or connected to a motor, with or without a drive mechanism, a housing or a means of variable speed drive

See ISO 12759.

3.2
air
abbreviated term for the expression “air or other gas”

3.3
standard air
by convention, air with a density of 1,2 kg/m^3

3.4 Fan installation categories according to the arrangement of ducting

See Figure 1.

3.4.1
installation category A
installation with free inlet and free outlet with a partition

See ISO 5801 and ISO 5802.

3.4.2
installation category B
installation with free inlet and ducted outlet

See ISO 5801 and ISO 5802.

3.4.3
installation category C
installation with ducted inlet and free outlet

See ISO 5801 and ISO 5802.

3.4.4
installation category D
installation with ducted inlet and ducted outlet

See ISO 5801 and ISO 5802.

3.4.5
installation category E
installation with free inlet and free outlet without a partition

3.5 Types of fan according to their function

3.5.1
ducted fan
fan used for moving air within a duct

NOTE This fan can be arranged in installation category B, C or D (see Figures 2, 3, 4 and 5).

3.5.2
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 This fan can be arranged in installation category A (see Figure 6).

3.5.3
jet fan
fan used for producing a jet of air in a space and unconnected to any ducting

See Figure 7.

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

3.5.4
circulating fan
fan used for moving air within a space which is unconnected to any ducting and is usually without a housing

See Figure 8.

3.5.5
air curtain unit
air moving device which produces an air curtain

See Figure 30.

3.5.5.1
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

3.6 Types of fan according to the fluid path within the impeller

3.6.1
centrifugal fan
fan in which the air enters the impeller with an essentially axial direction and leaves it in a direction perpendicular to this axis

See Figure 2.

NOTE 1 The centrifugal fan is also known as a radial-flow fan.

NOTE 2 The impeller can have one or two inlet(s) and might include a shroud and/or a backplate (centreplate) (see Figure 16).

NOTE 3 The impeller is defined as “backward-curved or 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 Figures 9 and 16).

NOTE 4 A centrifugal fan can be of the low-, medium- or high-pressure type, according to the aspect ratio of fan inlet diameter to outside diameter of the impeller. These terms indicate that the pressure generated at a given flow rate is low, medium or high.

NOTE 5 Figure 9 shows a cross-section through a family of impellers having the same inlet diameter. Fans with ratios of fan inlet/outside impeller diameter of greater than approximately 0,63 mm are considered “low aspect ratio”, and lower than approximately 0,4 mm are considered “high aspect ratio”. Medium aspect ratio centrifugal fans are intermediate between these two.

NOTE 6 The impeller diameter and the casing scroll radii increase with the pressure range for which the fan is designed.

NOTE 7 These categories are also affected by the ability to run at the necessary peripheral speed (see 5.2 and Table 1).

3.6.2
axial-flow fan
fan in which the air enters and leaves the impeller along essentially cylindrical surfaces coaxial with the fan

See Figure 3.

NOTE 1 An axial-flow fan can be of the low-, medium- or high-pressure type, according to the aspect ratio of hub diameter to outside impeller diameter. These terms indicate that the pressure generated at a given flow rate is low, medium or high.

NOTE 2 Figure 10 shows a cross-section through a family of impellers having the same outside diameter. Fans with ratios of hub/outside impeller diameter of less than approximately 0,4 mm are considered “low aspect ratio”, and greater than approximately 0,71 mm are considered “high aspect ratio”. Medium aspect ratio axial fans are intermediate between these two figures.

NOTE 3 These categories are also affected by the ability to run at the necessary peripheral speed.

3.6.2.1
contra-rotating fan
axial-flow fan which has two impellers arranged in series and rotating in opposite directions

See Figure 32.

3.6.2.2
reversible axial-flow fan
axial-flow fan that is specially designed to rotate in either direction, regardless of whether or not the performance is identical in both directions

3.6.2.3
propeller fan
axial-flow fan having an impeller with a small number of broad blades of uniform material thickness and designed to operate in an orifice

3.6.2.4
plate-mounted axial-flow fan
axial-flow fan in which the impeller rotates in an orifice or spigot of relatively short axial length, the impeller blades being of aerofoil section

3.6.2.5
vane-axial fan
axial-flow fan suitable for ducted applications, which has guide vanes before or after the impeller, or both

3.6.2.6
tube-axial fan
axial-flow fan without guide vanes, suitable for ducted applications

3.6.3
mixed-flow fan
fan in which the fluid path through the impeller is intermediate between the centrifugal and axial-flow types

See Figures 5 and 11.

3.6.4
cross-flow 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

See Figure 12.

3.6.5
peripheral or side channel fan
air moving device for which the circulation of fluid in the toric casing is helicoidal

NOTE 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 15).

3.6.6
multi-stage fan
fan having two or more impellers working in series

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

NOTE 1 Multi-stage fans can have guide vanes and interconnecting ducts between successive impellers.

NOTE 2 The blades of an impeller can be either of a profiled section (as an aerofoil) or of uniform thickness (see Figure 16).

3.6.7
in-line centrifugal fan
fan having a centrifugal impeller used in an in-line ducted configuration

See Figure 4.

3.6.8
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

See Figure 27 c).

3.6.9
plug fan
fan having an unhoused impeller arranged such that the system into which it is inserted acts as a housing, allowing air to be drawn into the impeller inlet

See Figure 13.

3.6.10
plenum fan
fan having an unhoused 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

See Figure 14.

3.6.11
in-line and box fan
fan that incorporates centrifugal/mixed-flow impellers

See Figures 4 and 31.

3.7 Types of fan according to operating conditions

3.7.1
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 from –20 °C to +80 °C

NOTE For temperatures greater than 40 °C, the motor is especially taken into consideration.

3.7.2
special-purpose fan
fan used for special operating conditions

See 3.7.2.1 to 3.7.2.12.

NOTE 1 A fan can have a combination of special features.

NOTE 2 The operating conditions stated below (3.7.2.1 to 3.7.2.12) represent a typical range, but the list is not necessarily complete. It is intended that the manufacturer and purchaser agree on other types having special features to suit specific applications.

3.7.2.1
hot-gas fan
fan used for handling hot gases continuously

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

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

NOTE 3 Indirect-drive fans can incorporate a means for cooling belts, bearings or other drive components, where necessary (for designation, see 5.3.2).

3.7.2.2
smoke-ventilating fan
fan suitable for handling hot smoke for a specified time/temperature profile

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

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

NOTE 3 Indirect-drive fans incorporate a means for cooling belts, bearings or other drive components, where necessary (for designation, see 5.3.2).

3.7.2.3
wet-gas fan
fan suitable for handling air containing particles of water or any other liquid

3.7.2.4
gas-tight fan
fan with a suitably sealed casing to match a specified leakage rate at a specified pressure

NOTE 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 (for categorization, see 5.3.4).

3.7.2.5
dust fan
fan suitable for handling dust-laden air, designed to suit the dust being handled

3.7.2.6
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 A conveying/transport fan can be of direct or indirect drive type, depending on whether or not the handled material passes through the impeller.

NOTE 2 Examples of solids are wood chips, textile waste and pulverized materials.

3.7.2.7
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 The fan can also incorporate other features to allow the use of cleaning sprays and facilitate the removal of any material.

3.7.2.8
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

3.7.2.9
corrosion-resistant fan
fan constructed from suitably corrosion-resistant materials or suitably treated to minimize corrosion by specified agents

3.7.2.10
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 may cause the ignition of dust or gases

NOTE 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 (for categorization, see 5.3.4).

3.7.2.11
powered-roof ventilator
fan designed for mounting on a roof and having exterior weather protection

3.7.2.12
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 It is principally used by fire-fighters to mitigate the effect of smoke and is also used to assist in inflating hot air balloons.

3.8 Fan elements

3.8.1
fan inlet
opening, usually circular or rectangular, through which the air first enters the fan casing

NOTE 1 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 When the inlet area is not clearly defined, agreement can be reached between the parties to the contract.

3.8.2
fan outlet
opening, usually circular or rectangular, through which the air finally leaves the fan casing

NOTE 1 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 can be taken as equal to the outlet area of the diffuser.

NOTE 2 When the outlet area is not clearly defined, agreement can be reached between the parties to the contract.

NOTE 3 For the special requirements of jet fans, see ISO 13350.

NOTE 4 For roof ventilators and unhoused fans, the outlet area can 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.

3.8.3
impeller tip diameter
maximum diameter measured over the tips of the blades of the impeller

NOTE This is expressed in millimetres.

See ISO 13351.

3.8.4
size designation
nominal impeller tip diameter, defined as the impeller tip diameter on which the design of that fan is based

4 Symbols and units

4.1 Symbols

The following symbols and primary units for the parameters listed apply.

Parameter	Symbol	Unit
Volume flow rate	q_V	m^3/s
Fan pressure	p_F	Pa
Power	P	W
Torque	τ	Nm
Gas density	ρ	kg/m^3
Impeller tip speed	u	m/s
Outlet or duct velocity	v	m/s
Rotational frequency	n	r/s
Rotational speed	N	r/min
Dimensions	—	mm
Moment of inertia	I	$kg{\cdot}m^2$
Stress	σ	Pa
Energy	E	J
Temperature	Θ	K
Temperature	T	°C
Work per unit mass	W	J/kg
Thrust (calculated, measured)	T_c, T_m	N

Note 1 For sound units, see ISO 13347-1.

Note 2 For efficiency units, see ISO 5801.

4.2 Multiples of primary units

The choice of the appropriate multiple or submultiple of an SI unit is governed by convenience. The multiple chosen for a particular application shall be that which leads to numerical values within a practical range (e.g. kilopascal for pressure, kilowatts for power and megapascal for stress).

4.3 Units of time

The second is the SI base unit of time, although outside SI the minute has been recognized by the International Committee for Weights and Measurements (CIPM) as necessary to be retained for use because of its practical importance. Manufacturers may, therefore, continue with the use of r/min for rotational speed.

4.4 Temperature of air or gas

The kelvin is the SI base unit of thermodynamic temperature and is preferred for most scientific and technological purposes. The degree Celsius (°C) is acceptable for practical applications.

5 Fan categories

5.1 General

Fans may be categorized according to

a) suitability for the fan pressure,

b) suitability of construction (including features required for smoke ventilation, gas tightness and ignition protection),

c) driving arrangement,

d) inlet and outlet conditions,

e) method of fan control,

f) rotation and position of parts, and

g) characteristic dimensions.

Examples of the use of the definitions and categories to identify a fan in a specification are given in Annex A.

5.2 Suitability for the fan pressure

A fan may also be defined as being low, medium or high pressure, according to the level of work per unit mass, and whether the influence of compressibility of the air or gas being handled has to be taken into account. For a detailed account of these considerations, see ISO 5801.

A low-pressure fan is then defined as having a pressure ratio less than 1,02 kPa and a reference Mach No. of less than 0,15. This corresponds to a pressure rise of less than 2 kPa when handling standard air.

A medium-pressure fan is defined as having a pressure ratio greater than 1,02 kPa and less than 1,1 kPa. The reference Mach No. shall be less than 0,15. This corresponds to a pressure rise of 2 kPa to 10 kPa.

A high-pressure fan is defined as having a pressure ratio and pressure rise greater than the above-mentioned.

5.2.1 Work per unit mass

A convention is used for all industrial fans except jet fans (see ISO 13350), denoting the work per unit mass as the quotient of air power and mass flow rate. The fan pressure is approximately equal to the product of work per unit mass and the mean stagnation density of the fluid within the fan.

5.2.2 Fan categories

Depending on its peripheral speed, a fan impeller develops more or less pressure. This International Standard defines a range of "fan categories" where the fan pressure at maximum efficiency and maximum rotational speed is not less than the value given in Table 1. In any event, this defined fan pressure (as shown in Table 1) shall not exceed 95 % of the maximum pressure developed by the fan at its maximum speed.

5.2.3 Changes in air density

These categories shall also be used to indicate whether or not the change in air density within the fan shall be considered. For a low-pressure fan, this change may be neglected. For a high-pressure fan, this change shall not be neglected, whereas for a medium-pressure fan, it may or may not be neglected depending on the desired accuracy. Detailed mechanical design and construction of the rotational elements are determined by the peripheral speed and, therefore, the pressure for which the fan is specified. For examples of centrifugal fans, see Figure 9.

Table 1 — Categorization of fan according to fan pressure

Fan description	Code	Maximum fan pressure (for standard air) kPa	Category
Low pressure	L	> 0 and $\leqslant 0{,}7$	0
		$> 0{,}7$ and $\leqslant 1$	1
		> 1 and $\leqslant 1{,}6$	2
		$> 1{,}6$ and $\leqslant 2{,}0$	3
Medium pressure	M	$> 2{,}0$ and $\leqslant 3{,}6$	4
		$> 3{,}6$ and $\leqslant 6{,}3$	5
		$> 6{,}3$ and $\leqslant 10$	6
High pressure	H	> 10 and $\leqslant 16$	7
		$> 16{,}0$ and $\leqslant 22{,}4$	8
		$> 22{,}4$ and $\leqslant 30$	9

5.3 Suitability of construction

5.3.1 Categorization according to casing construction

Fans are used for a variety of purposes (see 3.7). The air or gas handled may be clean or contain moisture or solid particles and may be at ambient or other temperature. Connection to its associated ducting can be via flexible elements or alternatively it may be attached directly, such that the casing has to withstand additional loads due to the dead weight of these connections. Where a high or low temperature is present, further loading can result from the effects of expansion or contraction. Casing thickness and stiffening are also determined by the ability to withstand the specified fan pressure and dynamic loads and by the need for a margin to counter the effects of any erosion or corrosion. For all these and other reasons, different methods of casing construction and different casing thicknesses are appropriate to the application.

The categorization in Table 2 reflects current practice and shall be used only to assist specification. It in no way indicates any form of grading. Category 1 is as valid for clean air ventilation as Category 3 is preferred for heavy industrial requirements.

Table 2 — Categorization of fan according to method of casing construction

Category	Typical casing features	Usage	Casing thickness
1	Lockformed, spot welded or screwed construction. Cradle or angle frame mounting	— Light HVAC clean air	$< 0{,}002\ 5D$
2	Lockformed, seam welded or continuously welded construction. Semi-universal design with bolted on side-plates	— Heavy HVAC — Light industrial — Light dust or moisture	$> 0{,}002\ 5D$
3	Fully welded fixed discharge	— Heavy industrial — Dirty air containing moisture or solids, or — High pressure or — High power	$> 0{,}003\ 33D$
NOTE D is the nominal impeller diameter, in millimetres.			

5.3.2 Designation for hot-gas fan

Where a fan is suitable for continuous operation up to a stated maximum temperature (for hot-gas fan, see 3.7.2.1), this should be indicated on the conventional fan rating plate itself.

The designation that shall be used is: T, followed by the maximum temperature in degrees Celsius (°C), for continuous operation.

EXAMPLE T/500 denotes a fan rated for a maximum continuous temperature of 500 °C.

5.3.3 Designation and recommended categorization for smoke-ventilating fans

If the fan is also, or only, capable of short-term operation at a high temperature, this information shall be clearly stated on a separate label (see 3.7.2.2).

5.3.4 Categorization for gas-tight fans

Gas-tight fans shall be categorized in accordance with Table 3 (see 3.7.2.4). The amount of leakage is dependent on the pressure within the fan casing and the time for which this must be maintained. The leakage rate is obtained by blocking off the fan inlet and outlet and "pumping up" or extracting the casing using an auxiliary test fan. The change in the test pressure shall be measured by a manometer as a function of time. The leakage rate is then determined from the flow of the auxiliary test fan or other pressure sources. This leakage shall be less than the value calculated from the formula appropriate to the category.

Normally, the fan is stationary during this test. However, if the correct functioning of the shaft seal is dependent on fan rotation, the test shall be carried out with the impeller removed and the remainder of the fan running.

Categories A to D match the established classes of allowable ductwork leakage rate used in the air-conditioning industry. Category E is often specified for systems handling toxic fumes, whilst categories F and G relate to nuclear and defence equipment specifications, respectively.

Table 3 — Categorization of gas-tight fans — Leakage as a function of test pressure

Leakage category	Maximum test pressure kPa	Time at maximum pressure min	Acceptance criteria/maximum leakage rate
A	0,5	15	$0{,}027 \times p^{0{,}65}$
B	1	15	$0{,}009 \times p^{0{,}65}$
C	2	15	$0{,}003 \times p^{0{,}65}$
D	2,5	15	$0{,}001 \times p^{0{,}65}$
E	2,5	15	$0{,}000\,5 \times p^{0{,}65}$
F	3	60	Fall in $p < 500$ Pa
G	10,5	15	No detectable leaks
H1	1,5	60	Fall in $p < 150$ Pa
H2	1,5	60	Fall in $p < 15$ Pa

NOTE 1 Leakage rates in categories A, B, C, D and E are in litres per second per square metre of casing wetted area and p is the test pressure in pascals.

NOTE 2 Leakage is defined as loss of pressure in categories F, H1 and H2. Especially when measuring the pressure loss according to leakage categories H1 or H2, attention has to be drawn to changes of the gas temperature inside the casing or the ambient pressure during measurement as they can taint the result significantly.

5.4 Drive arrangements

The six most commonly used types of drive are the following.

a) Direct drive from the shaft of the motor or other prime mover: the impeller is fixed to the shaft extension.

b) Drive through an in-line direct coupling: the drive shaft and the impeller shaft are each fixed on a part of the in-line direct coupling and rotate at the same speed.

c) Drive through an in-line slipping coupling: the drive shaft is fixed to the primary part of the coupling and the impeller shaft to the secondary part of the coupling, enabling them to rotate at different speeds, the relative difference of which (i.e. the slip) depends upon the speed, the torque to be transmitted and, when appropriate, the degree of control applied to the coupling.

d) Drive through a gearbox: the drive shaft and the impeller shaft are not necessarily coaxial; they may be parallel or at an angle, their speeds being in one or more given ratio(s).

e) Belt drive: the drive shaft and the impeller shaft are not in-line, but parallel, the drive between the two being by means of flat, toothed or vee belts (or belts of some other section) and suitable pulleys. Their speeds are in a given ratio subject to a small amount of slip, except in the case of the toothed belt.

f) Direct drive with inset motor: the motor is set inside the fan casing or impeller such as an external rotor motor.

Fans shall be classified according to the drive arrangements of the fan, especially as far as direct and belt driven units are concerned. These are shown in Table 4 for centrifugal units and Table 5 for axial units.

Table 4 — Drive arrangements for centrifugal fans

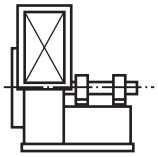
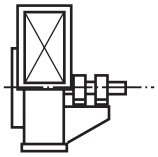
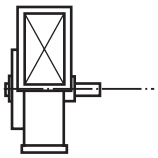
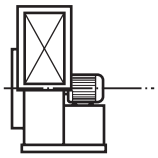
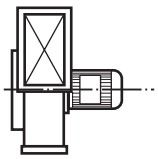
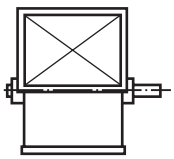
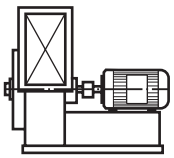
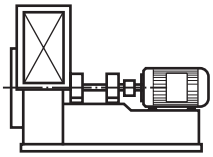
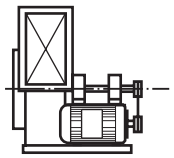
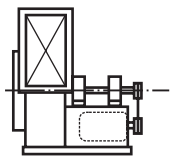
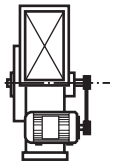
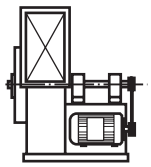
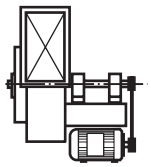
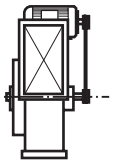
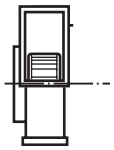
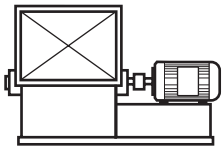
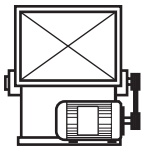
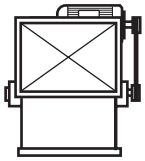
Arrangement No.	Description	Motor position (see Figure 24)	Illustration
1	Single-inlet fan for belt drive. Impeller overhung on shaft running in two plummer block, pillow block bearings or a double-bearing block supported by a pedestal.	—	
2	Single-inlet fan for belt drive. Impeller overhung on shaft running in bearings supported by a bracket attached to the fan casing.	—	
3	Single-inlet fan for belt drive. Impeller mounted on shaft running in bearings on each side of casing and supported by the fan casing.	—	
4	Single-inlet fan for direct drive. Impeller overhung on motor shaft. No bearings on fan. Motor supported by base.	—	
5	Single-inlet fan for direct drive. Impeller overhung on motor shaft. No bearings on fan. Motor attached to casing side by its flanged end-shield.	—	
6	Double-inlet fan for belt drive. Impeller mounted on shaft running in bearings on each side of casing and supported by the fan casing.	—	
7	Single-inlet fan for coupling drive. Generally, as arrangement no. 3, but with a base for the driving motor.	—	
8	Single-inlet fan for coupling drive. Generally, as arrangement no. 1, plus an extended base for the driving motor.	—	
9	Single-inlet fan for coupling drive. Generally, as arrangement no. 1, but with the motor mounted on the outside of the bearing pedestal.	W or Z	
10	Single-inlet fan for belt drive. Generally, as arrangement no. 1, but with the drive motor inside the bearing pedestal.	U	

Table 4 (*continued*)

Arrangement No.	Description	Motor position (see Figure 24)	Illustration
11	Single-inlet fan for belt drive. Generally, as arrangement no. 3, but with the fan and motor supported by a common base frame.	W or Z (very rarely X or Y)	
12	Single-inlet fan for belt drive. Generally, as arrangement no. 1, but with the fan and motor supported by a common base frame.	W or Z (very rarely X or Y)	
13	Single-inlet fan for belt drive. Generally, as arrangement no. 1, but with the motor fixed underneath the bearing pedestal.	U	
14	Single-inlet fan for belt drive. Generally, as arrangement no. 3, but with the motor supported by the fan scroll.	V, W or Z	
15	Single-inlet fan for direct drive. Driving motor in-set within impeller and fan casing.	—	
16	Double-inlet fan for direct drive. Driving motor in-set within impeller and fan casing.	—	
17	Double-inlet fan for coupling drive. Generally, as arrangement no. 6, but with a base for the driving motor.	—	
18	Double-inlet fan for belt drive. Generally, as arrangement no. 6, but with a fan and motor supported by common base frame.	W or Z (very rarely X or Y)	
19	Double-inlet fan for belt drive. Generally, as arrangement no. 6, but with the motor supported by the fan scroll.	V, W or Z	

NOTE Arrangement nos. 1, 3, 6, 7, 8 and 17 can also be provided with the bearings mounted on pedestals for base set independent of the fan housing.

Table 5 — Drive arrangements for axial-flow fans

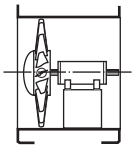
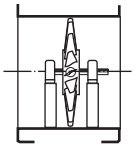
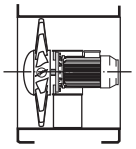
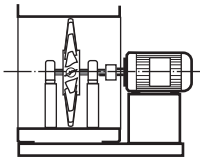
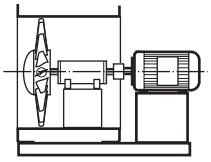
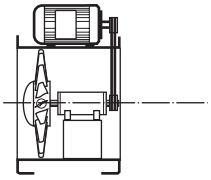
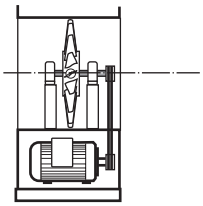
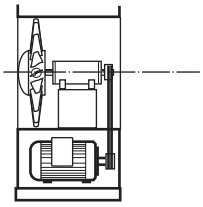
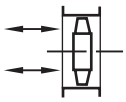
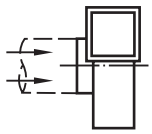
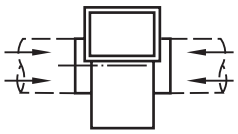
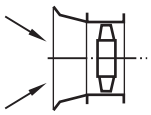
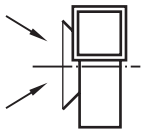
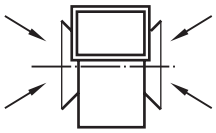
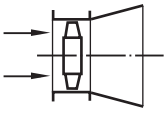
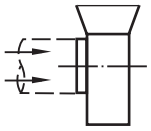
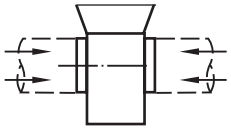
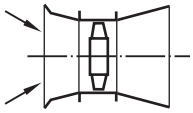
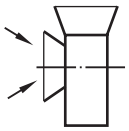
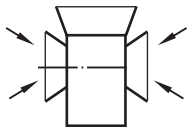
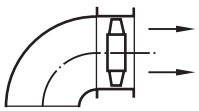
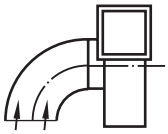
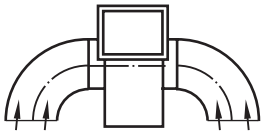
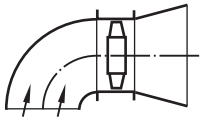
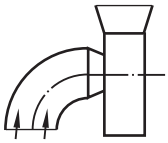
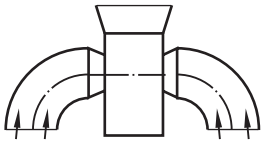
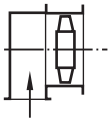
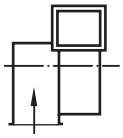
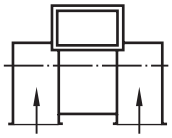
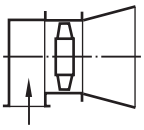
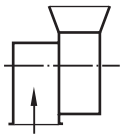
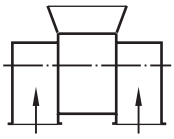
Arrangement No.	Description	Motor position (see Figure 24)	Illustration
1	Belt drive. Impeller overhung on shaft running in two bearings, suitably supported.	—	
3	Belt drive. Impeller overhung on shaft running between bearings and supported by fan housing.	—	
4	Direct drive. Impeller overhung on driving motor shaft. No bearings on fan. Driving motor base-mounted or integrally direct-connected.	—	
7	Coupling drive. Generally, as arrangement no. 3, but with a base for the driving motor.	—	
8	Coupling drive. Generally, as arrangement no. 1, plus an extended base for the driving motor.	—	
9	Belt drive. Generally, as arrangement no. 1, but with a driving motor outside and supported by the fan casing.	See Figure 21	
11	Belt drive. Generally, as arrangement no. 3, but with fan and driving motor outside and supported by a common base frame.	U, V, W or Z (very rarely X or Y)	
12	Belt drive. Generally, as arrangement no. 1, plus an extended base for the driving motor.	U, V, W or Z (very rarely X or Y)	

Table 6 — Inlet and outlet ancillaries for fans

Subcode	Description	Illustration		
		Axial-flow-fans	Single-inlet centrifugal fans	Double-inlet centrifugal fans
U	Fan with inlet and outlet openings immediately adjacent to the casing.			
E	Fan with a cone or bellmouth inlet and with the outlet opening immediately adjacent.			
D	Fan with a diffuser on the fan outlet and with the inlet opening immediately adjacent.			
ED	Fan with a cone or bellmouth inlet on the inlet side and a diffuser on the outlet.			
B	Fan with a bend on the inlet side and the outlet side immediately adjacent.			
BD	Fan with a bend on the inlet side and a diffuser on the outlet.			
S	Fan with side box entry to the inlet and outlet opening immediately adjacent.			
SD	Fan with side box entry to the inlet and diffuser on the fan outlet.			

5.5 Inlet and outlet conditions

The direction or condition of the flow into or out of the fan may be modified by the addition of ancillaries. These are identified by alphabetical subcodes (see Table 6).

5.6 Method of fan control

The following are the various methods of fan control commonly used in order to modify fan performance.

a) Speed control: speed can be varied either continuously or in steps by a variable-speed motor, variable-speed coupling, convertors (inverters), voltage control or by use of electronically commutated or switched reluctance motors.

NOTE 1 At widely varying operational conditions, speed control is much more efficient than damper or vane control.

b) Damper control: the fan performance is controlled by means of a damper, either on the inlet or on the outlet, creating an additional variable system resistance.

c) Vane control: vanes mounted at the fan inlet can be adjusted in order to change the fan performance by controlling the swirl at the fan inlet.

d) Blade pitch control: variable blade pitch control (normally only for axial-flow fans). The blade angle of the impeller can be varied whilst the impeller is rotating, all blades being simultaneously varied by one operation.

e) Adjustable pitch: if the blade angle of the impeller can be altered only when the impeller is stationary, this method of control is termed “adjustable pitch”.

NOTE 2 When the blade angle cannot be changed, it is said that the fan has a “fixed pitch”.

5.7 Designation of direction of rotation and position of parts of the fan assembly

5.7.1 General

The conventions specified in this subclause shall be used for designating the direction of rotation of the fan and the position of some of its parts.

5.7.2 Direction of rotation

By convention, the direction of rotation is determined from the side opposite the impeller inlet, no matter what the actual position of the drive (see Figures 17, 18 and 19). The direction of rotation is designated clockwise (right-hand, symbol RD) or anticlockwise (left-hand, symbol LG) according to the direction seen when viewed along the axis of the fan from the side opposite the impeller inlet.

For a contra-rotating fan, rotation of the first stage shall determine the direction of rotation.

NOTE 1 For a double-inlet centrifugal fan and a cross-flow fan, the direction of rotation is determined when viewed from the driving side.

NOTE 2 Clockwise rotation of the fan can entail anticlockwise rotation of the driving motor. Rotational direction of motor is always defined looking upon the driving end of the motor shaft.

5.7.3 Outlet position of a centrifugal fan

The angular positions of the outlet of a fan shall be defined in relation to an origin taken as a straight line perpendicular to the mounting base towards the axis of rotation (see Figures 20 and 21).

The outlet position of a centrifugal fan is designated by the symbol for the direction of rotation, i.e. LG or RD, followed by the angle, in degrees, between the origin and the axis of discharge, the angle being measured in the direction of rotation as defined in 5.7.2 (e.g. LG 135 or RD 90) (see Figures 17, 20 and 21).

5.7.4 Position of component parts of a centrifugal fan with volute casing

The angular position of a motor, inlet box or bend, inspection door or any other component is designated by the symbol for the direction of rotation (i.e. LG or RD) followed by the angle, in degrees, between the origin as defined in 5.7.3 and the axis of the component part, the angle being measured in the direction of rotation as defined in 5.7.2 (see Figure 22).

NOTE Where the fan casing is not provided with feet, the outlet position is taken as 0°.

5.7.5 Position of component parts of an axial-flow, mixed-flow or other fan with coaxial inlet and outlet

The angular position of a motor, an inlet box or bend, outlet bend, inspection door, terminal box, mounting feet, extended lubricators and axis of the belt drive or gearbox input shaft, is defined by the angle, in degrees, between the origin and the axis of the component measured in a clockwise direction, when viewed along the axis of rotation, from the side opposite to the inlet, irrespective of the direction of rotation of the fan (see Figure 23).

An exception is a reversible axial-flow fan which is viewed from the driving side. Where the definition of origin given in Figure 23 does not apply, an arbitrary origin may be chosen.

5.7.6 Position of motor or other prime mover

5.7.6.1 Plan view position of motor for belt or chain drive

The position of a motor when viewed perpendicular to the fan mounting base shall be denoted by the letters W, X, Y, Z, as shown in Figure 24, and it shall be specified whether the drive is on the inlet side or on the side opposite the inlet.

5.7.6.2 Position of motor in a direct-driven axial-flow, mixed-flow or other fan with coaxial inlet and outlet

The motor position for a direct-driven fan with horizontal or vertical axis shall be designated as shown in Figure 25.

5.8 Characteristic dimensions and component parts

5.8.1 Characteristic dimensions

Size designations and inlet and outlet flanges shall be as defined in ISO 13351. The definitions of size designation are given in 3.8.4.

Figures 26 to 29 show the arrangements of typical fans. In each case, the fan inlet is identified by “1”, whilst the outlet is identified by “2” and the impeller tip diameter by “3.”

5.8.2 Terms for fan component parts

The illustrations in Figures 26, 27, 28 and 29 have been chosen as examples to show component parts of fans (Table 7 gives the index of fan parts and Table 8 lists the preferred terms for fan component parts). Many alternative features and arrangements are possible and the selected illustrations shall not be taken as standard designs for the kinds of fan involved.

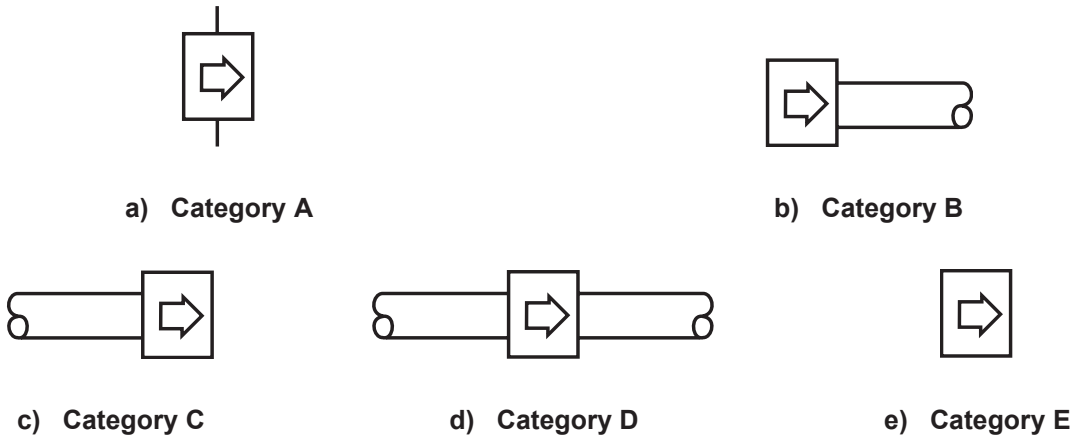
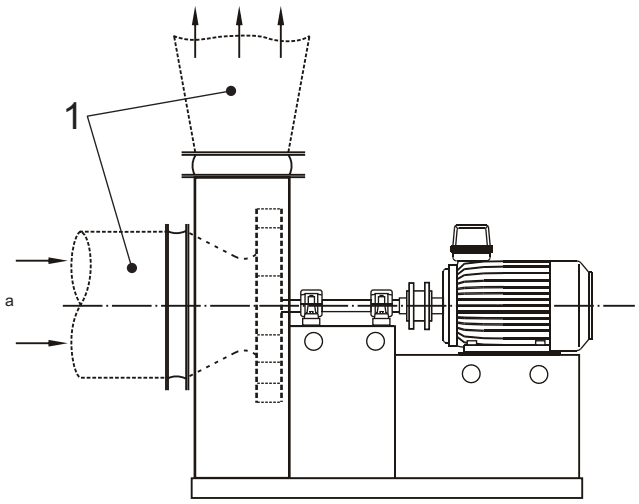


Figure 1 — Installation category

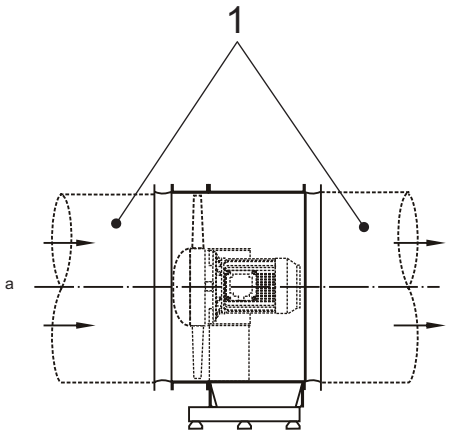


Key

1 duct

a Flow of air.

Figure 2 — Centrifugal fan

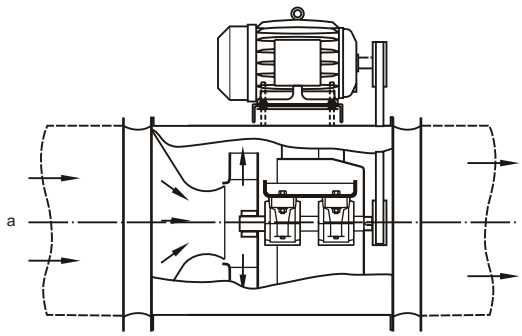


Key

1 duct

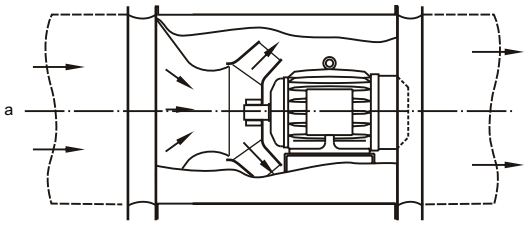
a Flow of air.

Figure 3 — Axial-flow fan



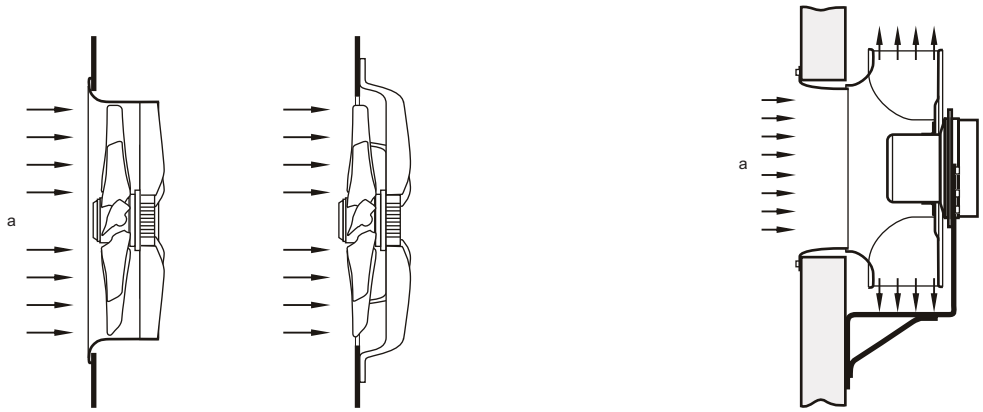
a Flow of air.

Figure 4 — In-line centrifugal fan



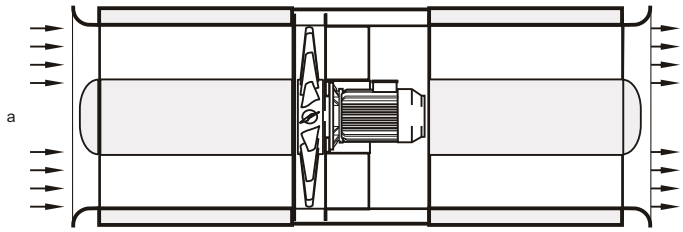
a Flow of air.

Figure 5 — Mixed-flow fan



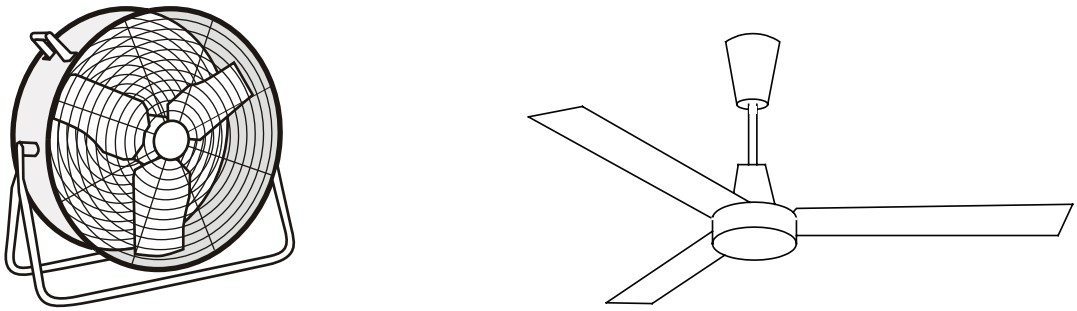
a Flow of air.

Figure 6 — Partition fans



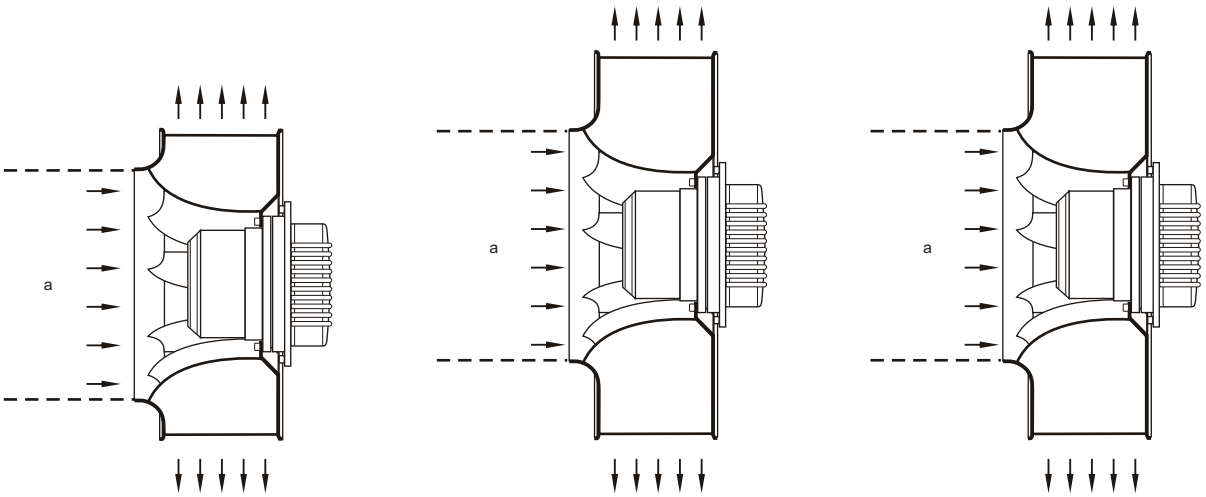
a Flow of air.

Figure 7 — Jet fan



a) For cooling **b) Ceiling fan**

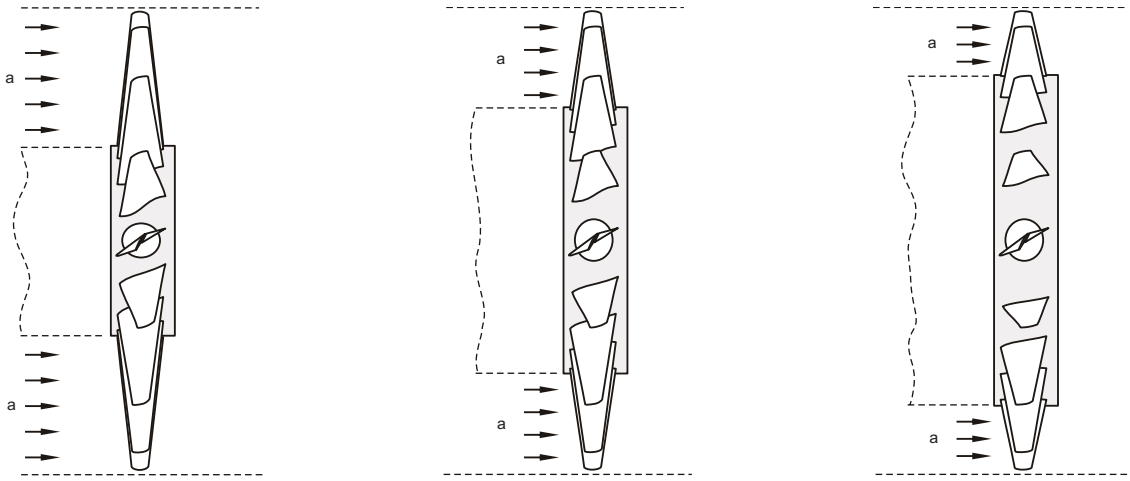
Figure 8 — Circulating fan



a) Low pressure **b) Medium pressure** **c) High pressure**

a Flow of air.

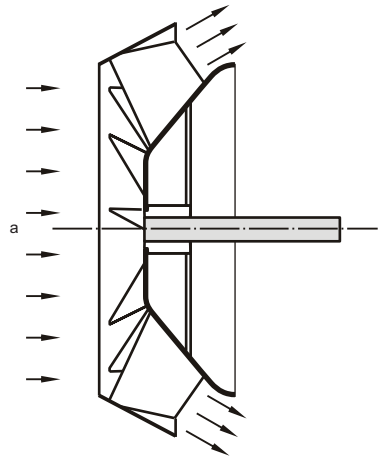
Figure 9 — Impellers of a centrifugal fan



a) Low pressure **b) Medium pressure** **c) High pressure**

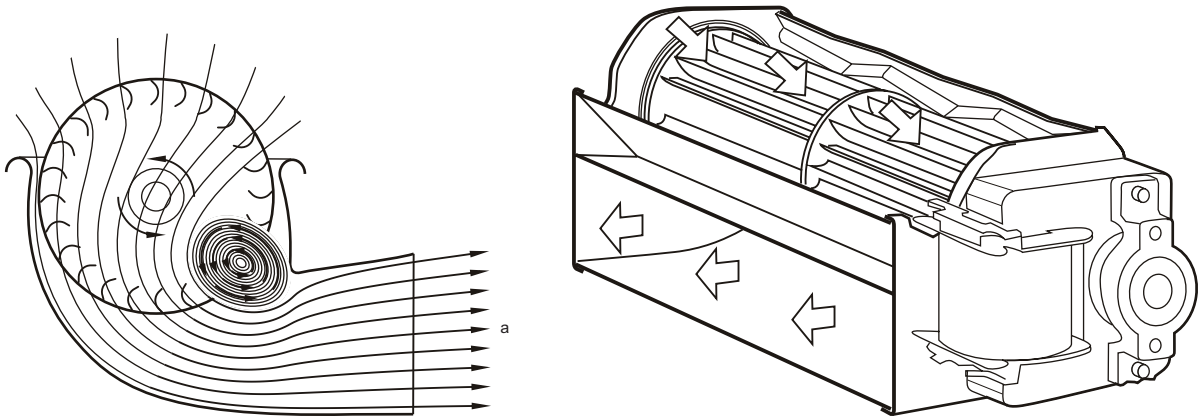
a Flow of air.

Figure 10 — Impellers of an axial-flow fan



a Flow of air.

Figure 11 — Impeller of a mixed-flow fan



a Flow of air.

Figure 12 — Cross-flow fan

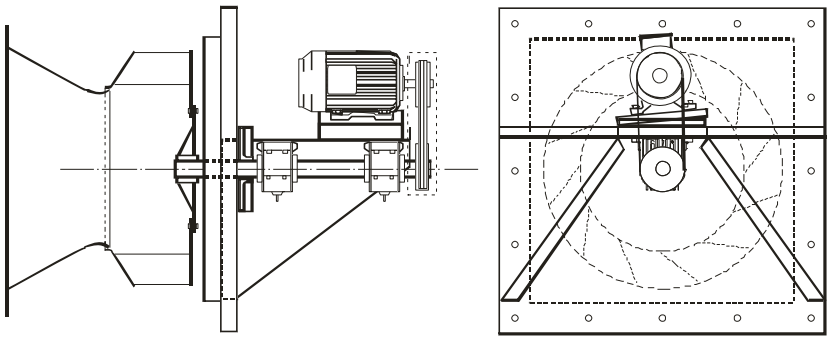


Figure 13 — Plug fan

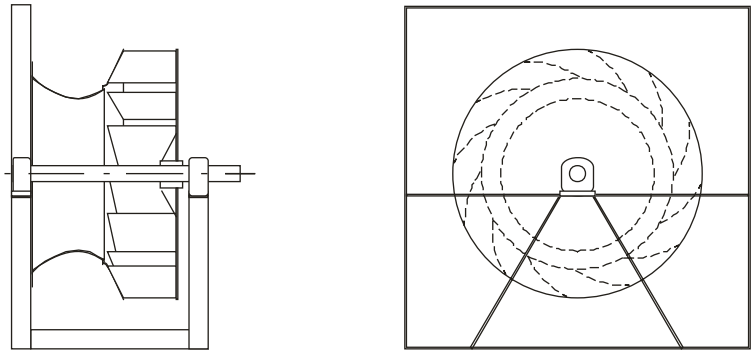
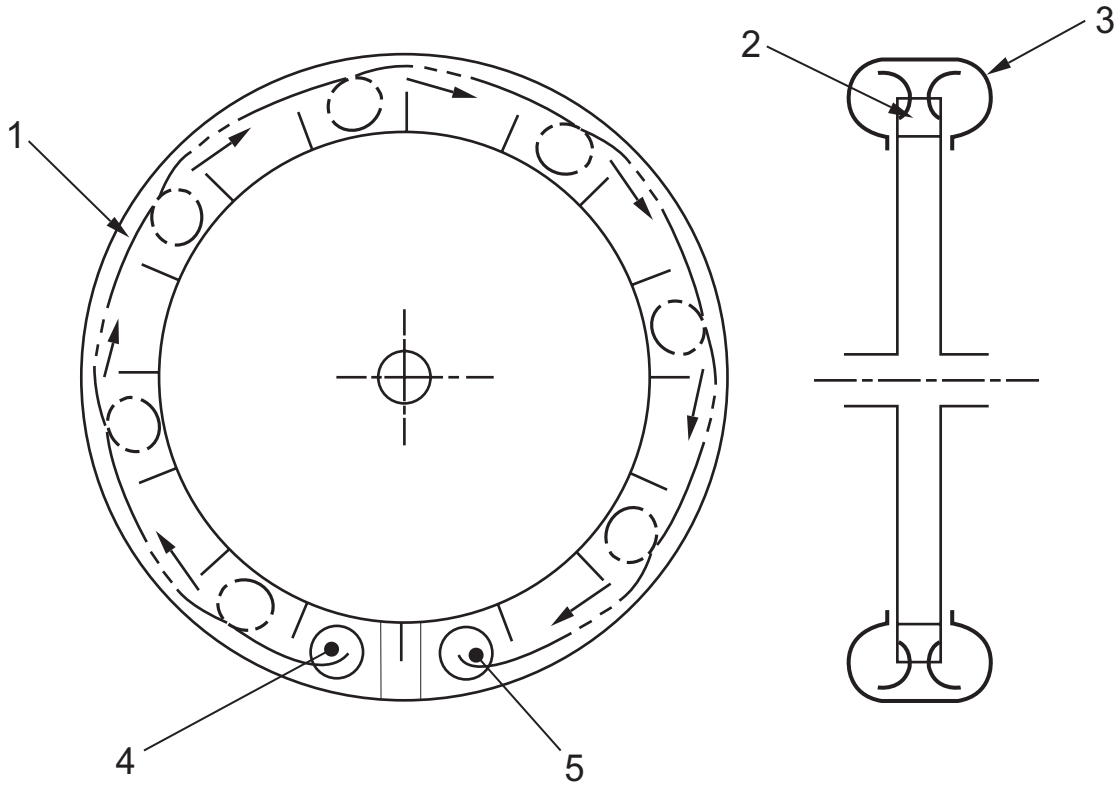


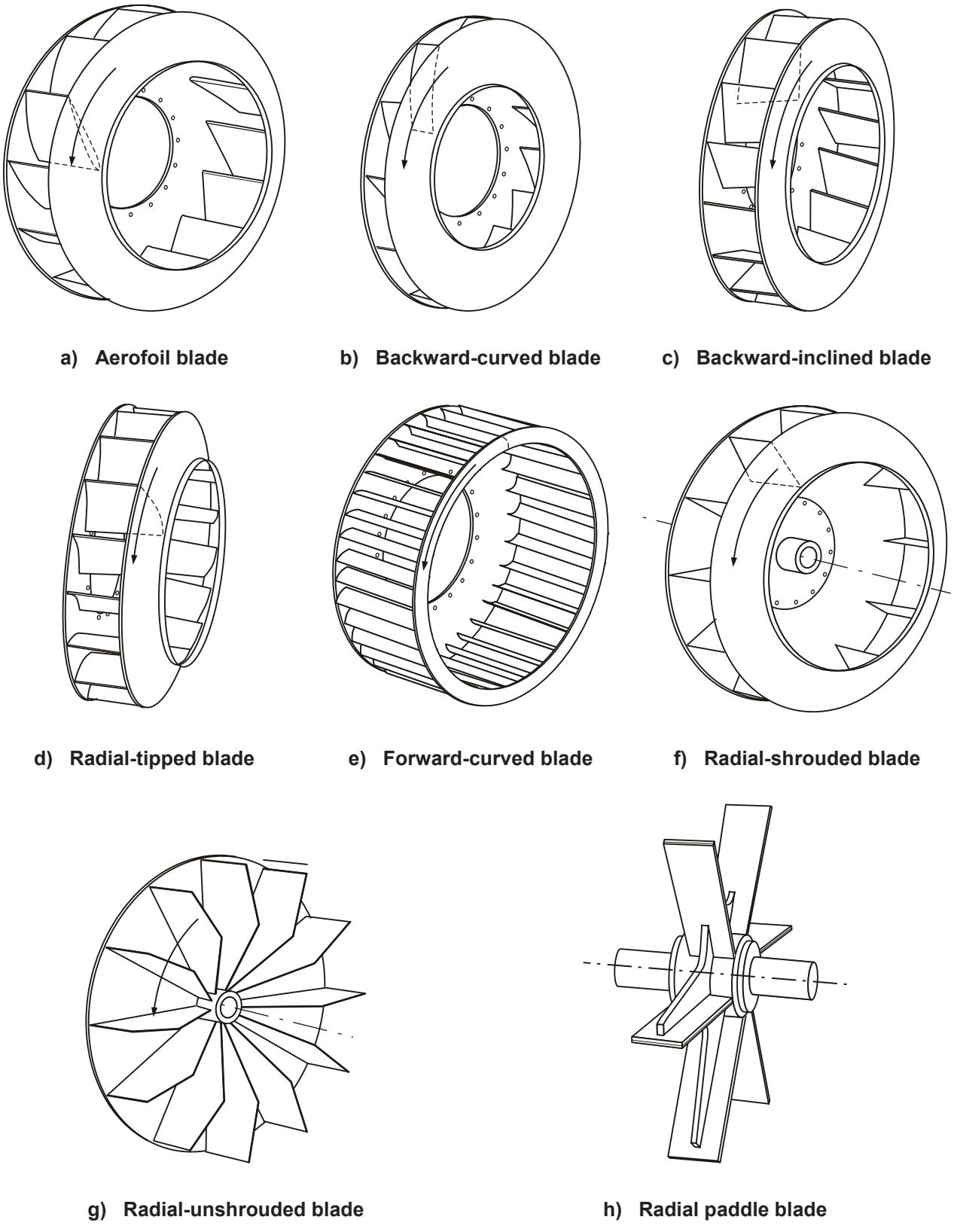
Figure 14 — Plenum fan



Key

1 fluid
2 blade
3 casing
4 inlet °C
5 outlet °C

Figure 15 — Impeller of a peripheral fan



a) Aerofoil blade

b) Backward-curved blade

c) Backward-inclined blade

d) Radial-tipped blade

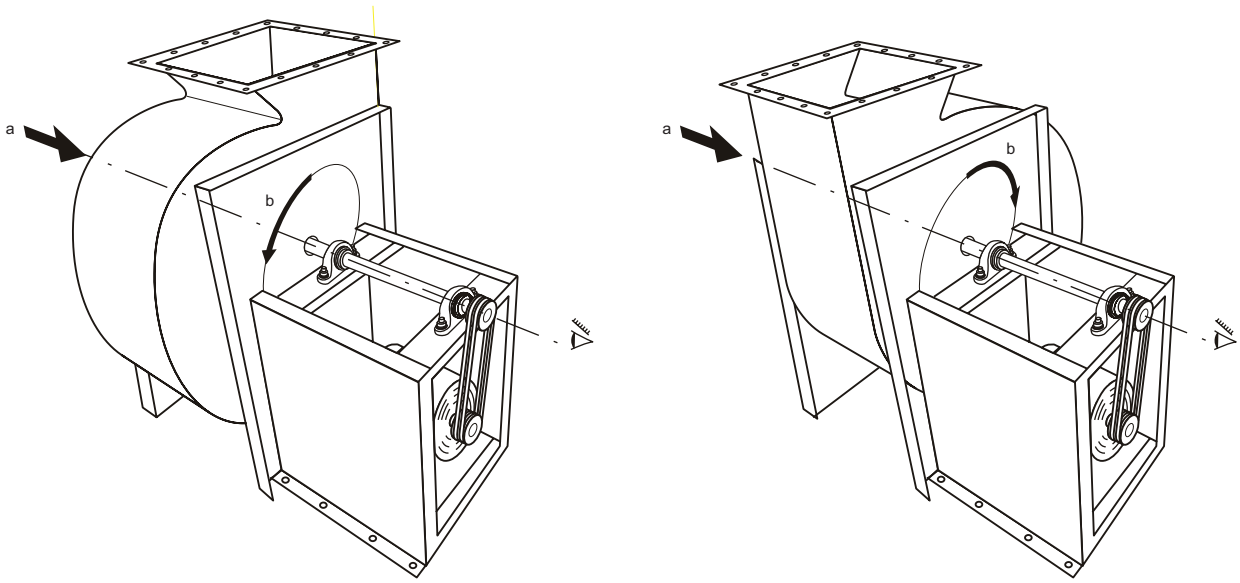
e) Forward-curved blade

f) Radial-shrouded blade

g) Radial-unshrouded blade

h) Radial paddle blade

Figure 16 — Centrifugal impeller types



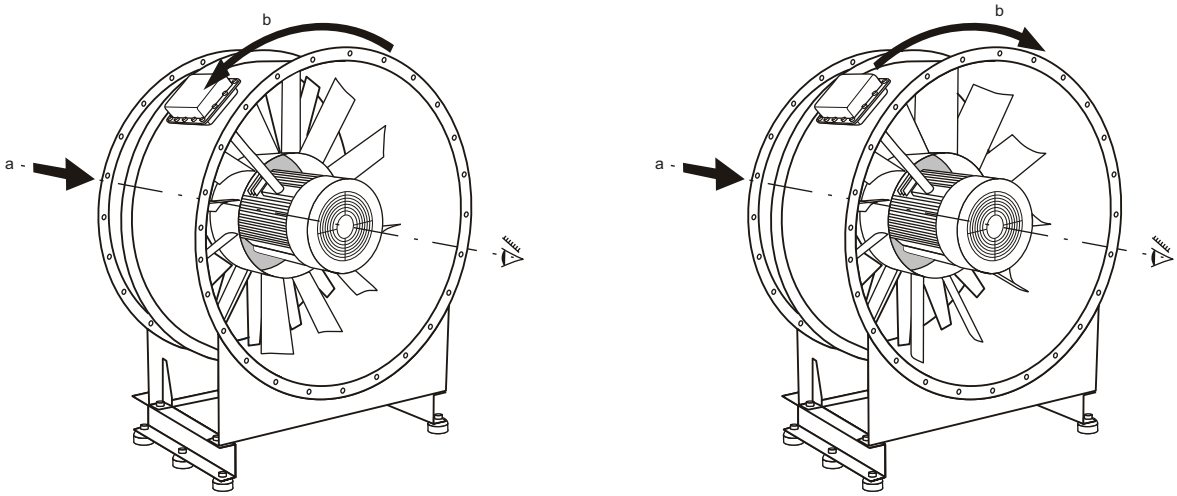
a) LG — Anticlockwise rotation **b) RD — Clockwise rotation**

a Flow of air.

b Direction of rotation.

The rotation of a single-inlet fan shall be determined from the side opposite the inlet, regardless of the actual location of the drives.

Figure 17 — Direction of rotation for centrifugal radial flow fan



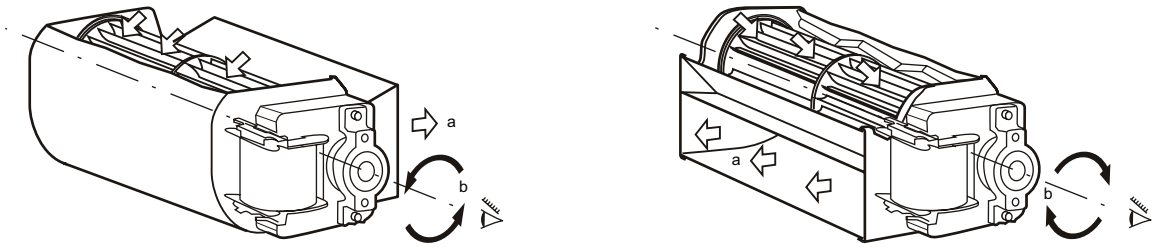
a) LG — Anticlockwise rotation **b) RD — Clockwise rotation**

a Flow of air.

b Direction of rotation.

NOTE The rotation of an axial-flow fan is determined from the side opposite the inlet.

Figure 18 — Direction of rotation of axial-flow and mixed-flow fans

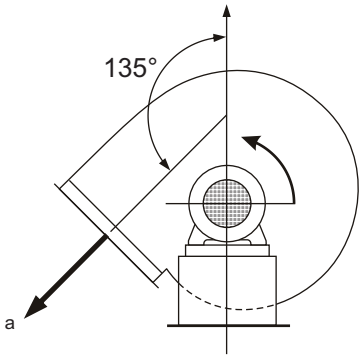


a) LG — Anticlockwise rotation **b) RD — Clockwise rotation**

a Flow of air.

b Direction of rotation.

Figure 19 — Direction of rotation of cross-flow fans



a Flow of air.

Figure 20 — Conventional designation of the outlet position of a centrifugal fan

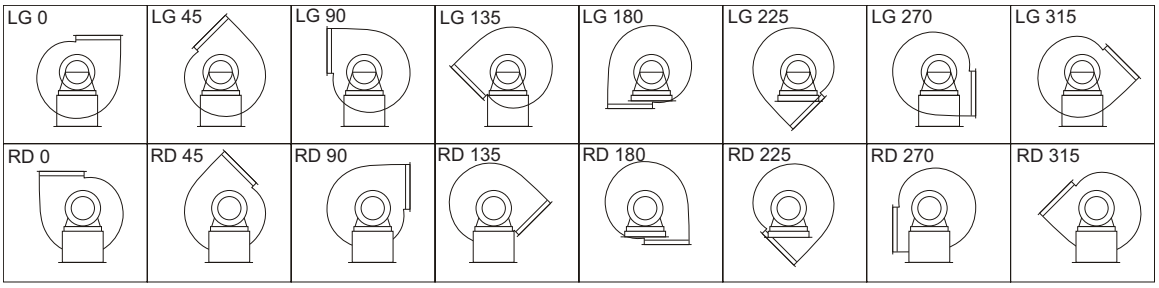
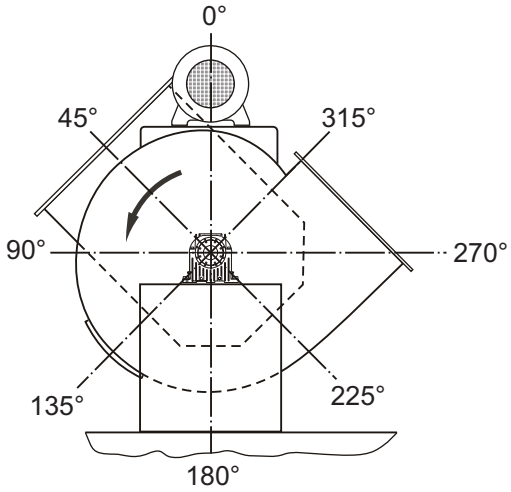
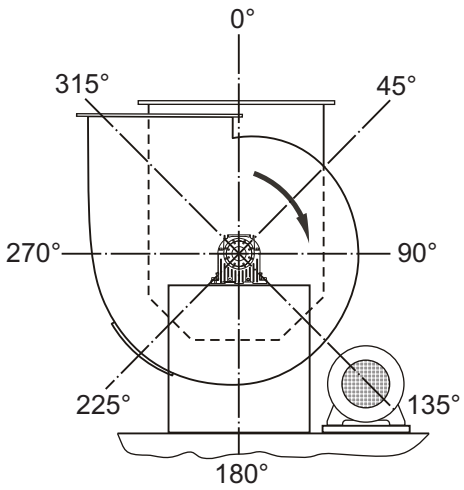


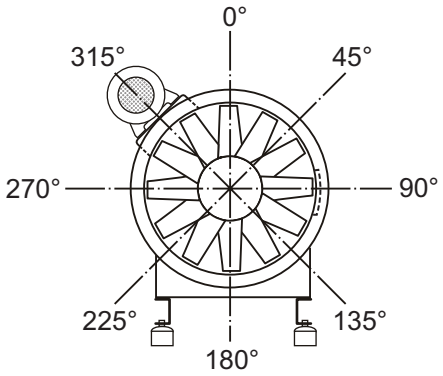
Figure 21 — Recommended positions for the outlet of a centrifugal fan





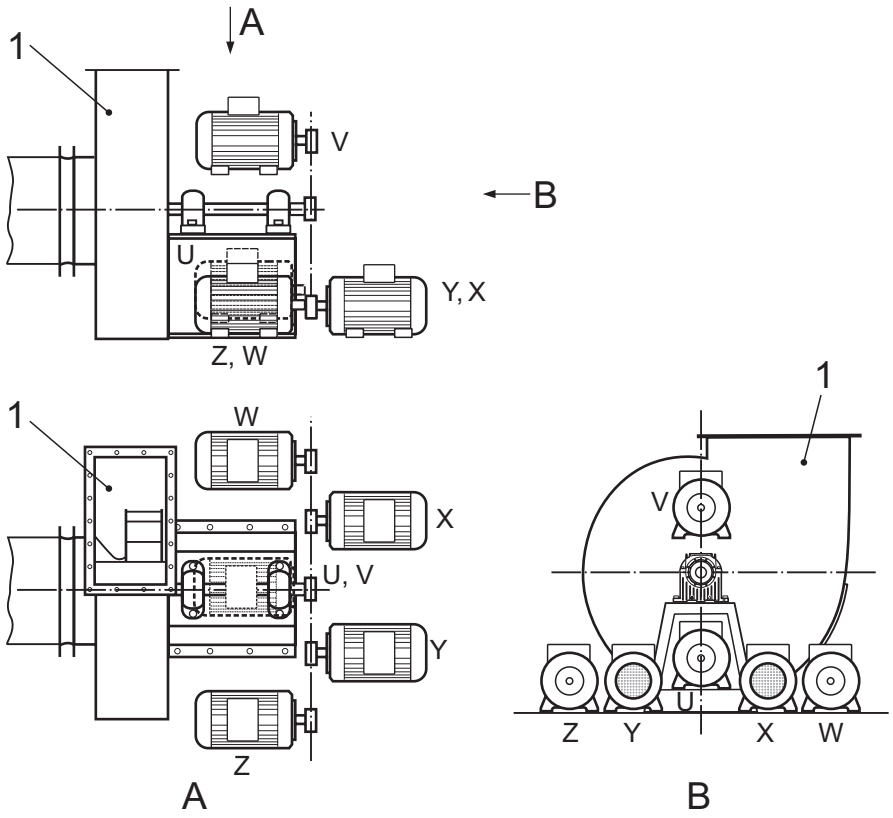
EXAMPLES				
	Outlet	LG 315	Outlet	RD 0
	Inspection door	LG 135	Inspection door	RD 225
	Inlet box	LG 45	Inlet box	RD 0
	Motor	LG 0	Motor	RD 135

Figure 22 — Conventional designation of the angular position of component parts of a centrifugal fan with volute casing



EXAMPLE Inspection door: 90°
Motor: 315°

Figure 23 — Conventional designation of the angular position of components of an axial-flow, mixed-flow or other fan with coaxial inlet and outlet



Key

1 fan

U below fan bearing level

V above fan bearing level

Figure 24 — Conventional designation of the alternative positions in plan view of a motor for a belt-driven fan

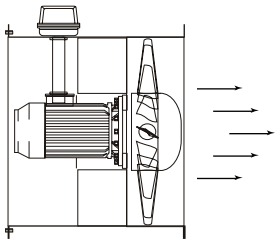
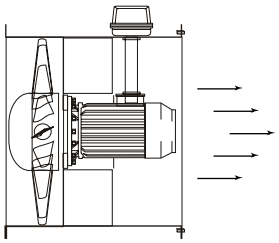
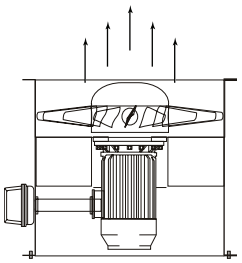
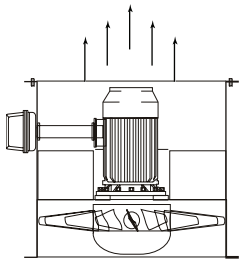
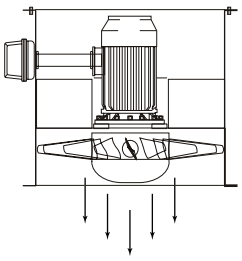
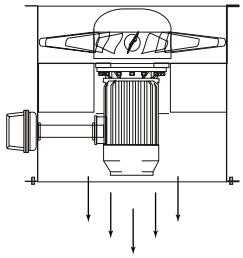
		A Motor upstream	B Motor downstream
Horizontal axis		 A	 B
Vertical axis	U Upward discharge	 AU	 BU
	D Downward discharge	 AD	 BD

Figure 25 — Conventional designation of the motor position in a direct-driven axial-flow, mixed-flow or other fan with coaxial inlet and outlet

Table 7 — Index illustration of fans

Ref.	Fan type	Features
Aa	Centrifugal	Backward-curved — indirect drive
Ab		Forward-curved — direct drive
Ac		Paddle blades — indirect drive
Ad		Vane control — coupled drive
Ae		Double inlet
Af		Multistage
Ag		Two stages with duct connection (duplex)
Ah		Radial blades
Ba	Axial-flow	Long casing — guide vanes — direct drive
Bb		Short casing — direct drive
Bc		Indirect drive
Bd		Shielded motor (bifurcated) — direct drive
Be		Multistage — indirect drive
Bf		Propeller fan
Ca	Mixed-flow	Direct drive
Da	Cross-flow	Direct drive

Table 8 — List of preferred terms for fan components

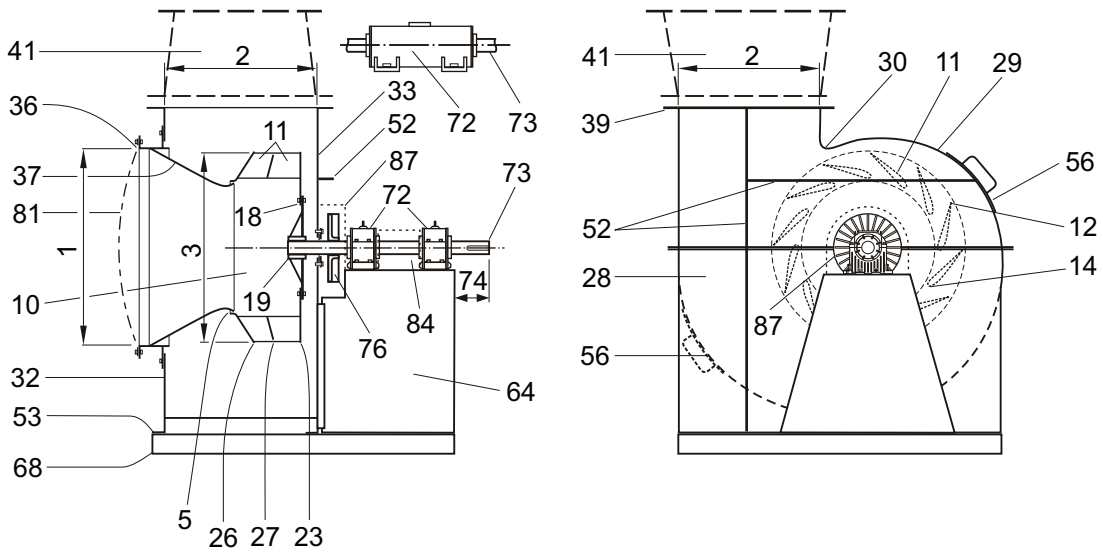
Item no.	Component part[a]	A[b]							B[b]						C[b]	D[b]
		a	**b**	**c**	**d**	**e**	**f**	**g**	**a**	**b**	**c**	**d**	**e**	**f**	**a**	**a**
10	Impeller	a	b	c	d	e	f	g	a	b	c	d	e	f	a	a
11	Blades	a	b	c		e	f		a	b	c	d	e	f	a	a
12	Blade tip	a	b	c			f									
13	Blade tip								a	b	c	d	e	f	a	
14	Blade inlet edge	a	b	c			f									
15	Blade leading edge								a	b			e	f		
16	Blade trailing edge								a	b			e	f		
17	Blade root								a	b	c	d	e		a	
18	Hub	a	b			e			a	b	c	d	e	f	a	
19	Hub boss	a	b	c		e	f		a	b					a	
20	Hub disc		b						a	b					a	
21	Hub rim								a	b					a	
22	Hub spider			c												
23	Impeller backplate	a	b				f									
24	Impeller centreplate					e										
25	Impeller endplate															a
26	Impeller shroud	a	b			e	f									
27	Impeller intermediate shroud	a														
28	Fan casing	a	b	c	d	e	f	g	a	b	c	d	e		a	a
29	Scroll plate	a	b	c	d	e	f	g								
30	Cut-off	a		c			f									
31	Extended cut-off		b			e										
32	Casing inlet sideplate	a	b	c	d	e	f	g								
33	Casing backplate	a	b	c	d		f	g								
34	Casing coverplate			c												
35	Inlet flange		b	c	d		f		a			d	e		a	
36	Inlet spigot	a														
37	Shaped inlet	a	b			e			a	b					a	
38	Inlet box		b						a							
39	Outlet flange	a		c			f	g	a			d	e		a	
40	Outlet spigot		b			e										
41	Outlet transformer	a														
42	Outlet expander						f		a				e			
43	Outlet reducer			c												
44	Interconnecting duct							g								
45	Centre fairing														a	
46	Upstream centre fairing								a				e		a	
47	Downstream centre fairing								a				e		a	
48	Fairing supports								a				e		a	
49	Guide vanes (a set)						f						e			
	(Guide vane)						f						e			
50	Upstream guide vanes (a set)								a							
	(Upstream guide vane)								a							
51	Downstream guide vanes (a set)								a				e		a	
	(Downstream guide vane)								a				e		a	
52	Casing stiffeners	a													a	
53	Base angles	a	b	c	d								e			

Table 8 (*continued*)

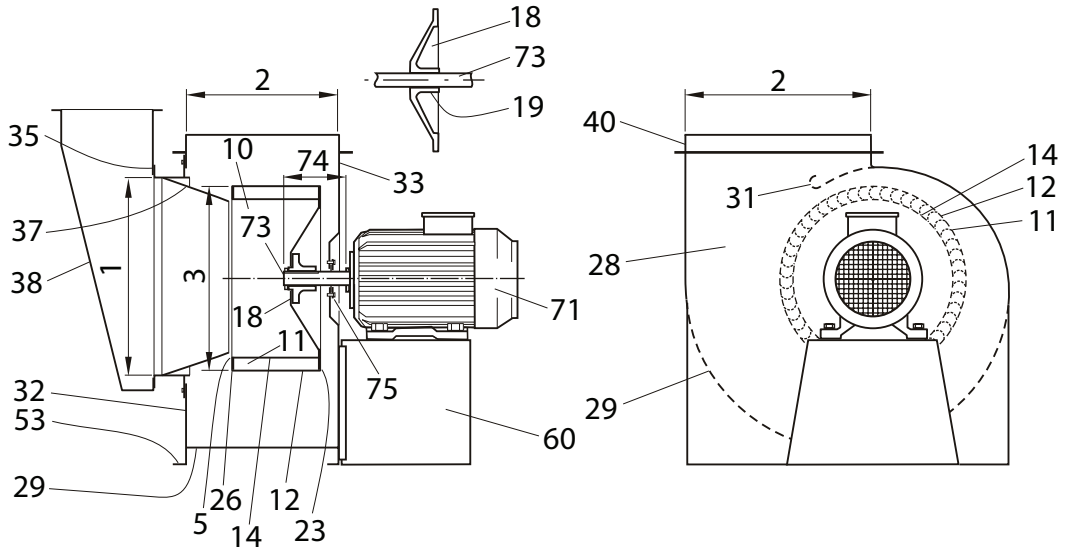
Item no.	Component part[a]	A[b]							B[b]						C[b]	D[b]
		a	**b**	**c**	**d**	**e**	**f**	**g**	**a**	**b**	**c**	**d**	**e**	**f**	**a**	**a**
54	Foot or feet					e			a		c				a	a
55	Casing drain			c												
56	Access or inspection door	a		c					a		c					
57	Mounting ring (wall flange)									b						
58	Mounting lugs									b						
59	Diaphragm plate													f		
60	Motor stool		b													
61	Motor bracket										c	d				
62	Motor arms									b				f		
63	Motor supports								a						a	
64	Bearing pedestal	a														
65	Bearing bracket			c									e			
66	Bearing stool				d											
67	Bearing supports					e					c					
68	Baseframe	a		c									e			
69	Anti-vibration mountings			c									e			
70	Combination baseplate				d											
71	Motor or other prime mover		b	c	d		f	g	a	b	c	d	e	f	a	a
72	Bearings	a		c	d	e					c		e			a
73	Shaft	a	b	c	d	e	f		a	b	c	d	e	f	a	a
74	Shaft extension	a	b	c		e			a							
75	Shaft seal		b													
76	Cooling disc (or impeller)	a														
77	Fan pulley			c							c		e			
78	Motor pulley			c							c		e			
79	Drive belt(s)			c							c		e			
80	Coupling				d											
81	Inlet guard	a							a						a	
82	Motor-side guard									b				f		
83	Impeller-side guard									b				f		
84	Shaft guard	a			d											
85	Drive guard			c							c		e			
86	Coupling guard				d											
87	Cooling disc (or cooling impeller) guard	a														
88	Inlet vane control				d											
	Dimensions															
1	Fan inlet	a	b	c	d		f	g	a			d	e		a	a
2	Fan outlet	a	b	c		e	f	g	a	b		d	e		a	a
3	Impeller tip diameter	a	b	c					a	b	c	d	e	f	a	
4	Impeller tip clearance								a	b	c	d	e	f	a	
5	Impeller inlet clearance	a	b	c		e	f									

[a] See Figures 26, 27, 28 and 29.

[b] See Table 7.

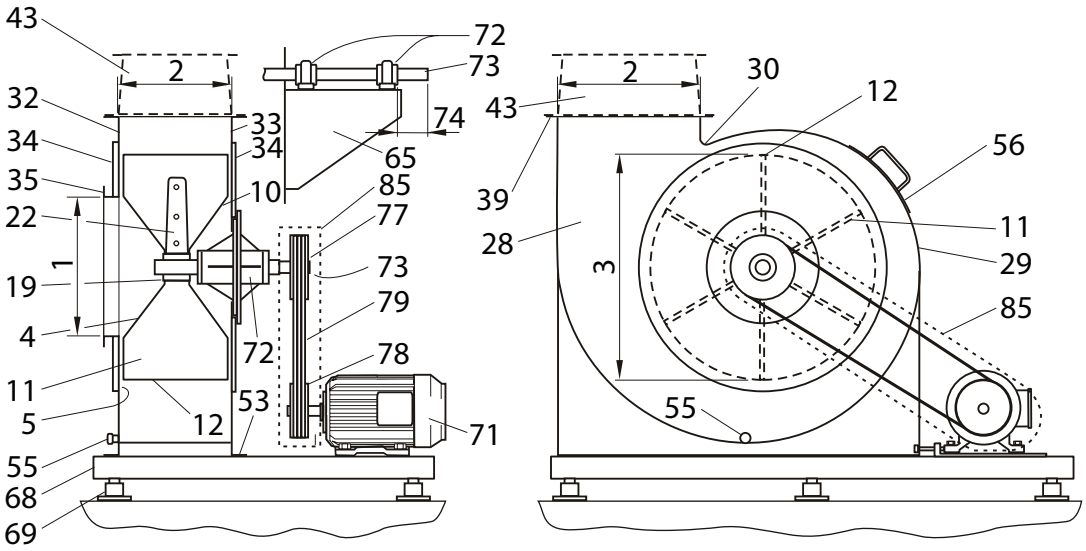


a) Example 1



b) Example 2

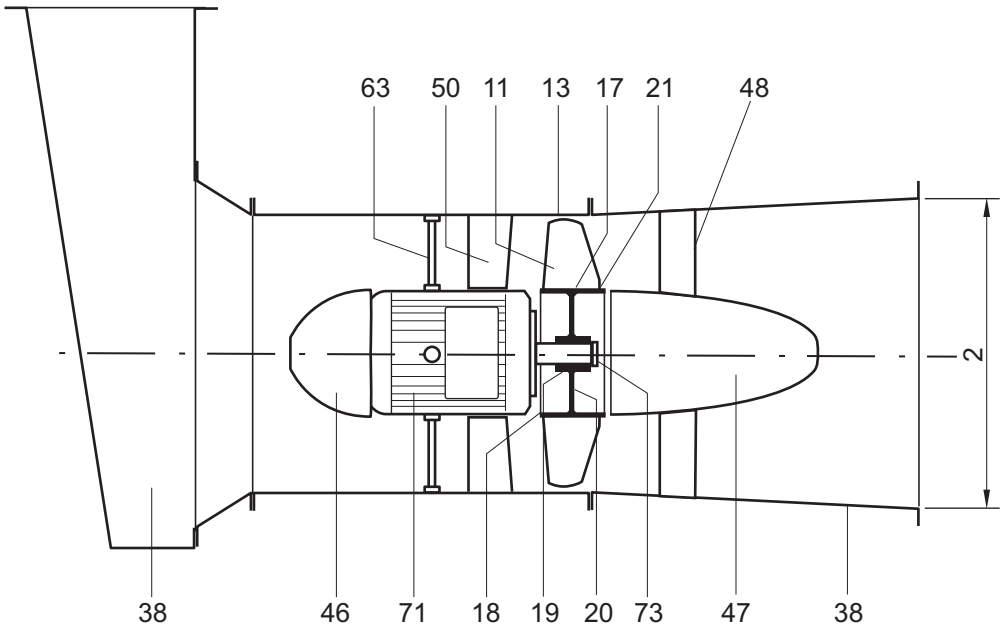
Figure 26 — Illustrations of centrifugal fans (*continued*)



c) Example 3

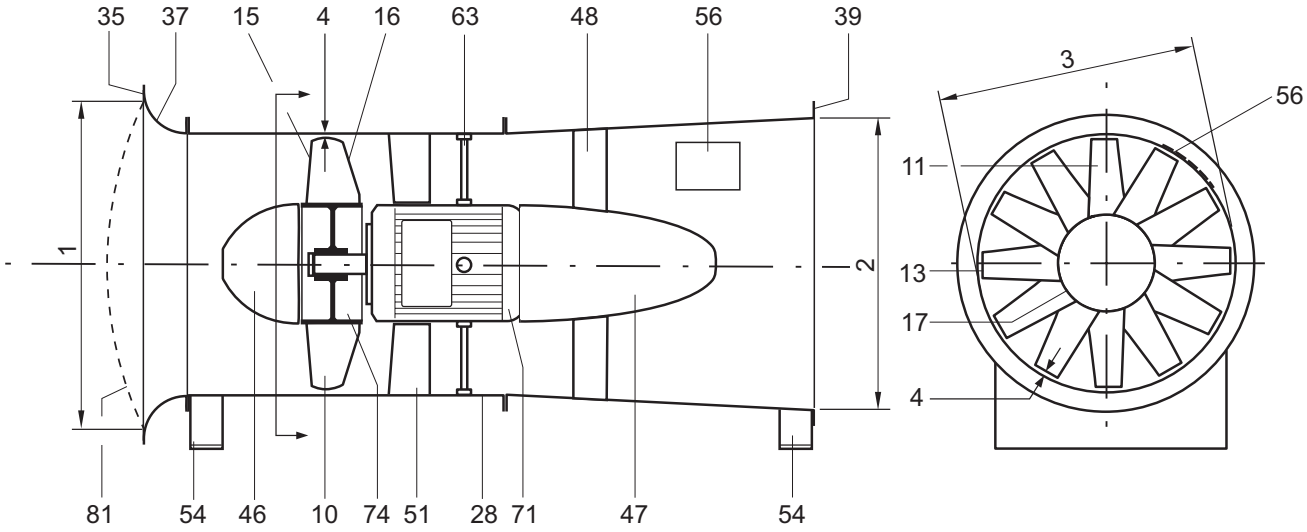
NOTE See Tables 7 and 8.

Figure 26 — Illustrations of centrifugal fans

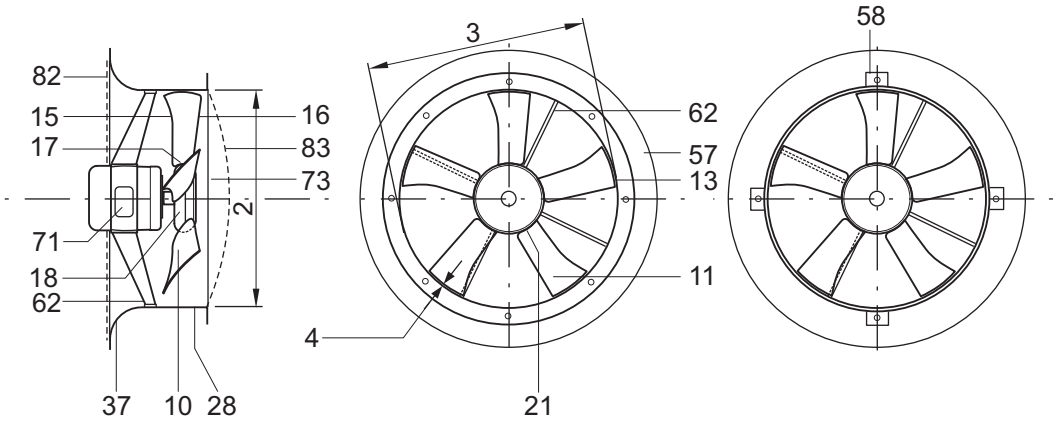


a) Example 1

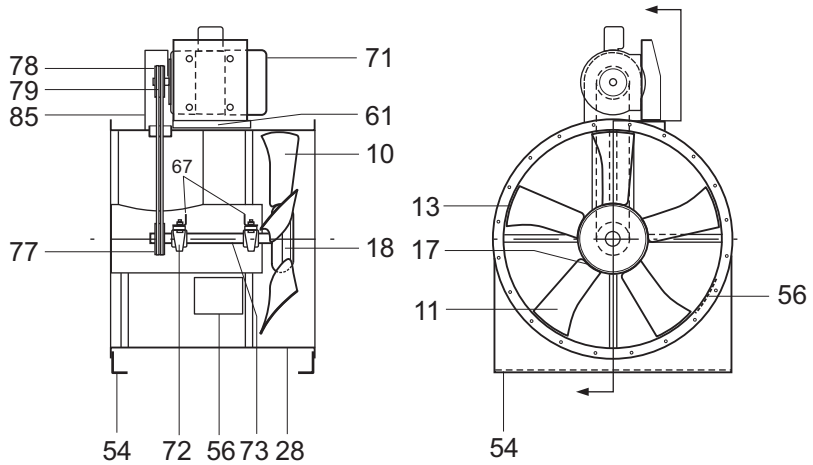
Figure 27 — Illustrations of axial-flow fans (*continued*)



b) Example 2

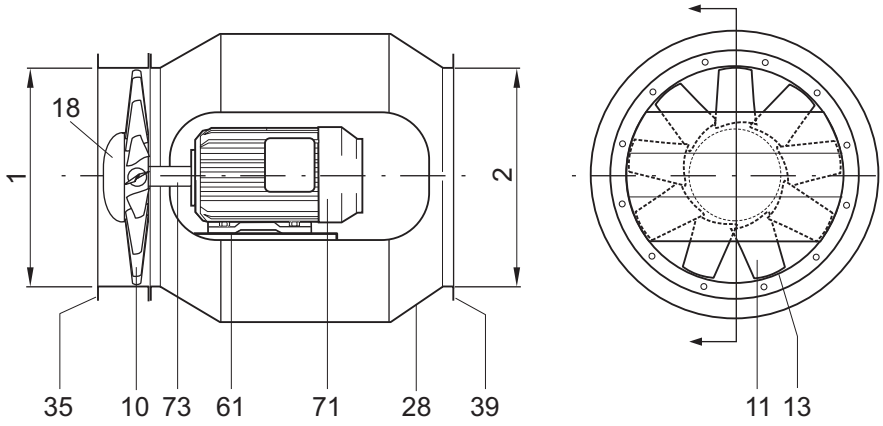


c) Example 3

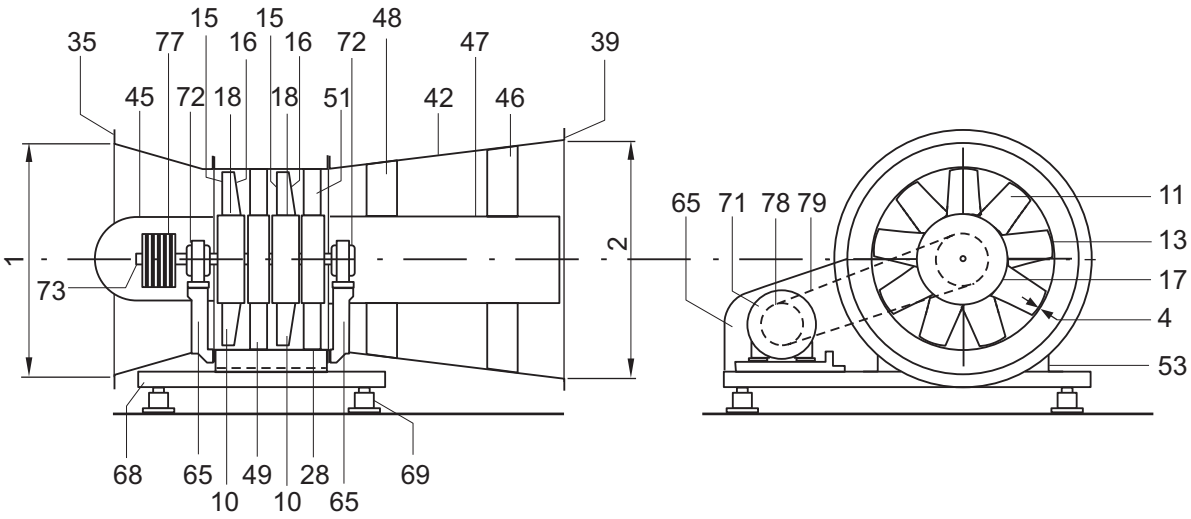


d) Example 4

Figure 27 — Illustrations of axial-flow fans (*continued*)



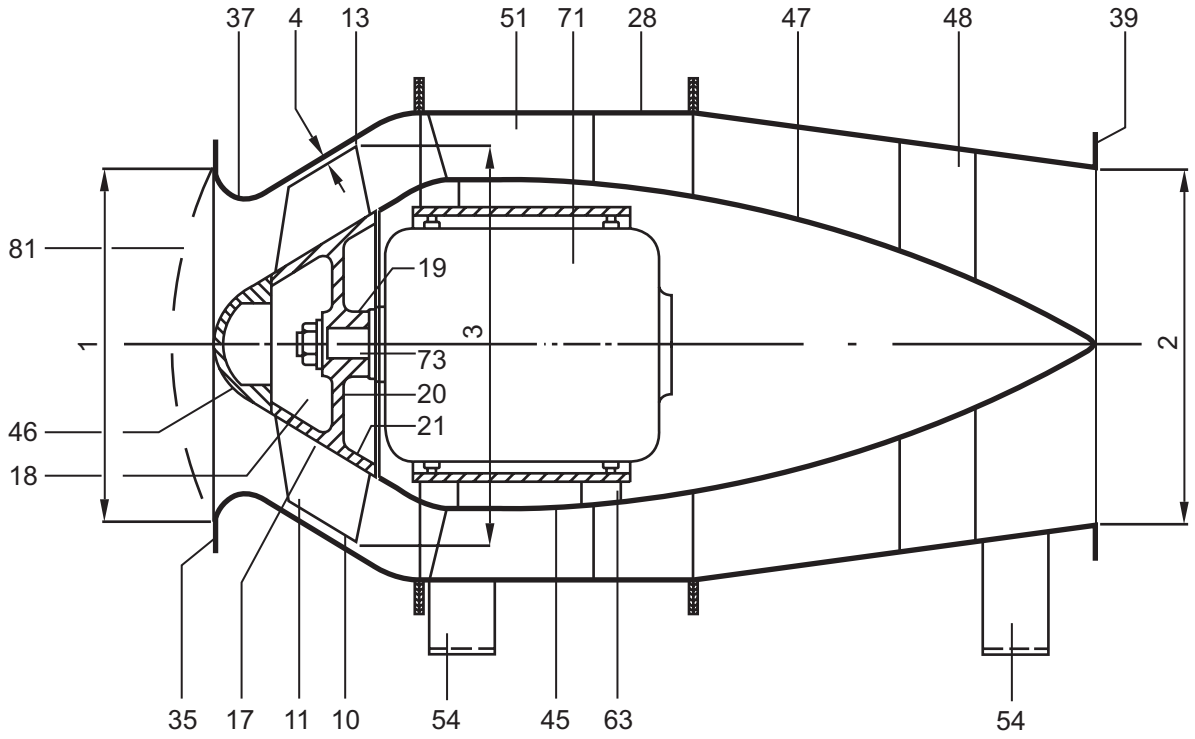
e) Example 5



f) Example 6

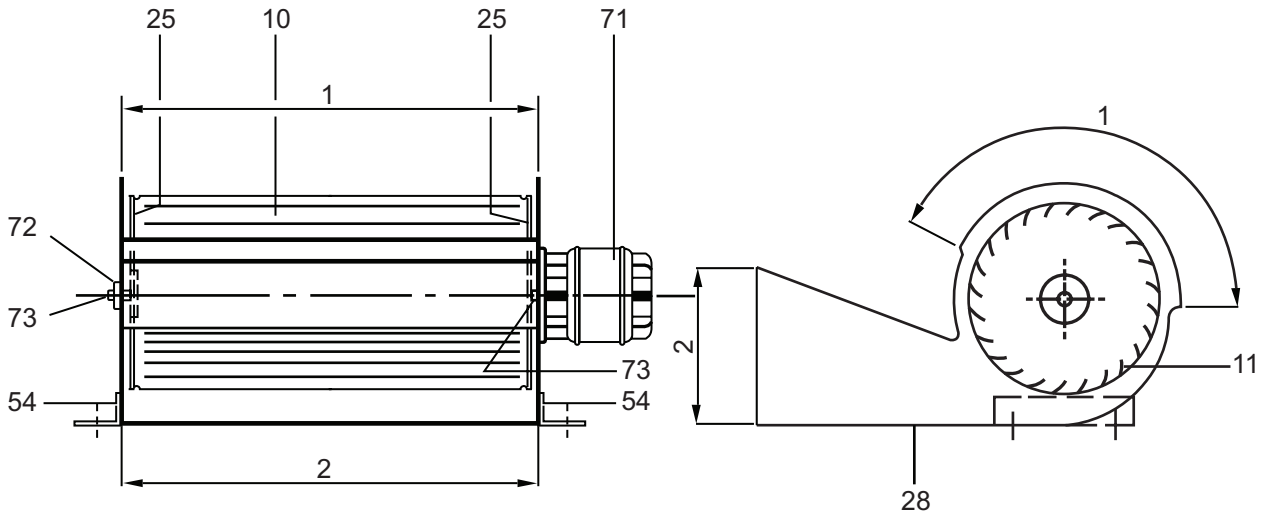
NOTE See Tables 7 and 8.

Figure 27 — Illustrations of axial-flow fans



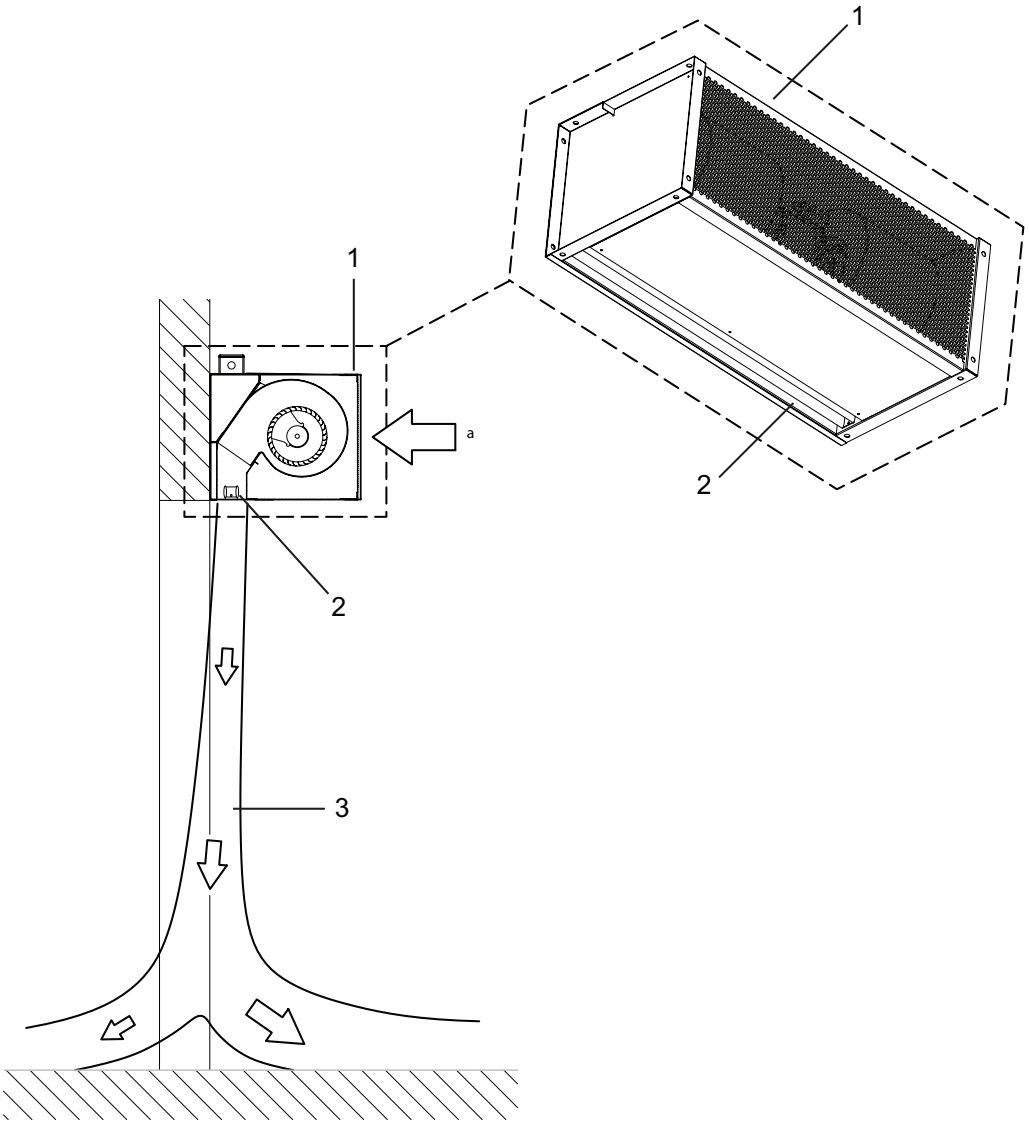
NOTE See Tables 7 and 8.

Figure 28 — Illustrations of a bifurcated mixed-flow fan



NOTE See Table 8.

Figure 29 — Illustrations of a cross-flow fan



Key

1 air curtain unit
2 outlet nozzle
3 air curtain

[a] Flow of air.

Figure 30 — Illustration of an air curtain and air curtain unit

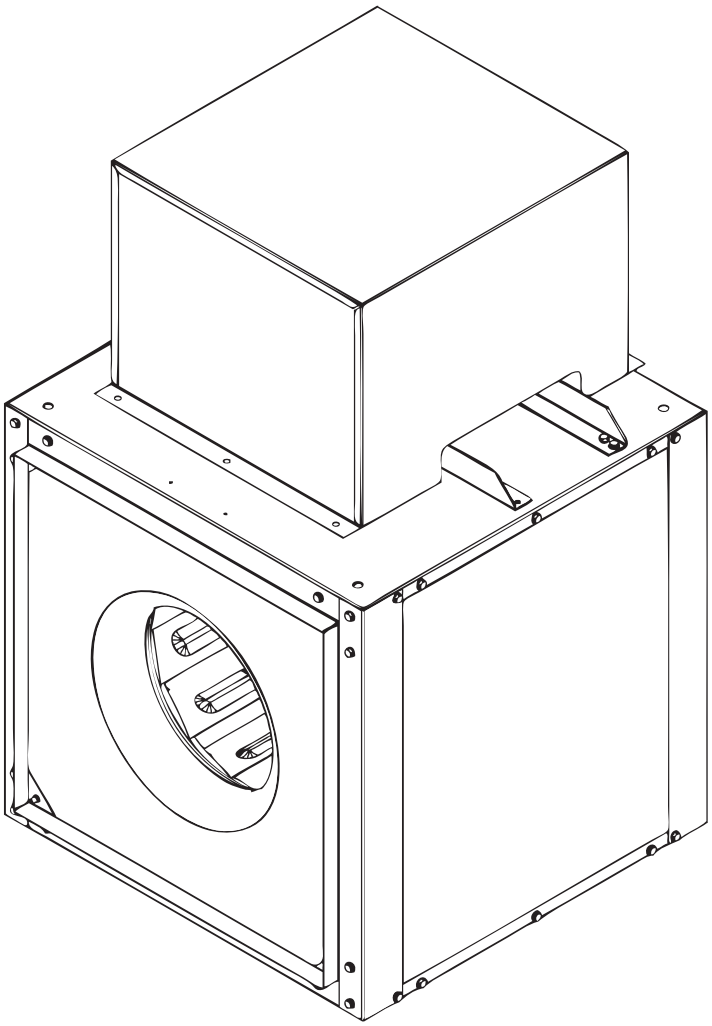
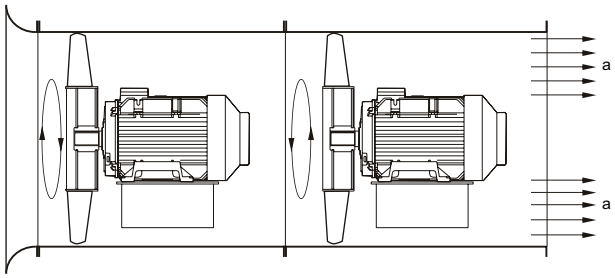


Figure 31 — Illustration of a box fan



[a] Flow of air.

Figure 32 — Illustration of a contra-rotating fan

Annex A
(informative)

Examples

A.1 Example 1 — Centrifugal fan

The coupling-drive heavy-duty centrifugal fan with impeller between bearings is designed for a duty of 38 m^3/s against a fan pressure of 6,3 kPa.

The casing should be suitable for supporting the associated ducting. Side boxed inlet with vane control and diffuser on the outlet terminates in a flange to match the client's ducting. The casing should be fitted with an inspection door and be suitable for handling radioactive fumes without detectable leakage.

Installation category	Category D	3.4, Figure 1
Type of fan as a function of its role	Ducted	3.5
Type of fan according to fluid path	Centrifugal	3.6
Suitability for pressure	High pressure, Category M/6	5.2, Table 1
Casing construction	Category 3	5.3.1, Table 2
Temperature category	Gas-tight fan, Category G	5.3.4, Table 3
Drive arrangement	Coaxial coupling, arrangement no. 7	5.4, Table 4
Inlet/outlet conditions	SD	5.5, Table 6
Method of fan control	Vane control	5.6
Component parts	Outlet RD 45	5.8, Figures 20, 21, 22
	Inspection door RD 315	
	Inlet box RD 0	
Motor position	In-line	5.8, Figure 22

A.2 Example 2 — Axial-flow fan

The belt drive axial-flow fan has a duct-mounted motor for open-inlet, ducted-outlet installation with discharge diffuser. Duty fan pressure is 1,0 kPa and flow rate is 20 m^3/s at standard density. The fan is also required to operate under emergency conditions, with a gas temperature of 300 °C for 1 h. There is an inspection door on the casing.

Installation category	Category B	3.4, Figure 1
Type of fan as a function of its role	Ducted	3.5
Type of fan according to fluid path	Axial-flow	3.6
Suitability for pressure	Medium pressure, Category L/2	5.2, Table 1
Casing construction	Category 2	5.3.1, Table 2
Temperature category	Smoke ventilating fan, Category D (HT/300/1,0)	5.3.3
Drive arrangement	Belt drive: arrangement no. 9	5.3.4, Table 5
Inlet/outlet conditions	ED	5.5, Table 6
Method of fan control	Vane control	5.6
Component parts	Rotation RD	5.7, Figure 18
	Inspection door 90°	
Motor position	Motor 0	5.7, Figure 23

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[2] ISO 12759, *Fans — Efficiency classification for fans*[1)]

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[4] ISO 13347-2, *Industrial fans — Determination of fan sound power levels under standardized laboratory conditions — Part 2: Reverberant room method*

[5] ISO 13347-3, *Industrial fans — Determination of fan sound power levels under standardized laboratory conditions — Part 3: Enveloping surface methods*

[6] ISO 13347-4, *Industrial fans — Determination of fan sound power levels under standardized laboratory conditions — Part 4: Sound intensity method*

[7] ISO 13348, *Industrial fans — Tolerances, methods of conversion and technical data presentation*

[8] ISO 13350, *Industrial fans — Performance testing of jet fans*

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[10] ISO 14695, *Industrial fans — Method of measurement of fan vibration*

[11] ISO 27327-1, *Fans — Air curtain units — Part 1: Laboratory methods of testing air curtain units for aerodynamic performance rating*

[12] ISO 80000-1, *Quantities and units — Part 1: General*

1) Under preparation.

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