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Draft Indian Standard

Specification for Three-Phase Induction Motors for Fans used in Air-Conditioning and Ventilation

(First Revision of IS 14377)

Rotating Machinery

Last date for comments – 12/01/2025

Sectional Committee, ETD 15

FOREWORD

(Formal clauses will be added later).

This standard has been prepared to specify the requirements for three-phase squirrel cage induction motors intended to be used for fans used in air-conditioning and ventilation.

Fans covered in this standard may be classified into following two groups:

- a) Axial flow fans which produce a flow of air in a direction parallel to the axis of rotation. The axial flow fans are most commonly used for applications requiring flow against low resistances. These fans are applied in air-conditioning work.
- b) Centrifugal fans which produce a flow perpendicular to the axis of rotation. Centrifugal fans may have either straight radial blades or blades curved with reference to the direction of rotation. The centrifugal fans are best adapted to moving air against considerable frictional resistance.

The requirements of single-phase fan duty motors are covered by IS 996: 2009.

This standard has been prepared on the basis of IEEMA 8: 1987 IEEMA standard for induction motors for fans used in air-conditioning and ventilation, issued by Indian Electrical and Electronics Manufacturers' Association, Bombay.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test, shall be rounded off in accordance with IS 2: 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Draft Indian Standard

SPECIFICATION FOR THREE-PHASE INDUCTION MOTORS FOR FANS USED IN AIR-
CONDITIONING AND VENTILATION

SCOPE

1.1 This standard covers three-phase squirrel cage induction motors for driving fans for ventilation, air-conditioning and commercial heating for voltages up to and including 11000 V and having windings with Class E, Class B and Class F insulation (*see* IS 1271).

1.2 This standard does not cover induction motors for induced draught fans.

1.3 Motors for use on systems employing non-preferred voltage and frequency (*see* 9) shall be considered as complying with this standard provided that these comply in all respects. The voltage and frequency for which they are designed shall be indicated on the rating plate of the motor.

2 REFERENCES

The standards listed in Annex A contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards.

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 15999 (Part 1)/IEC 60334-1 and IS 1885 (Part 35) shall apply.

4 CHARACTERISTICS FOR FANS

Typical characteristics for axial flow fans, centrifugal fans with forward curved blades, and centrifugal fans with backward curved blades, are given in Annex B.

5 SITE CONDITIONS

5.1 The site conditions set out in IS 15999 (Part 1)/IEC 60034-1 shall apply.

5.2 In case the cooling air temperature is higher than the ambient temperature of 40 °C the variation shall be in steps of 5 °C. The limits of permissible temperature-rise for different classes of insulation shall then be correspondingly reduced from the values given in IS 15999 (Part 1)/IEC 60034-1, by the amount by which the cooling air temperature exceeds 40 °C.

5.3 Supply Voltage and Frequency Variation

5.3.1 The induction motors covered by this standard shall be capable of delivering rated output with:

- a) terminal voltage differing from its rated value by not more than 6 percent;
- b) frequency differing from its rated value by not more than 3 percent; and
- c) any combination of (a) and (b).

5.3.2 In case of continuous operation at extreme voltage limits, the temperature-rise limits specified in Table 8 'Limits of temperature rise of windings indirectly cooled by air' of IS 15999 (Part 1)/IEC 60034-1 shall not be exceeded by more than 10 °C.

5.3.4 Motors, when operated under the extreme conditions of voltage and frequency variation, may not necessarily have their performance in accordance with IS 15999 (Part 1)/IEC 60034-1.

5.4 It shall be assumed that the location and moisture or fumes shall not seriously interfere with the operation of the motor for driving fans.

6 TYPE OF ENCLOSURE

The motor for driving fans shall have enclosure providing one of the degrees of protection specified in IS/IEC 60034-5.

7 METHOD OF COOLING

The methods of cooling of motors and their designations shall be in accordance with IS 6362.

8 MATERIALS

All materials and components including insulation windings shall conform to relevant Indian Standards wherever these exist. Wherever it is not practicable to comply with this requirement, it shall be subject to agreement between the manufacturer and the purchaser.

9 RATINGS

9.1 Rated Voltage

The preferred rated voltages shall be 415 V, 3.3 kV, 6.6 kV and 11 kV in accordance with IS 12360.

9.2 Rated Frequency

9.2.1 The rated frequency shall be 50 Hz.

9.2.2 Rated Output

The preferred output ratings of the motor shall be in accordance with 5.5 'Rated output' of IS 15999 (Part 1)/IEC 60334-1.

10 DUTY RATING

For the purpose of this standard, only duty S1 (continuous duty as per IS 15999 (Part 1)/IEC 60034-1) shall be applicable.

11 DIMENSIONS

11.1 The dimensions of the foot-mounted motor shall conform to IS 1231. The flange mounted motor shall have dimensions in accordance with IS 2223.

11.2 Mounting dimensions for rod mounted motors shall be in accordance with Table 1.

11.3 Threaded Shaft

11.3.1 All motor shafts of 30 mm diameter and above shall be provided with center holes. The dimensions of the threaded center hole in the shaft shall be in accordance with IS 2540.

11.3.2 For motor shafts below 30 mm diameter, the provision of the threaded centerhole shall be subject to agreement between the manufacturer and the purchaser. However, the dimensions of the agreed threaded center hole shall be in accordance with IS 2540.

Table 1 Mounting Dimensions for Rod Mounted Motor
(Clause 11.2)

| Sl No. | Frame Number (See IS 1231) | Maximum Overall Dimensions, mm | | | |
|--------|-------------------------------|--------------------------------|-----|-------|-----|
| | | (3) | (4) | (5) | (6) |
| (1) | (2) | (3) | (4) | (5) | (6) |
| i) | 80 | 95 | 90 | 55 | M12 |
| ii) | 90L | 105 | 90 | 73.5 | M12 |
| iii) | 100L | 117 | 100 | 83 | M12 |
| iv) | 112M | 130 | 100 | 90 | M12 |
| v) | 132M | 155 | 140 | 108 | M16 |
| vi) | 160L | 185 | 200 | 135 | M20 |
| vii) | 180L | 205 | 200 | 160.5 | M20 |
| viii) | 200L | 229 | 224 | 173.5 | M24 |
| ix) | 225M | 255 | 224 | 192.5 | M24 |
| x) | 250M | 285 | 224 | 230.5 | M24 |

12 EARTHING

Earthing of the motor shall be done in accordance with the relevant provisions of IS 3043.

13 PERFORMANCE VALUES

Unless otherwise specified by the user, the performance values of the motor for driving fans shall be in accordance with IS 15999 (Part 1)/IEC 60334-1.

14 TORQUES

14.1 With any of the methods employed for starting the motor, the minimum motor torque shall be higher than that of fan/blower in the entire range of operation.

14.2 Breakaway (Starting) Torques

14.2.1 The motor shall develop adequate breakaway torque for smooth and satisfactory the load. Recommendations acceleration to control of the period of starting furnished acceleration and the requirements by fan manufacturers, required to facilitate to be smooth of the load are given in Annex C.

15 OVERLOAD

The provisions of IS 15999 (Part 1)/IEC 60334-1 shall apply.

16 LIMITS OF VIBRATION SEVERITY

Unless otherwise specified by the user, the severity of vibration for the motors shall be within the limits specified in IS 12075.

17 LIMITS OF TEMPERATURE RISE

17.1 The limits of permissible temperature rise above the cooling medium temperature for motors having windings with Class E, Class-B and Class F insulation shall be in accordance with IS 15999 (Part 1)/IEC 60034-1.

17.2 Some motors located inside ducts are cooled by the air stream of the driven load. The air thrown by the driven fan serves to cool the motor body. In such cases, the temperature-rise of the motor is also dependent on the velocity of air flowing over the- motor body and the temperature-rise test on these motors can be conducted only with the driven fan and other accessories like ducts, dampers, mounted in position. The temperature rise tests for such motors may be carried out subject to agreement between the manufacturer and the purchaser.

18 EFFICIENCY AND POWER FACTOR

18.1 Efficiency

The efficiency shall be declared at the rated load of the motor. The method of determining the efficiency shall be in accordance with IS 4029. The tolerance applicable to the determined values shall be in accordance with IS 15999 (Part 1)/IEC 60334-1.

18.2 Power Factor

If a statement of power factor is required, shall be declared at the rated load of the motor. The method of determining the power factor shall be in accordance with IS 4029. The tolerance applicable to the determined accordance values shall be in **12** 'Tolerances' of IS 15999 (Part 1)/IEC 60334-1.

19 TOLERANCES

The tolerances on performance be in values shall be in accordance with **12** 'Tolerances' of IS 15999 (Part 1)/IEC 60334-1.

20 TERMINAL AND TERMINAL MARKINGS

20.1 The position of the terminal box, other than rod mounted motors; shall be in accordance with IS 1231. In case of rod mounted motors it shall be subject to agreement between the manufacturer and the purchaser.

20.2 The terminal markings of the motor shall conform to IS 15999 (Part 7)/IEC 60034-7.

21 RATING PLATE

A rating plate stating the following shall be provided with each motor:

- a) Reference to this standard, that is, Ref. ISS
- b) Induction motor for fan used in air conditioning and ventilation;
- c) Name of the manufacturer;
- d) Manufacturer's number and frame number or flange designation;
- e) Class of duty;
- f) Class of insulation;
- g) Rated voltage;
- h) Rated frequency in Hz;
- j) Number of phases and winding connections;
- k) Rated output in kW;
- m) Speed in revolutions per minute, at rated output;
- n) Rated current;
- p) Efficiency at rated output; and
- q) Ambient temperature if above 40 °C.

22 STANDARD MARKING

The motor may also be marked with the Standard Mark.

22.1 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

23 INFORMATION TO BE GIVEN WITH ENQUIRY AND ORDER

The general information to be furnished when enquiring for or ordering the motor for fans used in air-conditioning and ventilation is given in Annex D.

24 TESTS

24.1 The provision of IS 15999 (Part 1) IEC 60034-1 as applied to squirrel cage induction motors shall be applicable.

24.2 The methods of test shall be in accordance with IS 4029.

ANNEX A

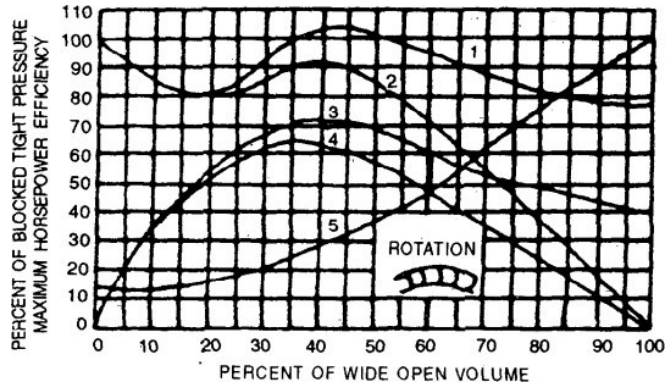
(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

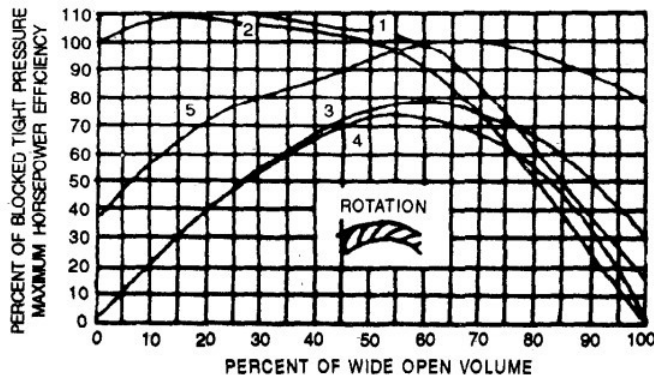
| | |
|---------------------------------------|--|
| IS 996: 2009 | Single phase a.c. induction motors for general purpose (<i>third revision</i>) |
| IS 1231: 2019 | Dimensions and output series of foot mounted induction motors — Frame Numbers 56 to 315 L (<i>fourth revision</i>) |
| IS 1271: 2012 | Electrical insulation - Thermal evaluation and designation (<i>second revision</i>) |
| IS 1885 (Part 35): 2021 | Electrotechnical vocabulary Part 35 Rotating machinery (<i>second revision</i>) |
| IS 2223: 1983 | Dimensions of flange mounted AC induction motors |
| IS 2540:2008 | Dimensions for threaded centre holes (<i>first revision</i>) |
| IS 3043: 2018 | Code of practice for earthing (<i>second revision</i>) |
| IS 4029: 2010 | Guide for testing three phase induction motors (<i>first revision</i>) |
| IS 6362: 1995 | Designation of methods of cooling of rotating electrical machines (<i>first revision</i>) |
| IS 15999 (Part 1)/IEC 60034-1 | Rotating electrical machines Part 1 Rating and performance |
| IS/IEC 60034-5: 2000 | Rotating electrical machines Part 5 Degrees of protection provided by the integral design of rotating electrical machines (IP Code) — Classification |
| IS 12360: 1988 | Voltage bands for electrical installations including preferred voltages and frequency |
| IS 12075: 2024 | Mechanical vibration of rotating electrical machines with shaft heights 56 mm and higher — Measurement, evaluation and limits of vibration severity (<i>second revision</i>) |
| IS 15999 (Part 7) : 2024/ IEC 60034-7 | Rotating electrical machines Part 7 Classification of types of construction mounting arrangements and terminal box position (IM Code) (<i>second revision</i>) |

ANNEX B
(Clause 4)

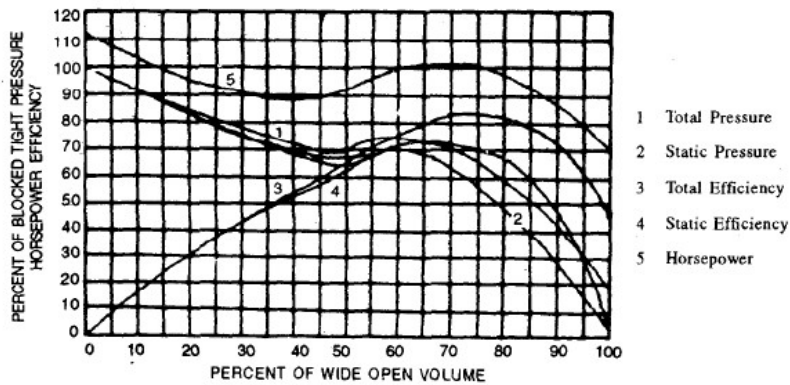
CHARACTERISTICS FOR FANS



TYPICAL OPERATING CHARACTERISTICS OF A CENTRIFUGAL FAN WITH FORWARD-CURVED BLADES



TYPICAL OPERATING CHARACTERISTICS OF A CENTRIFUGAL FAN WITH BACKWARD-CURVED BLADES



TYPICAL OPERATING CHARACTERISTICS OF A VANE-AXIAL-FLOW FAN

ANNEX C
(Clause 14.2.1)

CONDITIONS FOR SMOOTH ACCELERATION OF THE LOAD DURING STARTING

C-1 It is necessary to correlate the torque-speed characteristics of the motor and the driven unit, keeping in mind the starting method employed and the GD^2 of the driven load for the motor to develop adequate breakaway torque for smooth and satisfactory acceleration of the load. For this purpose the manufacturer of fans shall furnish the following:

- a) Speed-torque characteristics; and
- b) GD^2 of driven load.

C-2 To restrict the accelerating period to a reasonable level and to control the period of starting, following is recommended:

- a) Axial flow blower/fan be started undamped, that is, with the vents open; and
- b) Centrifugal blowers/fans be started damped, that is, with vents closed.

ANNEX D
(Clause 23)

INFORMATION TO BE GIVEN WITH ENQUIRY AND ORDER

When enquiring for and ordering an electric motor for fans used with air-conditioners and ventilation complying with this standard, the following particulars should be supplied by the purchaser:

1. Reference to this standard, that is, Ref ISS.
2. Rated voltage and permitted variation.
3. Frequency in Hz.
4. No. of phases.
5. Number of poles.
6. Full load speed in RPM
7. Mechanical output in kW (for multi speed motors indicate output for each speed)
8. Ambient temperature °C.
9. Temperature rises.
10. Humidity
11. Altitude (m).
12. Class of insulation.
13. Degree of protection.
14. Type of enclosure.
15. Method of cooling.
16. Type of construction/mounting details.
17. GD^2 of the drive with reference to motor speed, whether starting on load or no load.
18. Starting.
19. Method of starting.
20. Minimum voltage.
21. Per unit locked rotor current.
22. Per unit locked rotor torque.
23. Per unit pull-out torque.
24. Terminal box.
25. Position of terminal box.
26. Cable size and type.
27. Fault level MVA (for HV motors).
28. Turnable through degree.
29. Cable glands.
30. Direction of rotation looking from shaft end.
31. Thread orientation for shaft center (Right hand or left hand).
32. System of earthing.
33. Shaft extension details.
34. Drive details - direct/belt driven.
35. Details of axial and/or radial thrust transmitted to motor bearings.
36. Torque speed characteristics of the driven equipment.
37. Other special requirements.