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IS 6272 (1987): Industrial Cooling Fans (Man Coolers) [ETD
5: Electric Fans]



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Indian Standard
SPECIFICATION FOR
INDUSTRIAL COOLING FANS
(MAN COOLERS)
(*First Revision*)

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Indian Standard

SPECIFICATION FOR
INDUSTRIAL COOLING FANS
(MAN COOLERS)
(*First Revision*)

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Indian Standard

SPECIFICATION FOR
INDUSTRIAL COOLING FANS
(MAN COOLERS)

(*First Revision*)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards on 3 July 1987, after the draft finalized by the Electric Fans Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 Industrial cooling fans are normally employed in workshops and such other industrial places to provide ventilation by blowing air towards areas which are hot, for example, furnaces. In some places, these fans are also known by the term 'Man coolers'.

0.3 This standard was originally published in 1971. This revision has been undertaken to take into account the experience gained since then and to align some of the safety requirements with the provisions of IS : 302-1979*.

0.4 In preparing this specification, the general aspects accepted in the IEC Publications on electric fans have been adopted.

0.5 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 : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard specifies the requirements and methods of test of industrial cooling fans (man coolers), non-oscillating, suitable for use on single-phase and 3-phase ac circuits, intended for normal industrial use.

*General and safety requirements for household and similar electrical appliances (*fifth revision*).

†Rules for rounding off numerical values (*revised*).

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions in addition to those given in IS : 1885 (Part 55) - 1981* shall apply.

2.1 Industrial Cooling Fan — A free air fan having two or more propeller type blades directly driven by an electric motor and having high air velocities in the axial direction. It may be mounted on a pedestal, a bracket or a tubular casing.

2.2 Cooling Air Temperature — The temperature of the surrounding atmosphere in which the fan operates.

2.3 Mounting — The mounting of a fan is the means of attaching the fan system (motor and blades) to its base.

2.4 Type Tests — Tests carried out to prove conformity with the requirements of this standard. These are intended to prove general qualities and design of a given type of fan.

2.5 Routine Tests — Tests carried out on each fan to check the essential requirements which are likely to vary during production.

2.6 Acceptance Tests — Tests carried out on samples selected from a lot for the purpose of verifying the acceptability of the lot.

3. SIZES

3.1 The sizes of fans covered in this standard shall be as given below:
450, 600, 750, 900 and 1 200 mm.

3.2 Sizes of fans specified above are subject to a tolerance of ± 5 mm.

4. RATED VOLTAGES

4.1 The preferred rated voltages for the industrial cooling fans shall be 240 V for single-phase and 415 V for 3-phase operations (*see also 6*).

5. RATED VOLTAGES

5.1 The standard frequency for industrial cooling fans shall be 50 Hz.

NOTE — Nevertheless, fans made for other frequencies shall be considered to comply with the specification provided they do so in all other relevant respects.

6. TYPE OF MOTORS

6.1 Induction motors of 450 and 600 mm fans shall either be of the single-phase or 3-phase type but in the case of 750, 900 and 1 200 mm fans, they shall be of the 3-phase type.

*Electrotechnical vocabulary : Part 55 Electric fans.

7. DESIGN AND GENERAL CONSTRUCTION

7.1 Enclosures

7.1.1 Motors of fans shall be of the totally-enclosed type.

7.1.2 The enclosures of all-insulated fans may form part or whole of the supplementary or reinforced insulation.

7.2 Blades — Fans shall be fitted with two or more well-balanced blades made from metal or other suitable material so as to be reasonably free from vibration. The blades and blade carriers shall be securely fixed so that they do not loosen in operation.

NOTE — It is desirable that the blades/impeller as well as the rotor of the motor are dynamically balanced.

7.3 Guard — Each fan shall have a suitable robust guard either of the open or close mesh type to provide, in normal use, adequate protection against personal injury. When the guards are in two pieces, positive locking arrangement to keep the two pieces together should be made.

7.4 Heat Resistance — No readily flammable material shall be used in the construction of fan. Moulded parts, if used, shall be of such materials as will withstand the maximum temperature attained in the adjacent component parts.

7.5 Bearing Lubrication — Instructions for proper lubrication of the bearings shall be furnished by the manufacturer. Proper types of bearing should be used to ensure a reasonable amount of silent operation.

7.6 Supply Cord — Unless specifically agreed otherwise between the supplier and the user, no cord shall be supplied. If flexible cord is supplied, it should be the tough rubber sheathed type or equivalent type [see IS : 9968 (Part 1) - 1981* or IS : 694 - 1977†] suitably connected to the terminals or contacts.

7.7 Terminal Box — In the case of those motors which do not have built-in cord terminations, a suitable terminal box shall be provided on the motor for making external connections.

7.8 Brackets — In bracket type fans, cast iron brackets shall not be used.

7.9 Cord Grip

7.9.1 All fans shall be provided with a cord grip, if cord is provided, capable of passing the test specified in 11.11 so that the conductors are protected from strain, including twisting and abrasion.

*Specification for elastomer insulated cables: Part 1 For working voltages up to and including 1 100 volts.

†Specification for PVC insulated cables for working voltages up to and including 1 100 volts (*second revision*).

7.9.2 The cord grip shall preferably be of insulating material or, if of metal, be adequately insulated.

7.9.3 On fans with double or reinforced insulation, the cord grip shall be so designed that the flexible cord does not come into contact with the fixing screws if they are accessible, or in contact with accessible metal parts. The cord grip shall be suitable for the type of cords which may be attached to the fan.

7.10 Protective Measures — From the point of view of protection against electric shock, electric fans shall be either of the following two types:

- a) With basic insulation only, with the accessible metal parts designed to be connected to an earthing terminal or contact (Class I fans); and
- b) With double or reinforced insulation, with the accessible metal parts not designed to be connected to an earthing terminal or contact (Class II fans).

7.10.1 All fans with basic insulation only shall be provided with an earthing terminal or contact (*see* 10.1.1). The earthing terminal or contact shall not be used for any other purpose.

7.11 Method of Mounting — The mounting may be one of the following types:

- a) *Rigid* — The direction of draught is changed only by changing the position of the fan.
- b) *Semi-Rigid* — A trunnion or swivel arrangement or both, incorporated in the mounting so that the direction of the air flow can be altered to suit the requirements. The minimum angle through which it is possible to rotate the fan horizontally as well as vertically without changing the position of the fan shall be 7° vertically and 45° horizontally.

7.12 Clamping Devices — All clamping devices, where provided, shall be of strong and simple design. They shall be so arranged that the mechanism may be positively adjusted without there being undue risk of its working loose. A step should be provided to prevent the guard fouling with bracket or column in the event of the fan dropping downwards owing to loose clamping.

7.13 Capacitors — Capacitors, if any, shall be easily replaceable and placed at sufficient distance from the windings, so that its maximum working temperature is not exceeded. Capacitors shall be clearly marked with

maximum safe working temperature, and the corresponding voltage and capacitance. Capacitors shall comply with IS : 1709-1984*.

7.14 Stability — The construction and overall dimensions of the base shall be such as to ensure that the fan is stable with an angle of tilt up to 10° in any direction.

8. GENERAL AND SAFETY REQUIREMENTS

8.1 Protection Against Electric Shock — In the assembled fan, live parts shall not be accessible to the standard test finger (*see* IS : 1401-1970†). In the case of a double insulated fan, both basically insulated parts and live parts shall not be accessible to the standard test finger. This requirement is applicable for all positions in normal use.

8.2 Electric Insulation — The electric insulation of the fans shall be adequate and the leakage current in normal use shall not be excessive.

8.2.1 When measured according to the method specified in 11.5, the insulation resistance shall be not less than 2 MΩ.

8.2.2 Leakage Current — Requirements of the relevant Indian Standards on motor shall apply.

8.2.2.1 The leakage current which may flow from the live parts to the accessible parts and metal foil on external insulating material connected together shall not exceed 300 μA (peak), that is 210 μA (rms).

8.2.3 There shall be no breakdown of the insulation when the fan is subjected to high voltage test as given in 11.3 or flash test (11.4), as the case may be.

8.3 Insulating Materials — Windings of fan shall be insulated with either Class A, Class E or Class B insulating materials which comply with limits of temperature-rise specified in 8.4. These insulating materials are detailed in IS : 1271-1985‡.

8.4 Temperature-Rise — The fan motor shall be tested at any cooling air temperature not exceeding 40°C, but whatever the value of this temperature be, the permissible temperature-rise shall not exceed the values shown in Table 1.

8.5 Finish — All the surfaces of both fan motor and blades shall be of corrosion resisting material or shall be suitably and durably protected against corrosion.

*Specification for capacitors for electric fan motors (*first revision*).

†Specification for accessibility test probes (*first revision*).

‡Thermal evaluation and classification of electrical insulation (*first revision*).

TABLE 1 PERMISSIBLE LIMITS OF TEMPERATURE-RISE

(Clauses 8.4, 11.14.2 and 11.14.2.1)

Sl. No.	PART OF MOTOR	TEMPERATURE-RISE (°C)			METHOD OF MEASUREMENT
		Class A Insulation	Class E Insulation	Class B Insulation	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Insulated windings of motors	60	75	75	Change of resistance
ii)	Uninsulated parts of motors	The temperature-rise shall in no case reach such a value that there is a risk of injury to any insulating material on adjacent parts			Thermometer
iii)	External surfaces other than metallic handles, likely to be touched momentarily during normal usage	40	40	40	Thermometer
iv)	External surface of capacitors	40	40	40	Thermometer

NOTE 1 — The thermocouples, if used, should be applied only to external surfaces which may be reached by an ordinary thermometer.

NOTE 2 — The temperature-rise values given above are for fans normally made to this specification to work in cooling air temperatures not exceeding 40°C. Nevertheless, fans made to work in higher cooling air temperatures may be regarded as complying with this specification, provided the temperature-rise values are reduced corresponding to the increase in cooling air temperature. Such fans shall be specially marked.

8.6 Interchangeability — The motor of the fan of a particular size and model and set of blades shall be interchangeable such that the performance of the fan keeps within limits specified in this standard.

8.7 Silent Operation — Precautions shall be taken in the manufacture of fans and regulators to ensure a reasonable degree of silence at all speeds.

NOTE — The need for specifying limits of noise level (acoustical) of the fans is recognized. However, it has not been found possible to specify these limits at present on account of:

- dependency of these limits on the actual location of fans,
- lack of data on the acceptable noise levels for different applications, and
- lack of agreed definition of noise level and method of evaluating the same.

The criterion of noise level may, therefore, be subject to an agreement between the manufacturer and the purchaser.

9. PERFORMANCE REQUIREMENTS

9.1 Minimum Standard of Performance — The minimum air delivery, maximum power input and the minimum peak velocity of different sizes of fans with different speeds shall be as given in Table 2 at the test distance specified in it.

TABLE 2 MINIMUM STANDARD OF PERFORMANCE
(Clauses 9.1 and 11.13.3.2)

SIZE OF FAN	SYNCHRONOUS SPEED	MAXIMUM POWER INPUT	MINIMUM TOTAL AIR DELIVERY AT 10 TIMES BLADE SWEEP	MINIMUM PEAK AIR VELOCITY AT A DISTANCE OF		
				10 Times the Blade Sweep	12 Times the Blade Sweep	15 Times the Blade Sweep
(1)	(2)	(3)	(4)	(5)	(6)	(7)
mm	rev/min	watt	m ³ /h	m/min	m/min	m/min
450	1 500	425	10 200	200	150	120
	3 000	2 000	20 400	250	225	200
600	1 500	550	25 500	250	200	150
750	1 500	1 500	34 000	250	200	150
900	1 000	1 800	51 000	250	200	150
1 200	1 000	3 500	68 000	250	200	150

9.2 Tolerances on Ratings

9.2.1 For an industrial cooling fan covered by this standard, in no case shall the measured performance be inferior to that given in this standard.

9.2.2 In addition, the observed results expressed as a percentage of the rating assigned by the manufacturer shall be within the following limits:

<i>Characteristic</i>	<i>Tolerance, Percent</i>
Electrical input power in watts	+ 10
Total air delivery	- 10
Fan speed	± 10

Where a tolerance in one direction is omitted, there is no restriction on the value in that direction.

10. MARKING

10.1 Each fan shall be indelibly marked with at least the following information:

- a) Manufacturer's name, trade-mark of fan (if any) and number;
- b) Rated voltage(s) or voltage range and number of phases;
- c) Input in watts;
- d) Size of fan;
- e) Rated speed of fan in rev/min;
- f) Rated frequency;
- g) Country of manufacture;
- h) Rated current; and
- j) Direction of rotation.

10.1.1 In the case of a fan provided with an earthing terminal or contact, it shall be indelibly marked with the symbol '⊥'.

10.1.2 For additional information that the manufacturer may be requested to supply, see Appendix A.

10.1.3 Industrial cooling fans may also be marked with the Standard Mark.

NOTE — 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 licence for the use of the Standard Mark may be granted to manufacturers or producers, may be obtained from the Bureau of Indian Standards.

11. TESTS

11.1 Categories of Tests

11.1.1 Type Tests — The tests specified below shall constitute type tests and shall be carried out on three samples of same type and rating selected, preferably, at random from a regular production lot:

- a) High voltage (**11.3**),
- b) Insulation resistance (**11.5**),
- c) Earthing continuity (**11.6**),
- d) Electrical input (**11.7**),

- e) Fan speed (11.8),
- f) Power factor (11.9),
- g) Leakage current (11.10),
- h) Cord grip (11.11),
- j) Starting (11.12),
- k) Air delivery (11.13), and
- m) Temperature-rise (11.14).

11.1.2 Acceptance Tests — The following shall constitute the acceptance tests:

- a) High voltage (11.3),
- b) Insulation resistance (11.5),
- c) Earthing continuity (11.6),
- d) Electrical input (11.7), and
- e) Fan speed (11.8).

11.1.2.1 A recommended sampling plan for acceptance tests is given in Appendix B.

11.1.3 Routine Tests — The following shall constitute routine tests:

- a) Flash test (11.4),
- b) Insulation resistance (11.5),
- c) Electrical input (11.7),
- d) Fan speed (11.8), and
- e) A simple running test to determine that the fan mechanism is in working order.

11.2 General Conditions of Test

11.2.1 Test Voltage and Frequency — Unless otherwise specified, the test shall be carried out at the rated voltage and frequency.

11.2.1.1 When a rated voltage is indicated on the name plate, the test shall be conducted at the rated voltage. If the fan is specified for two or more distinct rated voltages with three or more supply terminals, the tests shall be carried out at the most unfavourable voltage. In case of doubt, the tests shall be carried out at all voltages.

11.2.1.2 When a voltage range is indicated on the name plate, the test shall be conducted at the mean of the upper and lower limits of the range, provided that the upper limit does not exceed the lower limit by more than 10 percent.

If the upper limit exceeds this value, the test shall be conducted at the voltage corresponding to either the upper limit or the lower limit whichever is more unfavourable to the particular test.

11.2.1.3 Limits of voltage variation — The variation in test voltage shall not exceed ± 1 percent of the test voltage during air delivery tests. While taking the current and wattage readings during these tests, however, the voltage shall be maintained at the test voltage.

11.2.2 Test Frequency — For a fan rated with a range of frequency, the test shall be made at the frequency which gives the most unfavourable results. Tolerance on frequency shall be ± 1 percent.

11.2.3 Limits of Error of Electrical Instruments — The ammeters, voltmeters and wattmeters used for type tests shall have a Class index 0.5 or better [see IS : 1248 (Part 1) -1983*]. For routine and acceptance tests, instruments of Class index 2 may be used.

11.3 High Voltage Test

11.3.1 The source of supply for high voltage test shall be not less than 500 VA.

11.3.2 The high voltage test shall be applied to all new and completed fan motors in normal working conditions with all parts in place except the capacitors which should be disconnected.

11.3.3 An ac test voltage at any convenient frequency between 40 and 60 Hz of approximately sine-wave-form shall be applied and maintained for one minute without showing any kind of breakdown or flashover.

The test voltage shall be applied as follows for fan motors:

- | | |
|---|-----------|
| a) Between live parts and body in the case of motors intended to be earthed | } 1 500 V |
| b) Between live parts and other inaccessible metal parts (that is, over the functional insulation) in the case of double insulated motors | |
| c) Between inaccessible metal parts and the body (that is, over the supplementary insulation) in the case of double insulated motors | } 2 500 V |
| d) Between live parts and body (that is, over the reinforced insulation) for reinforced insulated motors | } 4 000 V |

*Specification for direct acting indicating analogue electrical measuring instrument and their accessories : Part 1 General requirements (*second revision*).

11.3.4 At the end of one minute, the test voltage shall be removed and the insulation resistance test conducted as in 11.5.

11.3.5 If this test is required to be repeated, the test voltage levels shall be reduced to 85 percent of the original value.

11.4 Flash Test — Every fan shall withstand the voltage 20 percent higher than that specified in 11.3.3 for one second, when it is applied instantaneously.

11.5 Insulation Resistance Test

11.5.1 The insulation resistance test shall be carried out on fans immediately after conducting high voltage or flash test, as the case may be.

11.5.2 The insulation resistance of fan motor shall not be less than $2M\Omega$ when tested with a dc voltage of approximately 500 V applied between points used for high voltage or flash test.

11.6 Earthing Continuity Test

11.6.1 For fans intended to be earthed, the resistance shall not exceed 0.1Ω between any exposed metal parts except the rotating parts supported by metal bearings, and

- a) the free end of the earthing conductor if the fan is fitted with a flexible cord, due allowance being made for the resistance of the earthing conductor of the flexible cord, or
- b) the earthing terminal or contact, when the fan is supplied without a flexible cord.

The resistance measurement shall be made with a current of 10 A with a dc voltage not exceeding 6 V.

11.7 Electrical Input Test — The electrical power input in watts to the fan shall be determined by running the fan with axis of the blades horizontal at the test voltage specified. The position of the fan shall be fixed so that the direction of the axis of the draught (that is, the axis of rotation of fan blades) is perpendicular to the test plane.

11.8 Fan Speed Test — The speed of rotation of the fan shall be determined by running the fan at the test voltage and its rated frequency. The method of measurement shall be such that the speed of the fan is not appreciably affected.

11.9 Power Factor Test — The power factor of the fan with its associated capacitor, if any, in circuit when tested at the test voltage and highest speed of the fan shall not be less than:

- a) 0.90 for capacitor type single-phase fans,

- b) 0.60 for non-capacitor type single-phase fans, and
- c) 0.60 for fans having an output of 1.0 kW or less and 0.70 for fans having output above 1.0 kW in case of 3-phase fans.

11.10 Leakage Current Test — This test shall be carried out in accordance with 13.2 of IS : 302-1979*.

11.11 Cord Grip Test — The flexible cord, where provided, shall be connected to the fan with the cord grip in the normal position. The conductors shall be introduced into the terminal and screws, if any, shall be slightly tightened so that the conductors cannot easily change their position. After this, it shall not be possible to push the cord further into the fan.

The flexible cord shall then be subjected 100 times to a pull of 100 N for one second. Immediately afterwards, the cord shall be subjected to a torque of 0.35 Nm for a period of one minute. The test shall be made with the flexible cord suitable for the fan and conforming to IS: 9968 (Part 1)-1981† or IS : 694-1977‡. During the test, no damage shall be caused to the flexible cord

At the end of the test, the cord shall not have been displaced by more than 2 mm and the ends of the conductors shall not have been noticeably displaced in the terminals.

11.12 Starting — The fan shall be capable of starting up from rest at the lowest speed step when 85 percent of the rated voltage or 85 percent of the lowest voltage in the voltage range is applied.

11.13 Air Delivery Test

11.13.1 The fan shall be tested in a test chamber of the following dimensions:

- a) Height — 4 m.
- b) Width — 12 m.
- c) Length — Shall be the sum of the following distances (see Fig. 1):
 - 1) 0.2 m (Min) — distance between the centre of the instrument shelf and the back wall.

*General and safety requirements for household and similar electrical appliances (fifth revision).

†Specification for elastomer insulated cables: Part 1 For working voltages up to and including 1 100 volts.

‡Specification for PVC insulated cables for working voltages up to and including 1 100 volts (second revision).

- 2) 1 m — distance between the plane of the fan blades (parallel to the back wall) and the vertical plane passing through the centre of the instrument shelf (parallel to the back wall).
- 3) a distance equal to fifteen times the blade sweep, between the plane of the fan blades and the test plane.
- 4) 4.5 m — between the test plane and the observer (or telescope).
- 5) 2 m — free space behind the observer.

The chamber shall be reasonably free from extraneous draughts while the test is being carried out.

11.13.1.1 The test chamber shall be free from obstructions. Any table or shelf for electrical instruments shall be on the intake side of the fan beyond a distance of 1.0 m from the plane of the fan blades. No heating or cooling apparatus shall be used in the test room while the test is in progress.

11.13.1.2 The fan shall be so situated that the front of the blades is at least 1.20 m from the back wall and 6 m from the side walls. The lowest tip of the fan blade shall have a clearance of 1.20 m; *Min* from the floor.

11.13.2 *Testing Instrument* — The air movement shall be measured by means of medium or low velocity rotating vane anemometer having an internal diameter of 70 mm, suitable for the range of velocities to be measured. Revolving vane anemometers having a diameter up to 100 mm may also be used alternatively. It is recommended that the anemometer be calibrated frequently (*see also 11.13.5*).

11.13.3 *Arrangement of Apparatus*

11.13.3.1 The arrangement of the apparatus (*see Fig. 1*) shall be such as to permit the anemometer being moved in a horizontal plane containing the axis of the fan, the movement being at right angles to the axis and extendable in both directions. The anemometer shall be supported in such a manner as to offer as little obstruction as possible to the air flow. The axis of anemometer vane shall always be parallel to the axis of the fan blades.

11.13.3.2 The distance between the test plane and the plane of the fan blades shall be in accordance with Table 2.

11.13.4 *Procedure for Test*

11.13.4.1 Before taking any steps towards testing a fan against this standard, it is essential that it should have been 'run-in' for at least one hour at the highest voltage of the rated voltage range.

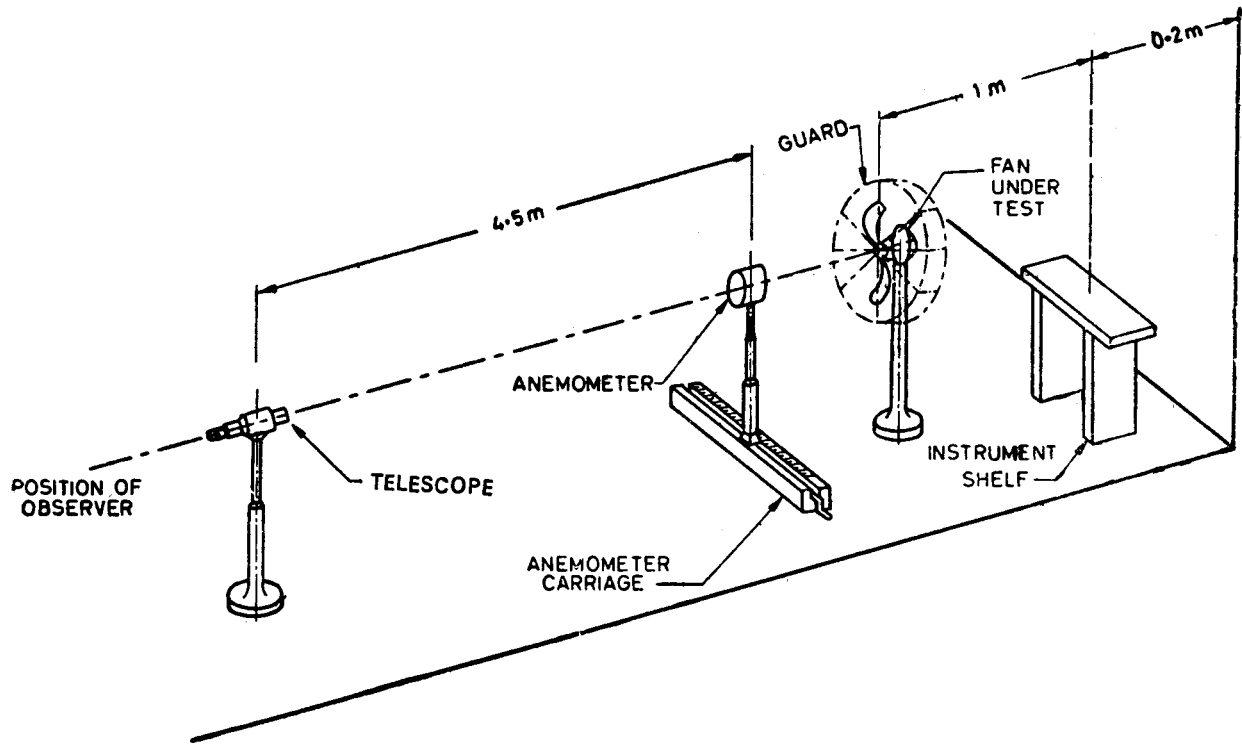


FIG. 1 ARRANGEMENT FOR AIR DELIVERY TEST

11.13.4.2 The measurements shall be carried out with the fan running at full speed at the test voltage and with the guard in position.

11.13.4.3 *Air velocity* — Readings shall be commenced at a point 20 mm from the axis of the fan blades and shall progress along the horizontal line in each direction by increments of 40 mm. Readings shall be continued in each direction until the true air velocity falls below 24 m/min.

11.13.4.4 Each reading shall consist of the time taken by an air movement of 300 m measured by the anemometer, except when such air movement takes more than 2 minutes; the reading shall then consist of the time taken by a movement of some convenient and readable quantity of air requiring approximately 2 minutes. In no case should the duration of the reading be less than one minute (*see also 11.13.5*).

11.13.4.5 The average air velocity over an annulus shall be the mean of the readings on either side of the axis of the fan blades at each mean radius of annulus.

11.13.4.6 The average velocity so obtained, multiplied by the area of the corresponding annulus, shall be taken as the total air delivery through that annulus.

11.13.4.7 The sum of the air deliveries through all such annuli up to the limit of readings (*see 11.13.4.4*) shall be taken as the measured air delivery of the fan for the purposes of this standard

11.13.5 For the purpose of measurement of air velocity, in addition to the use of anemometer, any other method which is capable of giving reliable results, is also permissible.

11.13.6 Air conditions (temperature, relative humidity and pressure) obtained at the test chamber during tests shall be recorded with the test result.

NOTE — No correction is to be made until an agreement is available on correction factor.

11.14 Temperature-Rise Test

11.14.1 *Measurement of Cooling Air Temperature During Test* — The cooling air temperature shall be measured by means of several thermometers placed at different points around the fan motor at a distance of 1 or 2 metres, and protected from all heat radiations and extraneous draughts. The thermometers used for this test shall be accurate to $\pm 0.5^{\circ}\text{C}$.

The value to be adopted for the temperature of the cooling air during a test shall be the mean of the readings of the thermometers taken

at equal intervals of time during the last quarter of the duration of the test.

11.14.2 Measurement of Temperature-Rise — The temperature-rise measurements shall be carried out by the method indicated in Table 1 immediately after the air delivery test or after the fan has been run long enough to ensure that temperature-rise has reached a constant value.

11.14.2.1 All temperature-rises to be measured by thermometer method [items (ii), (iii) and (iv) of Table 1] shall be taken at the hottest accessible surface of the part, as also on the parts which are likely to cause injury to any adjacent insulating material.

11.14.2.2 The method of measurement of temperature-rise by change in resistance for copper conductors is given below:

The temperature-rise $t_2 - t_1$ may be obtained from the ratio of the resistances by the formula:

$$\frac{t_2 + 235}{t_1 + 235} = \frac{R_2}{R_1}$$

where

R_2 = resistance of the winding at temperature t_2 (°C) at the end of the test, and

R_1 = initial resistance of the winding at temperature t_1 (°C) (cold).

From the above, the hot temperature (t_2) may be expressed as:

$$t_2 = \frac{R_2}{R_1} (t_1 + 235) - 235$$

APPENDIX A

(Clause 10.1 2)

ADDITIONAL INFORMATION TO BE SUPPLIED BY THE MANUFACTURER

A-1. The following additional information in respect of an industrial cooling fan shall be supplied by the manufacturer on request:

- a) Power factor;
- b) Air delivery at test voltage;

- c) Number of blades;
- d) Type of regulator and number of running positions;
- e) Class of insulation;
- f) Rated speed, rev/min;
- g) Type of bearings; and
- h) Instructions for lubrication of bearings.

APPENDIX B

(Clause 11.1.2.1)

SAMPLING PLAN FOR ACCEPTANCE TESTS

B-1. LOT

B-1.1 All the fans of same size and rating manufactured from the same material under similar conditions of production in a factory shall be grouped together to constitute a lot.

B-2. SCALE OF SAMPLING

B-2.1 For judging the conformity of the lot to the requirements of acceptance tests, sampling shall be done for each lot separately. For this purpose, the number of fans to be selected at random from each lot shall depend upon the size of the lot and shall be in accordance with col 1 and 2 of Table 3.

TABLE 3 SAMPLE SIZE AND ACCEPTANCE NUMBER

LOT SIZE	SAMPLE SIZE		ACCEPTANCE NUMBER	FIRST REJECTION NUMBER	SECOND REJECTION NUMBER
	First Sample	Second Sample			
(1)	(2)	(2)	(4)	(5)	(6)
Up to 25	3	3	0	2	2
26 to 50	5	5	0	2	2
51 to 100	8	8	0	2	2
101 to 300	13	13	0	2	2
301 and above	20	20	0	3	4

B-2.2 In order to ensure the randomness of selection, procedures given in IS : 4905-1968* may be followed.

B-3. CRITERIA FOR CONFORMITY

B-3.1 The number of fans selected at random in accordance with col 1 and 2 of Table 3 shall be subjected to all the acceptance tests. A fan failing to meet any of the requirements of the acceptance tests shall be termed as defective. The lot shall be considered as conforming to the requirements of acceptance tests if there is no defective in the sample and shall be rejected if the number of defectives in the sample is greater than or equal to the first rejection number given in col 5 of Table 3. If the number of defectives is between acceptance number and first rejection number, the second sample of the same size (as given in col 3) shall be selected from the lot at random and subjected to the acceptance test. If the total number of defectives in both the samples combined is less than the second rejection number given in col 6 of Table 3, the lot shall be accepted, otherwise not.

*Methods for random sampling.

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AMENDMENT NO. 1 SEPTEMBER 1993
TO
IS 6272 : 1987 SPECIFICATION FOR INDUSTRIAL
COOLING FANS (MAN COOLERS)

(First Revision)

(Page 9, clause 9.1) — Add the following sub-clause after 9.1:

'9.1.1 For compliance with requirements of this standard, the values of total air delivery shall not be less than those specified in Table 2. In case higher values of air delivery is declared by the manufacturer (*see 10.1.2*) the observed results, expressed as the percentage of the values declared by the manufacturer shall not be less than 90 percent of the declared values. Similarly for any values of fan speed declared by the manufacturer (*see 10.1.2*) observed results expressed as the percentage of the values declared by the manufacturer shall not be more than 10 percent or less than 90 percent of the declared value. The actual input when measured shall not exceed the declared value by more than 10 percent subject to the condition that the observed value shall in no case exceed the specified value given in Table 2.'

[*Page 14, clause 11.9(c)*] — Substitute the following for the existing entries:

'11.9 (c) 0.60 for fans having an input of 1.0 kw or less than 0.70 for fans having input above 1.0 kw in case of 3-phase fans.'

AMENDMENT NO. 2 MARCH 2002
TO
IS 6272 : 1987 SPECIFICATION FOR INDUSTRIAL
COOLING FANS (MAN COOLERS)
(First Revision)

(Page 5, clause 7.3, first sentence) — Substitute the following for the existing:

'Each fan shall have a suitable robust guard either of the open or close mesh type to provide, in normal use, adequate protection against personal injury having clearance of minimum 25 mm between the guard periphery and the tips of blades.'

(ETD 05)