भारतीय मानक

Indian Standard

IS 11951 : 2024

डायरेक्ट वाष्पशील वायु शीतलन यंत्र के लिए पम्पसेट — विशिष्टि

(दूसरा पुनरीक्षण)

Pumpset for Direct Evaporative Air Cooler — Specification

(Second Revision)

ICS 27.200; 23.100.10

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Refrigeration and Air Conditioning Sectional Committee, MED 03

FOREWORD

This standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Refrigeration and Air Conditioning Sectional Committee had been approved by the Mechanical Engineering Division Council.

An evaporative cooler also known as desert cooler is a device that cools air through the evaporation of water. Evaporative cooling differs from other air conditioning systems, which use vapor-compression or absorption refrigeration cycles. Evaporative coolers are relatively simpler and requires less energy than other forms of cooling. The pumpset are essential components of cooler and are used for recirculating the water to the filter pad.

This standard was first published in 1987 and was subsequently revised in 2009. In this revision of the standard, the latest advancements in the field particularly in the pump type being used in the manufacturing of various types of evaporative air coolers has been added.

The major changes in this revision are as follows:

a) Scope has been revised to include submersible pumps;
b) Terminologies have been added;
c) Typical components material of the submersible and non-submersible pumps have been added;
d) Water requirements have been incorporated;
e) Additional tests have been added; and
f) Safety requirements which are paramount for a product submerged or in direct contact with water have also been incorporated.

This standard contributes to the Sustainable Development Goal 9 'Industry, Innovation and Infrastructure: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The composition of the Committee, responsible for the formulation of this standard is given in Annex D.

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 or analysis, 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.

Indian Standard

PUMPSET FOR DIRECT EVAPORATIVE AIR COOLER — SPECIFICATION

(Second Revision)

1 SCOPE

This standard specifies the performance and safety requirements of water pumpset (submersible and non-submersible) for use in evaporative air coolers of various types for household and similar applications. The types of pumpset covered in this standard shall be capable to handle normal potable water suitable for operating at a rated voltage up to and including 250 V, a.c., 50 Hz for single phase.

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 edition of these standards.

3 DEFINITIONS

For the purpose of this standard, the following definitions shall apply:

3.1 Clear Water — Clear water shall mean water having the characteristics specified below:

a) Turbidity — 50 ppm, (silica scale) *Max*;
b) Chlorides — 500 ppm, *Max*;
c) Total solids — 3 000 ppm, *Max*;
d) *p*H — 6.5 to 8.5;
e) Temperature — 33 ºC, *Max*; and
f) Specific gravity — 1.004, *Max* .

3.2 Discharge Head — The maximum height of water which a pump can lift vertically when operated at rated voltage conditions, it is the vertical distance from the water surface to the level of water that pump is able to raise vertically.

3.3 Normal Operation — Operation of pumps with zero inlet pressure of clear cold water and discharge at specified maximum head.

3.4 Non-Submersible Vertical Pumps — Pump having electrical motor part separated from the liquid part and not immersed in liquid/water during normal use. It can be independent as shown in Fig. 2 (Type 1 or Type 2) where blower is attached on the other side.

NOTE — If any characteristics of the water differ from those specified in **3.4**, the pump details shall have to be agreed between the manufacturer/supplier and the user. In such cases, the characteristics shall be specified in the purchase order.

3.5 Submersible Pumps — The pumps having the electrical motor part completely or partially immersed in the water while in normal use. *S*ee Fig. 1.

4 CLASSIFICATION

The pumps shall be classified according to the method of installation as follows:

a) Submersible pump; and
b) Non-submersible vertical pump (Type 1 and Type 2).

5 MATERIAL

5.1 The typical materials used in the pumpset are given in the table in **5.1.1** and **5.1.2** for the guidance of the manufacturer and the user.

5.1.1 *Non-Submersible Pumpset*

Sl No.	*Components*	*Material*
(1)	(2)	(3)
i)	Motor housing (casing)	Rolled steel sheet as per IS 14491 or aluminium casting or cast iron casting
ii)	Impeller blades and impeller housing	Polypropylene as per IS 10951
iii)	Fixing plate	Rolled steel sheet as per IS 14491 or polypropylene as per IS 10951
iv)	Motor shaft	Stainless steel as per IS 6527/ Ceramic

Sl No.	*Components*	*Material*
(1)	(2)	(3)
v)	Fan	Polypropylene as per IS 10951
vi)	Ball/roller/needle bearing and bush bearing	Non-magnetic self-lubricating bearings/sintered bush/phosphor bronze bush

NOTE — Any other materials not covered in the table can also be used provided it meets all the requirement of the corresponding Indian/ National /International Standard as declared by the manufacturer.

5.1.2 *Submersible Pumpset*

Sl No.	*Components*	*Material*
(1)	(2)	(3)
i)	Motor housing (casing)	Acrylonitrile butadiene styrene (ABS) as per IS 17077 (Part 1)/Polyurethane
ii)	Impeller blades and impeller housing	Polyoxymethylene (POM)/Nylon 6 as per IS 13463/Nylon 66 as per IS 13464
iii)	Motor shaft	Stainless steel as per IS 6527/Ceramics
iv)	Vane	Nylon 6 as per IS 13463/Nylon 66 as per IS 13464
v)	Rotor	Magnetic material
vi)	End bushes	Polyoxymethylene (POM)/Rubber

NOTE — Any other materials not covered in the table can also be used provided it meets all the requirement of the corresponding Indian/National /International Standard as declared by the manufacturer.

6 RATINGS

6.1 Ratings shall be as per Table 1 and Table 2.

Table 1 AC Motor Driven Pumpsets (Non-Submersible Type)

(*Clause* 6.1, 7.3, 9.1 *and* 9.4.2)

Sl No.	**Discharge Head**	**Minimum Discharge**	**Type 1 Motor Wattage**	**Type 2 Motor Wattage**
	m	l/min	W	W
(1)	(2)	(3)	(4)	(5)
i)	up to 1.0	2	50 *Max*	As per fan/blower motor wattage
ii)	up to 1.5	2	50 *Max*	As per fan/blower motor wattage
iii)	up to 2.0	2	70 *Max*	As per fan/blower motor wattage

NOTE — Pump may be connected to the motor by any other suitable means also.

Table 2 AC Motor Driven Pumpsets (Submersible Type)

(*Clauses* 6.1, 7.3, 9.1, 9.4.2, Annex B *and* Annex C)

Sl No.	Motor Wattage	Minimum Discharge Head, H_d	Discharge Measurement Height, h	Minimum Discharge*
	W	m	m	l/min
(1)	(2)	(3)	(4)	(5)
i)	up to and including 5	0.3	0.2	1
ii)	> 5 to ≤ 10	0.6	0.5	2
iii)	> 10 to ≤ 15	1	0.8	3
iv)	> 15 to ≤ 20	1.6	1	7
v)	> 20 to ≤ 25	2	1	10

NOTES

1 *Pump to be tested with minimum 13 mm I.D. flexible pipe without any sharp bends.

2 Pump suction area to be fully immersed in water.

3 Tests for minimum discharge and minimum discharge head (H_d) shall be done as per Annex B and Annex C respectively.

4 This includes pumps with or without inlet mesh/filter.

6.2 A typical sketch of the pumpsets are given below:

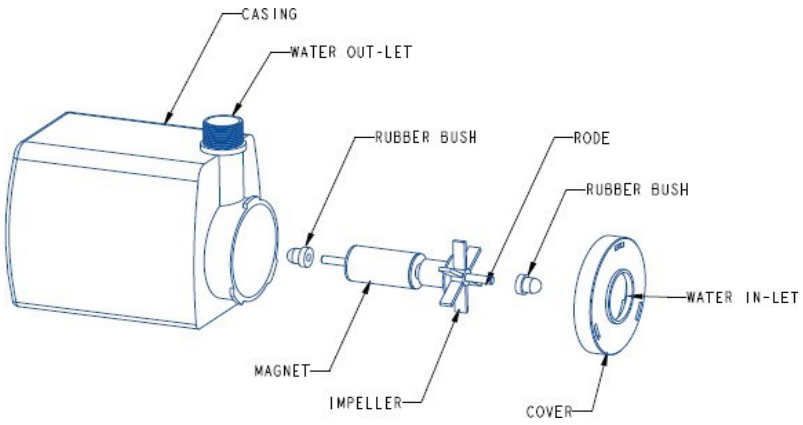
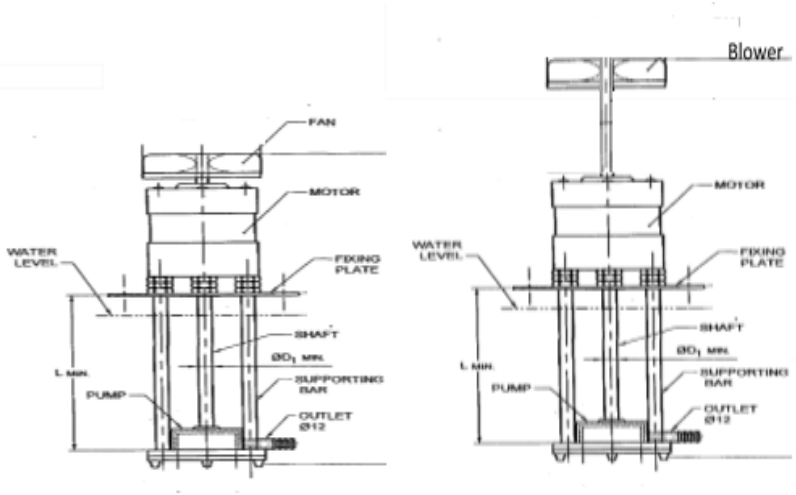


FIG. 1 TYPICAL SECTION OF SUBMERSIBLE PUMP

NOTE — Bottom suction pump may also be present.



Type 1 Type 2

FIG. 2 TYPICAL SECTION OF NON-SUBMERSIBLE PUMP

7 PRIME MOVER

7.1 For non-submersible pumpsets, the motor shall be fan cooled and totally enclosed, conforming to IS 996. For submersible pumps; **13**, **15**, **16**, and **31** of IS 302-1 shall be applicable.

7.2 The motor shall have continuous rating and shall run at no load without damage. The motor shall withstand voltage fluctuations within ± 10 percent.

7.3 The power consumption of the motor shall be as specified in Table 1 and Table 2.

8 GENERAL REQUIREMENTS

8.1 The general design of the non-submersible pumpset shall be such as not to allow the motor to go inside the water in the tank of the desert cooler. Submersible pumpset shall be fixed inside the tank.

8.2 The pumpset shall be able to withstand vibrations and shock during its normal operation without causing any permanent damage of its components and/or the complete pump assembly.

Compliance shall be checked by carrying out the tests specified in IS 9000 (Part 8).

9 PERFORMANCE REQUIREMENT

9.1 Pumpset shall be tested and shall meet the requirements of discharge as given in Table 1 and Table 2 for non-submersible pumpset and submersible pumpset respectively.

9.2 For non-submersible pumps, the motor incorporated in the pumpset shall meet with the requirements of temperature rise and insulation resistance as per in Table 3 of IS 302-1 and **12.7** of IS 996 respectively, when tested in accordance with the method given IS 996.

9.3 Water Requirement

Water as per **3.4** shall be used. It shall be clear with no visible contamination and water shall be at less than maximum ambient temperature while in use.

9.4 Reliability Tests

9.4.1 The pumpset shall be tested for 500 h continuously at rated voltage in complete evaporative air cooler assembly. The water temperature shall be at room temperature. After the test, the pumpset shall neither get damaged nor shall its performance gets impaired and shall conform to **13** of IS 302-1.

9.4.2 To create the actual condition one pumpset sample shall be fitted at appropriate height in the cooler body along with the cooler fan running and having water head as per the Table 1 or Table 2. Alternatively, more number of pump samples may be fitted in the same cooler and they shall lift water to a height of 1m and throw water in a duct kept inside the cooler body.

9.4.3 The motor shall be enclosed with minimum IP44 protection for non-submersible pumps and IPX8 for submersible pumps in accordance with IS/IEC 60529. These pumps shall be mounted suitably inside the water tank to avoid any fouling with the cooler body and any components inside the tank.

9.4.4 The minimum water level in the cooler shall be maintained during the test.

9.4.5 The pumpset shall have temperature over protector.

9.4.6 *Dry Run Test*

The pump shall be run without water at normal ambient condition. Maximum duration of the test shall be 24 h continuously without failure with temperature over protector. There shall not be any fire during or after the test. After the test, pumpset shall neither get damaged nor shall its performance gets impaired.

9.5 Routine Test

These shall consist of routine tests that would be conducted on each and every unit after completion at the manufacturer's works:

a) Operational test; and
b) Leakage current and electric strength at operating temperature as per **13** of IS 302-1.

9.6 Type Test

The type tests shall consist of the tests that would be necessary to check up the performance and characteristics of the units and components, and shall be carried out by a recognized testing authority. Once a unit has undergone type tests, any minor or essential alterations which the manufacturer intends to make, shall further be type tested and shall be carried out in accordance with the procedure laid down in this standard.

9.6.1 Besides the routine tests outlined in 9.5, the type tests shall comprise of the following tests:

a) Performance requirements (9.1);
b) Tests on motor (7.3 and 9.2) :
   1) Motor output (7.3);
   2) Temperature rise (Table 3 of IS 302-1); and
   3) Insulation resistance (**12.7** of IS 996)
c) Reliability tests (9.4):
   1) Continuously run test (9.4.1);
   2) Ingress protection test (9.4.3); and
   3) Dry run test (9.4.6).
d) Safety requirements (9.7):
   1) Leakage current and electric strength at operating temperature (**13** of IS 302-1);
   2) Moisture resistance (**15** of IS 302-1); and
   3) Leakage current and electric strength (**16** of IS 302-1).

9.7 Safety Requirements

The pumpset shall meet all the safety requirements specified in **13**, **15**, **16**, and **31** of IS 302-1.

10 MARKING

10.1 Pumpset shall be marked with the following:

a) Manufacturer's name or trademark;
b) Serial No. of pump;
c) Year of manufacture;
d) Rated power consumption of motor;
e) Rated voltage and frequency;
f) Rated speed (non-submersible);
g) Head (m), volume rate of flow, in l/min (LPM); and
h) Type of pumpset.

10.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 302 (Part 1) : 2008	Safety of household and similar electrical appliances: Part 1 General requirements (*sixth revision*)
IS 996 : 2009	Single phase a.c. induction motors for general purpose (*third revision*)
IS 3315 : 2019	Evaporative air coolers (desert coolers) — Specification (*third revision*)
IS 6527 : 1995	Stainless steel wire rods — Specification (*first revision*)
IS 10951 : 2020	Specification for polypropylene (PP) materials for moulding and extrusion (*second revision*)
IS 14491 : 1997	Low carbon high strength cold rolled steel sheets and coils for cold forming — Specification
IS 17077 (Part1) : 2022	Plastics — Acrylonitrile-Butadienestyrene (ABS) moulding and extrusion materials: Part 1 Designation system and specifications (*first revision*)
IS/IEC 60068-2-6 : 2007	Environmental testing: Part 2 Tests, Section 6 Test Fc: Vibration (sinusoidal)
IS/IEC 60529 : 2001	Degrees of protection provided by enclosures (IP Code)

ANNEX B

(*Table 2*)

TEST METHOD TO MEASURE WATER FLOW AT SPECIFIED HEIGHT/RATING

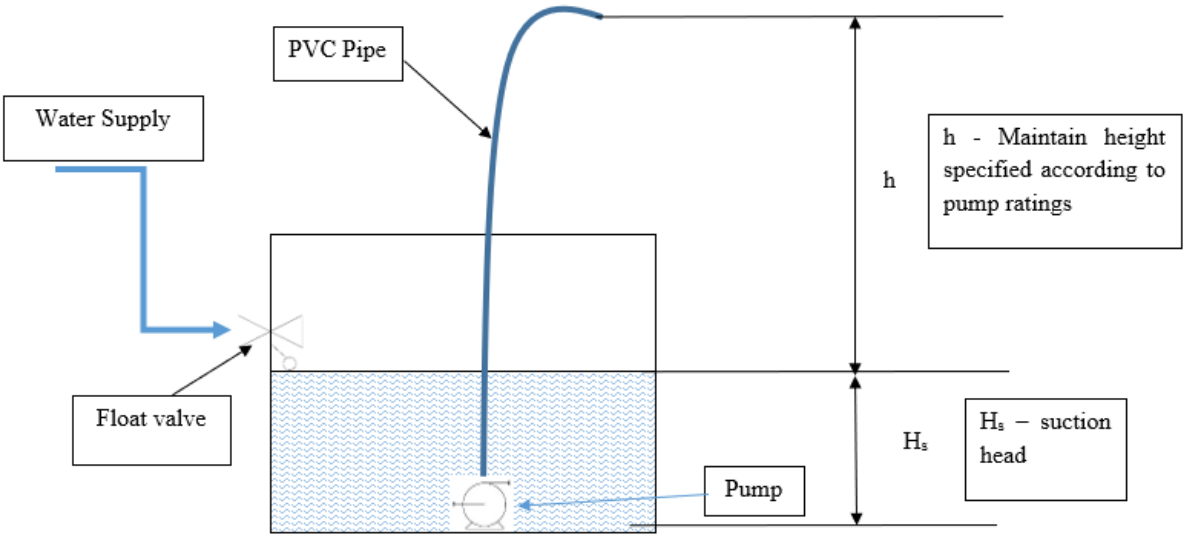


FIG. 3 TEST METHOD TO MEASURE WATER FLOW AT SPECIFIED HEIGHT/ RATING

Test method:

a) Maintain the suction head (H_s) of water tank by using a float valve connected to water supply to 300 (– 10) mm;
b) Connect regular pipe used in air cooler and fix the discharge height (*h*) as specified in the Table 2;
c) Switch on the pump at rated voltage and measure the volume of discharged water in 1 minute using a calibrated measuring flask; and
d) Calculate the Pump discharge in l/*h* by formula below:

Flow rate (l/*h*) = volume of discharged water in liters per min × 60 (l/h)

ANNEX C

(*Table 2*)

TEST METHOD TO MEASURE DISCHARGE HEAD

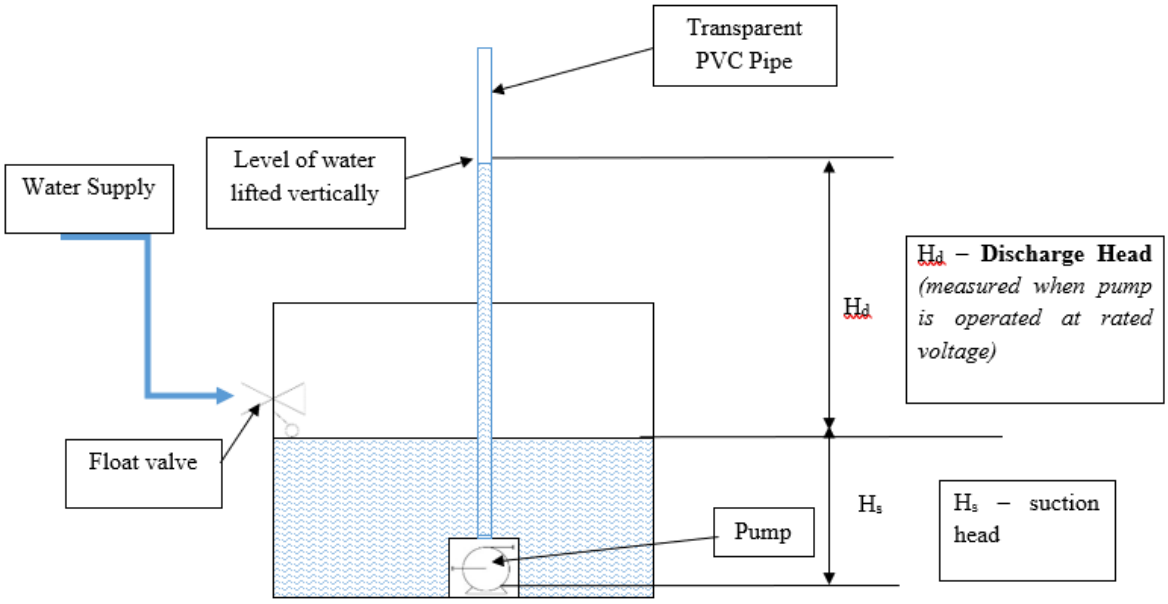


FIG. 4 TEST METHOD TO MEASURE DISCHARGE HEAD

Test method:

a) Maintain the suction head (H_s) of water tank by using a float valve connected to water supply to 300 (– 10) mm;

b) Connect the pump to a transparent PVC pipe fixed vertically. (Total length should be min 2.5 m above water surface);

c) Operate the pump at rated voltage and observe the maximum level of water which the pump can lift;

d) Measure the distance between water surface and the level (lower meniscus) of water column inside the transparent pipe; and

e) The distance measured above is the discharge head (H_d) of the pump under testing.

ANNEX D

(*Foreword*)

COMMITTEE COMPOSITION

Refrigeration and Air Conditioning Sectional Committee, MED 03

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