

भारतीय मानक
Indian Standard

IS 16542 : 2016
(Reaffirmed 2021)

समस्त ग्लास इवेक्यूएटिड नलिका सौर
संग्रहक हेतु भंडारण पानी की
टंकी — विशिष्टि

**Direct Insertion Type Storage Water
Tank for All Glass Evacuated Tubes
Solar Collector — Specification**

ICS 27.160

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Renewable Energy Sources Sectional Committee, MED 04

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Renewable Energy Sources Sectional Committee had been approved by the Mechanical Engineering Division Council.

While formulating this standard assistance has mainly been derived from Ministry of New and Renewable Energy working draft STD 02:2012 (R) ‘Draft standard storage water tank for all glass evacuated tubes solar collector’.

The requirements for all glass evacuated solar collector tubes is covered in IS 16543 : 2016 ‘All glass evacuated solar collector tube — Specification’ and the requirements for all glass evacuated tubes solar water heater system is covered in IS 16544 : 2016 ‘All glass evacuated tubes solar water heating system’.

The relevant SI units and corresponding conversion factors are given below for guidance:

$$\begin{aligned}\text{Pressure } 1\text{Pa (Pascal)} &= 1 \text{ N/m}^2 \\ 1 \text{ kgf/mm}^2 &= 9.80665 \text{ MPa}\end{aligned}$$

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

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 : 1960 ‘Rules for rounding off numerical values (*revised*)’. 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

DIRECT INSERTION TYPE STORAGE WATER TANK FOR ALL GLASS EVACUATED TUBES SOLAR COLLECTOR — SPECIFICATION

1 SCOPE

This standard specifies requirements of direct insertion type storage water tank of water capacity up to 500 litre for use with all glass evacuated tubes solar collector. This standard covers only vented type storage water tank.

2 REFERENCES

The standards listed below 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 the standards indicated below:

IS No.	Title
277 : 2003	Galvanized steel sheets (plain and corrugated) — Specification (<i>sixth revision</i>)
1079 : 2009	Hot rolled carbon steel sheet and strip — Specification (<i>sixth revision</i>)
6911 : 1992	Stainless steel plate, sheet and strip — Specification (<i>first revision</i>)
14246 : 2013	Continuously pre-painted galvanized steel sheets and coils (<i>first revision</i>)
16368 : 2015	Test procedure for thermosyphon type domestic solar hot water heating system

3 DEFINITIONS

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

3.1 Vented Storage Water Tank — Storage water tank having opening to the atmosphere and pressure inside the tank is always equal to atmospheric pressure all the time.

3.2 Working Pressure — Working pressure is 0.3 bar.

4 DESIGN OF DIRECT INSERTION TYPE STORAGE WATER TANK

Storage water tank is integrated to the collector, that is evacuated glass tubes of collector are directly connected to storage water tank. A typical solar collector with direct insertion type storage water tank is shown in Fig. 1.

5 MAIN PARTS OF STORAGE WATER TANK

5.1 Inner Tank

Inner tank shall be manufactured from any of the following materials:

- a) Stainless steel sheet conforming to grade X02Cr19Ni10 or X02Cr17Ni12Mo2 of IS 6911. The thickness of sheet shall be minimum 0.5 mm for up to 300 litre water capacity and 0.6 mm for above 300 litre water capacity and shall withstand a pressure of 1.5 times working pressure.

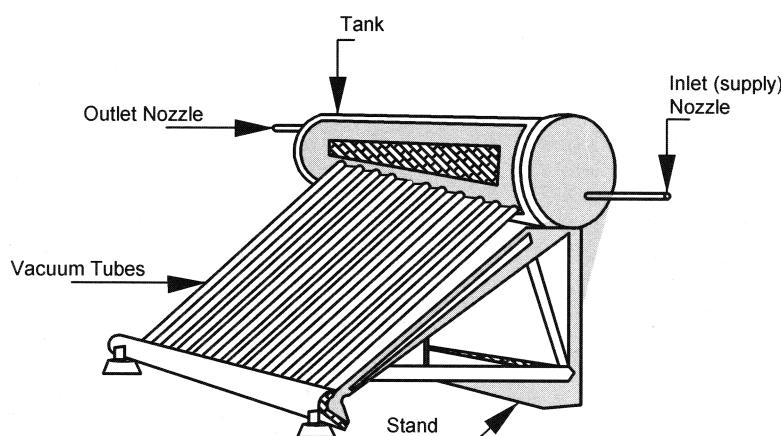


FIG. 1 DIRECT INSERTION TYPE STORAGE WATER TANK

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- b) Mild steel sheet conforming to IS 1079 with anti-corrosive coating. The thickness of mild steel sheet shall be minimum 1.5 mm for up to 300 litre water capacity and 2.0 mm for above 300 litre water capacity. The thickness of coating shall be minimum 150 micron and should be capable to withstand minimum five years of performance. Anti-corrosive coating should be enamel coating (glass lining or enamel lining) or any other food grade coating conforming to suitable Indian Standard.

NOTE — For purpose of protective coating on mild steel plate Total Dissolved Solids (TDS) considered is (more than 300 PPM) and chlorides contents (more than 50 PPM) in water.

- c) GI sheets conforming to IS 277. The thickness of GI sheet shall be minimum 1.5 mm up to 300 litre and 2.0 mm for above 300 litre water capacity. The thickness of coating on welding joint shall be minimum 150 micron and should be capable to withstand minimum five years of performance. Anti-corrosive coating shall be of any food grade conforming to suitable Indian Standard.

NOTE — For purpose of protective coating on GI sheet plate TDS considered is (more than 300 PPM) and chlorides contents (more than 50 PPM) in water.

5.2 Outer Cladding

The material of outer cladding shall be pre-painted galvanized steel conforming to IS 14246. Alternatively, material of outer cladding may be aluminum/stainless steel/FRP of suitable thickness.

5.3 Insulation Layer

The insulation layer shall be pre-injected poly urethane foam (PUF) of minimum thickness 50 mm. The density of PUF shall be 28 to 36 kg/m³.

5.4 Inner Sealing

The material of inner sealing shall be high temperature resistant silicon rubber.

5.5 Outer Sealing

The material of outer sealing shall be ethylene propylene diene monomer (EPDM) rubber.

5.6 Sacrificial Anode (Optional)

Additional corrosion protection may be provided by the installation of a sacrificial anode. The anode shall be manufactured from magnesium (or a material with higher protection potential) cored with a steel rod to ensure mechanical and wear strength suitable for the duty it has to perform and to withstand the mechanical shocks which may be induced during transport and installation. The anode shall be mounted in a robust

manner at the end of the tank and shall be in electrical contact with the inner tank. The anode shall be easily replaceable.

6 GENERAL REQUIREMENTS

6.1 The outer cladding shall be smooth without any crack or obvious scratch and no coating peeling off.

6.2 Insulation layer shall be stuffed tightly. There shall be no obvious shrinkage or bulging of insulating material.

6.3 Outer sealing shall be without any defect.

6.4 Access door may be provided for easy periodic cleaning of the tank.

6.5 All holes of tank may be provided with protective caps to avoid entry of any foreign material in the tank before its installation in the system.

6.6 Protective caps shall be provided at inlet and outlet of the tank.

7 TEST REQUIREMENTS

7.1 Measurement of Storage Water Tank Capacity

The capacity of storage water tank shall be within $^{+5}_{-0}$ percent of declared capacity when measured as per **8.1**.

NOTE — The declared capacity of storage water tank shall be equal to capacity of the system. Volume of water in evacuated tubes and manifold shall not be accounted in the capacity of storage water tank.

7.2 Leakage Test

No leakage when tested as per **8.2**.

7.3 Idle Heating Test

There shall be no deformation, crack or other damage when tested as per **8.3**.

7.4 Integral Test

There shall be no leakage or damage when tested as per **8.4**.

7.5 Performance Test

Heat loss coefficient of the system (U_L) shall be $< 2 \text{ W}/(\text{m}^2 \text{ }^\circ\text{C})$, when tested as per **8.5**.

7.6 Thermal Shock Test for Inner Sealing

The sample of silicon rubber shall be kept in an electric oven at a temperature of 150°C for 4 h. After heating, the samples shall be taken out and cooled in air for 2 h and shall again be put in the oven at 150°C for 4 h. The sample shall be taken out and cooled and shall be inspected for any appearance of cracks or brittleness.

7.7 Thermal Shock Test for Outer Sealing

The sample of EPDM rubber shall be kept in an electric oven at a temperature of 125°C for 4 h. After heating, the samples shall be taken out and cooled in air for 2 h and shall again be put in the oven at 125°C for 4 h. The sample shall be taken out and cooled and shall be inspected for any appearance of cracks or brittleness

8 TEST PROCEDURE

8.1 Measurement of Storage Water Tank Capacity

Volume of water required to fill the empty storage water tank at ambient temperature shall be measured to find the capacity, in litre.

8.2 Leakage Test

Fill the storage water tank with clean water and release the air inside the tank. Close air vent and increase the pressure to 0.5 Bar and maintain the pressure for minimum 5 min. There shall be no leakage or permanent deformity.

8.3 Idle Heating Test

Install the system with water storage tank under test outdoors according to operating conditions. There shall be no presence of water inside the system. Measure the daily cumulative solar irradiance on the plane of the collector which shall be more than 16 MJ/m². The average wind velocity shall be 4m/s or less. This test to be conducted for three consecutive days. At the end of the test there shall be no deformation, crack or other damage to storage water tank.

8.4 Integral Test

Install the system with water storage tank under test outdoors according to operating conditions. The system is filled with water. Measure the daily cumulative solar irradiance on the plane of the collector which shall be more than 16 MJ/m². The average wind velocity shall be 4m/s or less. This test to be conducted for three consecutive days. At the end of the test there shall be no leakage or damage to storage water tank.

8.5 Performance Test

Test the system with water storage tank under test for

heat loss coefficient as per IS 16368.

9 TYPE OF TEST

9.1 Routine Test

Each inner tank shall be tested for leakage as per **8.2** for a period of 5 min by manufacturer.

9.2 Type Test

All the tests specified in **7.1, 7.2, 7.3, 7.4, 7.5, 7.6** and **7.7** are type tests and shall be carried out initially for each capacity either in manufacturer's lab or outside approved lab for testing of the product. These tests shall be repeated every two years after initial approval or before, if there is any change in design, technology or materials.

10 MARKING

10.1 The following information shall be marked on the storage water tank:

- a) Name of the manufacturer's or trade-mark;
- b) Water capacity, in litre;
- c) Serial No.;
- d) Month and year of manufacture;
- e) Material and its thickness of the inner tank; and
- f) Material and density of insulation.

10.2 BIS Certification Marking

Each tank may also be marked with the Standard Mark.

10.2.1 The use of Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

11 PACKING

The storage water tanks shall be suitably packed to avoid any damage during handling, storage and transportation.

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ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Renewable Energy Sources Sectional Committee, MED 04

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Ministry of New and Renewable Energy, New Delhi	SHRI SOHAIL AKTHAR (Chairman)
Biogas Forum India, New Delhi	DR A. R. SHUKLA
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