

MNRE Standard
STORAGE WATER TANK FOR ALL GLASS (Glass in Glass) EVACUATED
TUBES SOLAR COLLECTOR

Ministry of New and Renewable Energy
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MNRE Standard

**STORAGE WATER TANK FOR ALL GLASS (Glass in Glass) EVACUATED
TUBES SOLAR COLLECTOR**

1.0 SCOPE

This standard specifies requirements of storage water tank for all glass evacuated tubes solar collector. This standard covers only vented type storage water tank.

2.0 REFERENCES

IS 277:2003 Galvanized steel sheets (Plain & corrugated)

IS 1079: 2009 Hot rolled carbon steel sheet and strip (sixth revision)

IS 6911: 1992 Stainless steel plate, sheet and strip –specification

IS 14246: 1995 Continuous pre-painted galvanized steel sheets and coils

IS ----- Test procedure for thermosyphon – type domestic solar hot water heating system

{DOC : MED04(1050)F} (under print).

MNRE STD 03:2013 All glass (glass in glass) evacuated tubes solar water heating system

3.0 DEFINITIONS

3.1 Vented type 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.

4.0 TYPE OF STORAGE WATER TANK

4.1 Close type storage water tank – Such type of storage water tank are close to collector but not integrated with the collector i.e. evacuated tubes of collector are connected to manifold and manifold is connected to storage water tank. A typical solar collector with close type storage water tank is shown in Fig.1.

4.2 Integrated type storage water tank – Such type of storage water tank are integrated to the collector i.e. evacuated glass tubes of collector are directly connected to storage water tank. A typical solar collector with integrated type storage water tank is shown in Fig.2.

5.0 MAIN PARTS OF STORAGE WATER TANK

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

- i) Stainless steel sheet conforming to grade X02Cr19Ni10 or X02Cr17Ni12Mo2 of IS 6911 or ASTM grade 304,304L,316. The thickness of sheet shall be minimum 0.5mm when fabricated using MIG / Argon arc / seam welding for tanks upto 300 litres capacity. Tanks may be manufactured from same thickness sheet by weldless technology.
- ii) Mild steel sheet conforming to IS 1079 with anti-corrosive coating. This material is specially suitable for use of tanks in areas having high TDS (more than 300 PPM) and chlorides contents (more than 50 PPM) in water. The thickness of sheet shall be minimum 1.5 mm for tanks upto 300 litres capacity. The thickness of coating shall be minimum 150 micron and should be capable to withstand minimum five years warranty. Anti-corrosive coating may be enamel coating (glass lining or enamel lining) or special food grade coating.
- iii) GI sheets conforming to IS 277 with suitable anti-corrosive coating. This material is specially suitable for use of tanks in areas having high TDS (more than 300 PPM) and chlorides contents (more than 50 PPM) in water. The thickness of sheet shall be minimum 1.5 mm for weld less tanks and minimum 2.0 mm for welded tanks for tanks upto 300 litres capacity. The tanks should be capable to withstand minimum five years warranty.

For capacities higher than 300 litres, thickness of tank should be adequate to withstand pressure of 0.2 MPa.

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

5.3 Insulation layer – The insulation layer shall be pre-injected PUF of minimum thickness 50mm. The free rise density of PUF shall be minimum 26 kg/m^3 and moulded density shall be minimum 36 kg/m^3 . For tanks of water capacity more than 300 litre, Rockwool insulation of minimum 100 mm thickness is also permitted. The thermal conductivity (k value) of Rockwool shall be not more than $0.055 \text{ W/(m} \cdot ^\circ\text{C)}$ at 100°C .

5.4 Inner seal ring for tubes – The material of inner sealing shall be of silicon rubber to withstand minimum temperature of 175°C .

5.5 Dust cover ring for tubes - The material shall be of EPDM rubber/ UV stabilized PVC.

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 cored with a steel rod (or a material with higher protection potential) 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.

6.0 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, in case of Rockwool shall be stuffed tightly. There shall be no obvious shrinkage or bulging of insulating material.
- 6.3** Access door may be provided for easy periodic cleaning of the tank (optional).
- 6.4** The tank shall be provided with appropriate packing to avoid entry of any foreign material in the tank before its installation in the system.

7.0 TEST REQUIREMENTS

- 7.1 Measurement of storage water tank capacity** – The capacity of storage water tank shall be within ± 5 % of declared capacity when measured as per **Appendix A**.
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 for inner tank**– No leakage when tested as per **Appendix B**.
- 7.3 Rigidity test** – There shall be no deformation or damage when tested as per **Appendix C**.
- 7.4 Idle heating test** – There shall be no deformation, crack or other damage when tested as per **Appendix D**.
- 7.5 Integral Test** – There shall be no leakage or damage when tested as per **Appendix E**.
- 7.6 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 Indian Standard {Doc: MED 04(1050)F } (under print)
Note: Tests specified in 7.3 to 7.6 above for storage water tank are not required separately when manufacturer of glass evacuated tubes solar collector is manufacturing tanks in-house. In this case during the testing of all glass evacuated tubes solar collector system as per MNRE STD 03, these tests are performed along with system.

8.0 TYPE OF TEST

8.1 **Routine test** – Each inner tank shall be tested for leakage as per clause 7.2 for a period of 10 minutes by manufacturer.

8.2 **Type test** – All the tests specified in 7.1 and 7.3 to 7.6 are type tests and shall be carried out initially for one capacity upto 500 litres capacity single unit either in manufacturer's lab or outside approved lab for approval 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. For systems above 500 litres capacity single unit test shall be carried out as per agreement between manufacturer and user.

9.0 TEST REPORT.

A test report shall be generated in the format given at **Appendix F**.

10.0 MARKING

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

- i) Name of the manufacturer's or trade mark,
- ii) Water capacity in litres,
- iii) Serial No., and
- iv) Month and year of manufacture.

11.0 PACKING

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

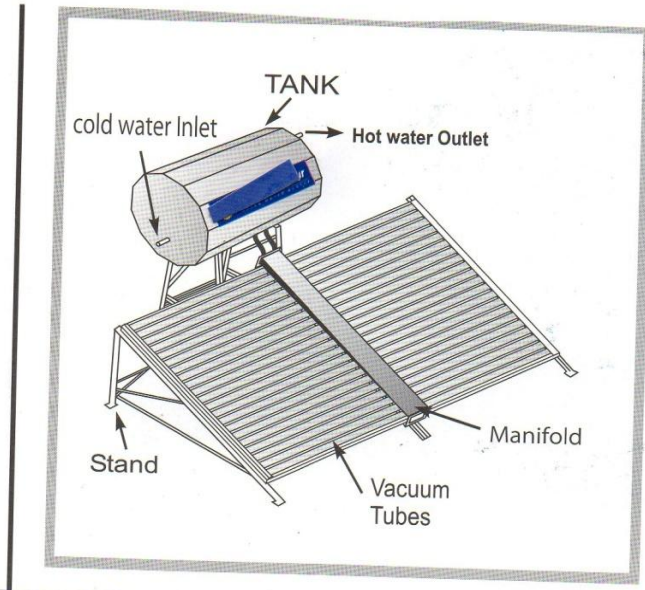


Fig 1

**CLOSE TYPE STORAGE
WATER TANK**

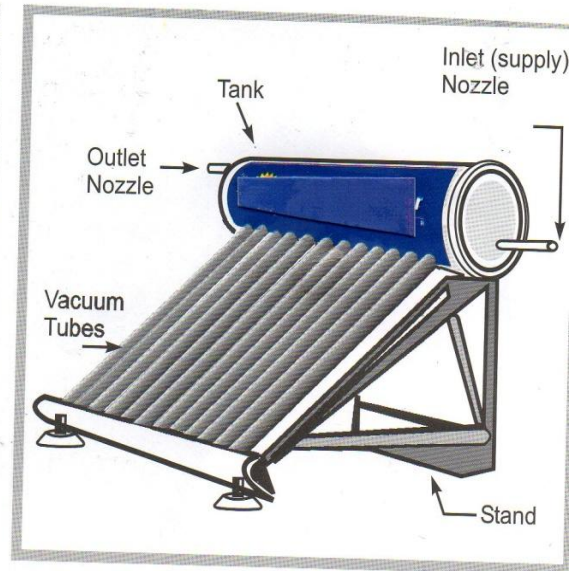


Fig 2

**INTEGRATED TYPE STORAGE
WATER TANK**

APPENDIX A

MEASUREMENT OF STORAGE WATER TANK CAPACITY (Clause 7.1)

A-1 Test conditions – This test may be conducted indoor or outdoor at ambient temperature.

A-2 Test instruments/test setup – Measuring Jars of capacity 20 litre, 5 litre, 2litre & 1litre

A-3 Test Procedure – Fill the empty storage water tank with measured volume of water.

A- 4 Result – Report total water volume required to fill the storage water tank in litres as capacity of tank.

APPENDIX B

LEAKAGE TEST FOR INNER TANK (Clause 7.2)

B-1 Test conditions – This test may be conducted indoor or outdoor at ambient temperature.

B-2 Test instruments/test setup – Air compressor with air storage tank of 500 litres capacity, Pressure gauge, Filter, Regulator, Stop watch, Water tank or soap solution

B-3 Test Procedure – Close all the holes of inner tank. Fill the tank with air and increase the pressure to 0.06 MPa for tanks upto 300 litres capacity and 0.2 MPa for tanks above 300 litres capacity. Maintain the pressure for 10 minutes. Check for any leakage either by submerging the inner tank inside water tank or by applying soap solution.

B-4 Result – There shall be no leakage or permanent deformity.

APPENDIX C

RIGIDITY TEST FOR STORAGE WATER TANK (Clause 7.3)

C-1 Test conditions – This test may be conducted indoor or outdoor at ambient temperature.

C -2 Test instruments/test setup –All glass evacuated solar water heating system without storage water tank, measuring steel scale, stop watch

C- 3 Test Procedure– Connect the storage water tank under test with all glass evacuated tube solar water heating system. Raise one end of the storage water tank connected in the system without water by 0.1m and keep for 5 minutes before putting to original position.

C-4 Result -There shall be no damage and apparent deformation in the connecting parts of the storage water tank.

APPENDIX D

IDLE HEATING TEST

(Clause 7.4)

D-1 Test conditions – This test shall be conducted outdoor as per operating conditions.

D-2 Test instruments/test setup – All glass evacuated solar water heating system without storage water tank, anemometer, pyranometer, data logger

D-3 Test Procedure – 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/m^2 . The average wind velocity shall be 4m/s or less. This test to be conducted for three consecutive days.

D-4 Test Result - At the end of the test there shall be no deformation, crack or other damage to storage water tank.

APPENDIX E

INTEGRAL TEST

(Clause 7.5)

E-1 Test conditions – This test shall be conducted outdoor as per operating conditions.

E-2 Test instruments/test setup – All glass evacuated solar water heating system without storage water tank, anemometer, pyranometer, data logger

E-3 Test Procedure – Install the system with water storage tank under test outdoor 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/m^2 . The average wind velocity shall be 4m/s or less. This test to be conducted for three consecutive days.

E-4 Test Result -At the end of the test there shall be no deformation, damage or leakage to storage water tank.

APPENDIX – F

**TEST REPORT
(Clause 9.0)**

Official Stationary of the Test Laboratory/ Institution Address and Contact Details

TEST REPORT		
A.	GENERAL	
1.	Name and Address of manufacturer/supplier	
2.	Contact details of manufacturer /supplier	
3.	Details of sample submitted/model	
4.	Latitude & longitude of test laboratory	Latitude – Longitude –
5.	Duration of the Test	Date of start - Date of completion -
B.	SPECIFICATIONS OF THE TEST SAMPLE (All dimensions are in mm, unless specified otherwise)	
	Storage Water Tank	
1	Make/Model	
2	Complete address of the manufacturer including e-mail/web site etc.	
3	Type	Close type/Integrated type
4	Capacity, litres	
5	Inner tank material & thickness	
6	Type of anti corrosive coating inside inner tank	
7	Outer cladding material & thickness	

8	Type of welding			
9	Insulation material & thickness			
10	Thermal conductivity of Rockwool if used			
11	Material of inner seal ring for tubes			
12	Sacrificial anode if provided			
C.	TEST RESULTS	Specified	Observed	Remarks
1	Storage water tank capacity, litres			
2	Leakage test for inner tank	No leakage or permanent deformity		
3	Rigidity test	No damage or deformation of connecting parts after test		
4	Idle heating test	No deformation, crack or other damage after test		
5	Integral test	No deformation, damage or leakage after test		
6	Performance test	Heat loss coefficient of the system shall be $< 2 \text{ W/m}^2 \cdot ^\circ\text{C}$		
7	Inner tank material & thickness			
8	Type of anti corrosive coating inside inner tank			
9	Outer cladding material & thickness			
10	Type of welding			
11	Insulation material & thickness			
12	Material of inner seal ring for tubes			
13	Sacrificial anode if provided			
14	Remarks			

Date:

Place:

(Testing Officer)

(Head of the Test laboratory)