



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS A 4111 : 2021

(JSSDA/JSA)

Solar water heater

ICS 27.160

Reference number : JIS A 4111 : 2021 (E)

PROTECTED BY COPYRIGHT

Date of Establishment: 1979-01-01

Date of Revision: 2021-03-22

Date of Public Notice in Official Gazette: 2021-03-22

Investigated by: Japanese Industrial Standards Committee

Standards Board for ISO area

Technical Committee on Architecture

JIS A 4111 : 2021, First English edition published in 2022-09

Translated and published by: Japanese Standards Association
Mita MT Building, 3-13-12, Mita, Minato-ku, Tokyo, 108-0073 JAPAN

In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

© JSA 2022

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

Printed in Japan

PROTECTED BY COPYRIGHT

AH/HN

Contents

	Page
1 Scope	1
2 Normative references	1
3 Terms and definitions	3
4 Types and names of individual parts	8
4.1 Types	8
4.2 Names of individual parts	8
5 Materials	11
5.1 Materials to be used for heat collecting body, cistern and hot water storage tank	11
5.2 Materials to be used for the exterior box	12
5.3 Materials to be used for the transmission body	13
5.4 Materials to be used for the connecting pipe	14
5.5 Heat insulating materials to be used for the heat collecting part and the hot water storage part	14
6 Structure	14
6.1 General	14
6.2 Ball tap	16
6.3 Air gap between the discharge opening of ball tap and the overflow surface	16
7 Performance	17
8 Appearance	19
9 Tests	19
9.1 Heat collecting performance test	19
9.2 Hot water storage quantity test	21
9.3 Holding water quantity test	21
9.4 Effective hot water supply efficiency test	22
9.5 Heat insulating performance test	23
9.6 Pressure resistance test	24
9.7 Freezing resistance test	24
9.8 Blank heating resistance test	25
9.9 Hot water supply performance test	26
9.10 Strength tests	26
9.11 Adhesion test	28
9.12 Salt spray test	28
9.13 Durability test of exterior plastics	29
9.14 Durability test of transmission body	29

9.15	Durability test of reflector	29
9.16	Leaching performance test	30
10	Appearance test	30
11	Inspection	30
11.1	Type inspection	30
11.2	Delivery inspection	31
12	Marking and information to be provided	31
12.1	Information to be marked on the product	31
12.2	Information to be included in attached documents	31
Annex A (informative)	Indoor test method for heat collecting performance	33
Annex B (informative)	Theoretical background of the heat insulating performance	35
Annex C (informative)	List of technically significant revisions from the previous edition	37

Foreword

This Japanese Industrial Standard has been revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Solar System Development Association (JSSDA)/Japanese Standards Association (JSA) with a draft being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act applied mutatis mutandis pursuant to the provision of Article 16 of the said Act. This edition replaces the previous edition (**JIS A 4111:2013**), which has been technically revised.

This **JIS** document is protected by the Copyright Act.

Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, published patent application or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, published patent application or utility model rights.

Blank

Solar water heater

1 Scope

This Japanese Industrial Standard specifies requirements for the natural circulating type solar water heaters (hereafter referred to as the water heaters) to be installed at a height of 10 m or less from the ground surface level, which are mainly used for the hot water supply of detached housings.

A list of technically significant revisions from the previous edition with reasons is given in Annex C.

2 Normative references

Part or all of the provisions of the following standards, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

- JIS A 1415 *Methods of exposure to laboratory light sources for polymeric material of buildings*
- JIS A 9504 *Man made mineral fibre thermal insulation materials*
- JIS A 9511 *Preformed cellular plastics thermal insulation materials*
- JIS A 9521 *Thermal insulation materials for buildings*
- JIS B 1501 *Rolling bearings — Balls*
- JIS B 2061 *Faucets, ball taps and flush valves*
- JIS B 2301 *Screwed type malleable cast iron pipe fittings*
- JIS B 2302 *Screwed type steel pipe fittings*
- JIS B 8410 *Pressure reducing valves for water works*
- JIS B 8414 *Relief valves for hot water appliances*
- JIS G 3131 *Hot-rolled mild steel plates, sheet and strip*
- JIS G 3141 *Cold-reduced carbon steel sheet and strip*
- JIS G 3302 *Hot-dip zinc-coated steel sheet and strip*
- JIS G 3312 *Prepainted hot-dip zinc-coated steel sheet and strip*
- JIS G 3313 *Electrolytic zinc-coated steel sheet and strip*
- JIS G 3314 *Hot-dip aluminium-coated steel sheet and strip*
- JIS G 3317 *Hot-dip zinc — 5 % aluminium alloy-coated steel sheet and strip*
- JIS G 3318 *Prepainted hot-dip zinc — 5 % aluminium alloy-coated steel sheet and strip*

- JIS G 3320 *Prepainted stainless steel sheet and strip*
- JIS G 3321 *Hot-dip 55% aluminium-zinc alloy-coated steel sheet and strip*
- JIS G 3322 *Prepainted hot-dip 55 % aluminium — zinc alloy-coated steel sheet and strip*
- JIS G 3442 *Galvanized steel pipes for ordinary piping*
- JIS G 3448 *Light gauge stainless steel tubes for ordinary piping*
- JIS G 3452 *Carbon steel pipes for ordinary piping*
- JIS G 3459 *Stainless steel pipes*
- JIS G 4305 *Cold-rolled stainless steel plate, sheet and strip*
- JIS H 3100 *Copper and copper alloy sheets, plates and strips*
- JIS H 3250 *Copper and copper alloy rods and bars*
- JIS H 3300 *Copper and copper alloy seamless pipes and tubes*
- JIS H 3401 *Pipe fittings of copper and copper alloys*
- JIS H 4000 *Aluminium and aluminium alloy sheets, strips and plates*
- JIS H 4100 *Aluminium and aluminium alloy extruded profiles*
- JIS K 6353 *Rubber goods for water works*
- JIS K 6718-1 *Plastics — Poly(methyl methacrylate) sheets — Types, dimensions and characteristics — Part 1 : Cast sheets*
- JIS K 6718-2 *Plastics — Poly(methyl methacrylate) sheets — Types, dimensions and characteristics — Part 2 : Extruded sheets*
- JIS K 6719-1 *Plastics — Polycarbonate (PC) moulding and extrusion materials — Part 1 : Designation system and basis for specifications*
- JIS K 6720-1 *Plastics — Homopolymer and copolymer resins of vinyl chloride — Part 1 : Designation system and basis for specifications*
- JIS K 6732 *Poly (vinyl chloride) films for agriculture*
- JIS K 6741 *Unplasticized poly(vinyl chloride) (PVC-U) pipes*
- JIS K 6742 *Unplasticized poly(vinyl chloride) (PVC-U) pipes for water supply*
- JIS K 6743 *Unplasticized poly(vinyl chloride) (PVC-U) pipe fittings for water supply*
- JIS K 6744 *Polyvinyl chloride prepainted and laminated metal sheet and strip*
- JIS K 6745 *Plastics — Unplasticized poly (vinyl chloride) sheets*
- JIS K 6761 *Polyethylene pipes for general purposes*
- JIS K 6762 *Double wall polyethylene pipes for water supply*
- JIS K 6781 *Polyethylene films for agriculture*
- JIS K 6919 *Liquid unsaturated polyester resins for fiber reinforced plastics*

- JIS K 6934-1 *Plastics — Acrylonitrile-butadiene-styrene (ABS) moulding and extrusion materials — Part 1 : Designation system and basis for specifications*
- JIS K 7137-1 *Plastics — Polytetrafluoroethylene (PTFE) semi-finished products — Part 1 : Requirements and designation*
- JIS K 7161-1 *Plastics — Determination of tensile properties — Part 1 : General principles*
- JIS K 7161-2 *Plastics — Determination of tensile properties — Part 2 : Test conditions for moulding and extrusion plastics*
- JIS K 7361-1 *Plastics — Determination of the total luminous transmittance of transparent materials — Part 1 : Single beam instrument*
- JIS R 3106 *Testing method for transmittance, reflectance and emissivity of flat glass and calculation of total solar energy transmittance of glazing*
- JIS R 3202 *Float glass and polished plate glass*
- JIS R 3203 *Patterned glass*
- JIS R 3205 *Laminated glass*
- JIS R 3206 *Tempered glass*
- JIS R 3411 *Textile glass chopped strand mats*
- JIS R 3412 *Textile glass rovings*
- JIS R 3417 *Textile glass — Woven roving*
- JIS S 3200-7 *Equipment for water supply service — Test methods of effect to water quality*
- JIS Z 1522 *Pressure sensitive adhesive cellophane tapes*
- JIS Z 2371 *Methods of salt spray testing*

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions apply.

3.1

natural circulating type water heater

water heater utilizing solar heat, which integrates a heat collecting part and a hot water storage part, wherein the thermal energy obtained at the heat collecting part is transported to the hot water storage part by utilizing the natural circulation generated in a thermosiphon, heat pipe or the like and the water for hot water supply is directly or indirectly heated and reserved under heat insulating state in the hot water storage part

3.2

heat collecting part

part composed of a transmission body, a heat collecting body, a heat insulating material, an inside reflector, an exterior box, fixing parts, etc., designed to convert the solar radiation energy into thermal energy to heat the water for hot water supply, heat collecting media or the like

3.3

hot water storage part

part composed of a hot water storage tank, a heat insulating material, an exterior box, fixing parts, a heat collecting part and connecting pipes thereof, designed to store under thermal insulation the water for hot water supply heated by thermal energy obtained in the heat collecting part

3.4

hot water storage tank

container built within the hot water storage part, which stores the water for hot water supply

Note 1 to entry It may also serve as a water feed part.

3.5

water feed part

feed water introduction part which automatically feeds water into the water heater, and which may or may not also control the water feeding amount and water feeding pressure to ensure smooth and safe supply of hot water

Note 1 to entry The water feed part of the ambient open type (hereafter referred to as open type) is comprised of a water feed inlet and cistern (in the water heater, a hot water storage tank usually acts as a cistern), a ball tap, an overflow pipe, etc.

Note 2 to entry The water feed part of the closed type is comprised of a water feed inlet, a pressure reducing valve for water works, etc.

3.6

reflector

object which reflects the solar radiation energy and increases the incident quantity to a heat collecting body

3.7

transmission body

part used for the surface of a heat collecting part, which transmits solar light and reduces the convection and radiation heat loss from a heat collecting body

3.8

heat collecting body

part which absorbs the incident solar radiation energy, converts it to thermal energy

and conducts it to the heat collecting medium

3.9

heat collecting surface

plane surface normal to the parallel beam, where the projected area on the heat collecting part by the parallel beam is maximum

3.10

total area of heat collecting part

projected area of the heat collecting part normal to the parallel beam, excluding the fixing parts (e.g. ⑫ in Figure 4) and protruding parts such as the connecting pipes (e.g. ⑪ in Figure 4) on the heat collecting part, shown in Figure 1 to Figure 3

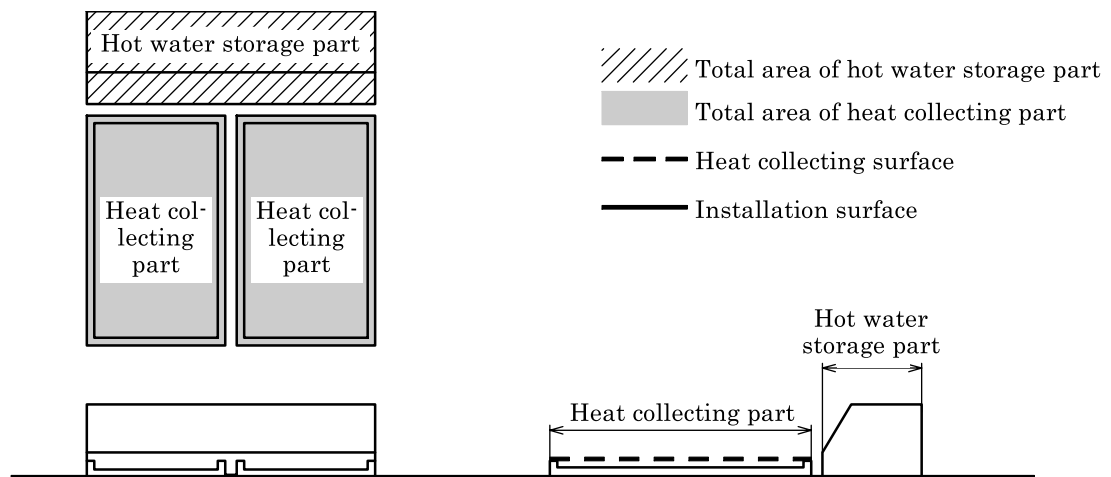


Figure 1 Example of total area of hot water storage part and total area of heat collecting part in natural circulating type water heater 1

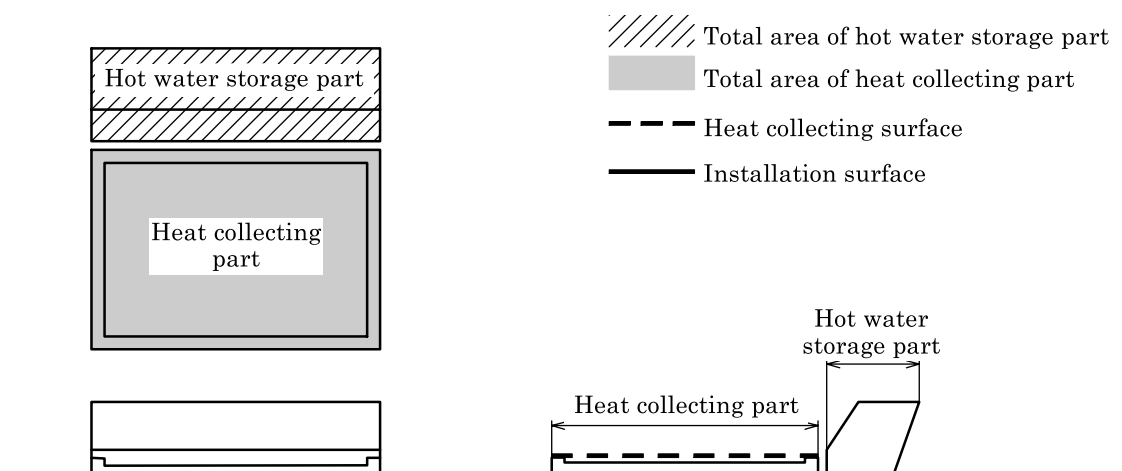


Figure 2 Example of total area of hot water storage part and total area of heat collecting part in natural circulating type water heater 2

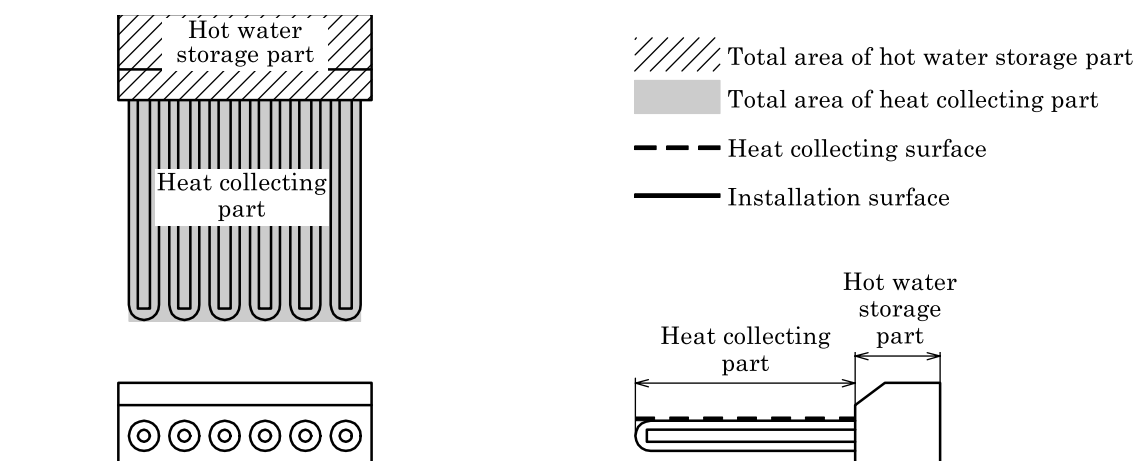


Figure 3 Example of total area of hot water storage part and total area of heat collecting part in natural circulating type water heater 3

3.11

total area of hot water storage part

projected area of the hot water storage part parallel to the installation surface of the water heater, excluding the fixing parts (e.g. ⑫ in Figure 4) and protruding parts such as the connecting pipes (e.g. ⑦ in Figure 4) on the hot water storage part, see Figures 1 to 3

3.12

area of water heater

sum of the total area of the heat collecting part and the total area of the hot water storage part

3.13

solar incident quantity on heat collecting surface

quantity of energy (kJ/m^2) per unit area on the heat collecting surface, obtained by time integration of the global solar irradiance (W/m^2) measured by using a thermopile type pyranometer

3.14

water heater heat collection efficiency

quantity of collected heat of water heater per unit area per day, Q_r [$\text{kJ}/(\text{m}^2/\text{day})$], divided by the solar incident quantity on heat collecting surface per day, I_d [$\text{kJ}/(\text{m}^2/\text{day})$]

Note 1 to entry The area used for this calculation is based on the total area of the heat collecting part.

3.15

heat collecting medium

medium to transport thermal energy from the heat collecting part to the hot water

storage part

3.16

blank heating

state of a water heater receiving solar radiation energy without being filled with heat collecting medium and water for hot water supply, and incapable of heat collection

3.17

hot water storage quantity

quantity of water for hot water supply to be stored in the hot water storage tank

3.18

holding water quantity

total of quantity of water for hot water supply and quantity of heat collecting medium to be stored in the hot water storage part

Note 1 to entry It is equal to the hot water storage quantity in the direct heating system water heater and to the total of the hot water storage quantity and the quantity of heat collecting medium to be stored in the hot water storage part in the indirect heating system water heater.

3.19

effective hot water supply efficiency

percentage of hot water supply heat quantity when all hot water in the hot water storage tank is supplied, compared to the heat quantity retained by hot water in the hot water storage tank after the heat collection is completed

Note 1 to entry While effective hot water supply efficiency is regarded as one of the metrics for the solar heat usage, this value may not represent the exact percentage of solar heat usage, since the heat quantity remaining in the hot water storage tank after the whole volume of hot water in the tank has been supplied can also be used for hot water supply. A hot water usage quantity equal to or more than the capacity of a hot water storage tank may suggest a possibility of hot water usage exceeding the effective hot water supply efficiency.

3.20

fixing part

part provided on a water heater for the purpose of tightly attaching the water heater to a frame and the main structure of a building with fixing wires and fixing metal fittings

3.21

direct installation

method of installation in which the lower surface of the heat collecting part or the lower surface of the heat collecting hot water storage part is approximately parallel to the

roof surface and the clearance between them does not exceed 100 mm

3.22

maximum working pressure

maximum pressure designated by the manufacturer for the water heater connection part

In a closed type water heater, this also refers to the maximum pressure of the hot water storage tank.

3.23

coating

film of applied paint or coating layer of a polyvinyl chloride coated and laminated metal plate

4 Types and names of individual parts

4.1 Types

The types of water heater shall be as follows.

- a) The water heaters are classified by the heating system in accordance with Table 1.

Table 1 Classification by heating system

Type	Heating system
Direct heating system	The water for hot water supply is directly heated by solar radiation energy in the heat collecting part.
Indirect heating system	The water for hot water supply is heated indirectly by use of a heat collecting medium which has been heated by solar radiation energy in the heat collecting part.

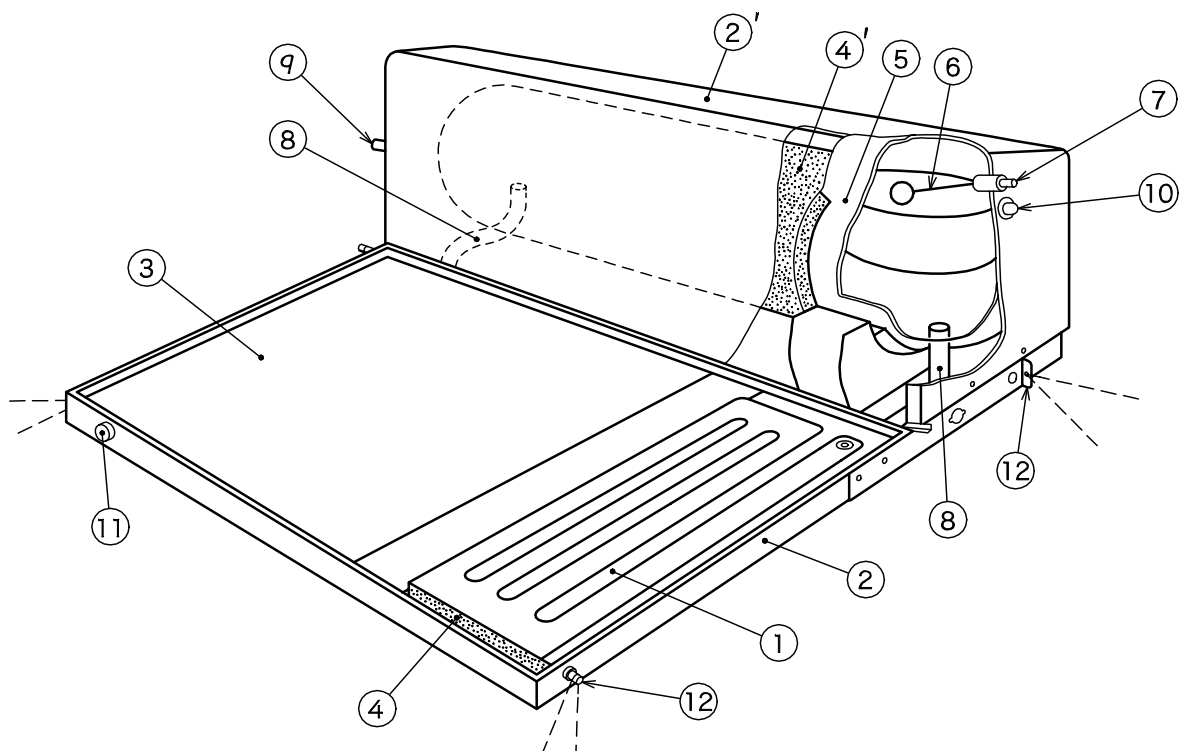
- b) The water heaters are classified by the structure in accordance with Table 2.

Table 2 Classification by structure

Type	Structure
Open type	The surface of water stored in the hot water storage tank is exposed to the atmosphere.
Closed type	The water for hot water supply stored in the hot water storage tank exceeds the atmospheric pressure.

4.2 Names of individual parts

The names of individual parts of a water heater are as shown in Figure 4 to Figure 6.



No.	Name	No.	Name
①	Heat collecting body	⑥	Ball tap
②	Exterior box	⑦	Water feed inlet
②'	Exterior box	⑧	Connecting pipe
③	Transmission body	⑨	Hot water supply outlet
④	Heat insulating material	⑩	Overflow pipe
④'	Heat insulating material	⑪	Drain hole
⑤	Hot water storage tank	⑫	Fixing part
NOTE 1 The heat collecting part is an assembly of ① to ④, and ⑪ and ⑫.			
NOTE 2 The hot water storage part is an assembly of ②', ④', ⑤ to ⑩, and ⑫			
NOTE 3 Some water heaters are provided with reflectors for enhancing the heat collection efficiency.			

Figure 4 Example of direct heating system, open type water heater