

**Certification Scheme  
Rules  
For Solar Collectors  
and Solar Water Heaters**

Prepared by  
SHAMCI



**Solar Heating Arab Mark  
and Certification Initiative**

## Contents

1	About SHAMCI	3
	1.1 SHAMCI Partners	3
2	Preface	3
3	Introduction	4
4	Definition of Scope	4
	4.1 Products covered by the scheme	4
	4.2 List of standards concerned	4
	4.2.1 Solar collectors	4
	4.2.2 Solar water heaters	4
5	Attestation of Conformity	5
6	Requirements for Involved Bodies	6
	6.1 General requirements	6
	6.2 Specific requirement for the different bodies	6
	6.2.1 Certification bodies	6
	6.2.2 Test labs	6
	6.2.3 Factory inspectors	6
7	Requirements for Products	7
8	Specification of the Manufacturer's Application File	7
9	Selection of Type Test Samples	7
10	Factory Production Control and Initial Inspection of Manufacturing Site	8
11	Surveillance	8
12	Collector Families	9
	12.1 Collector families	9
	12.2 Use of different collector components with same characteristics	9
13	Changes in products – re-testing	10
14	Complaints	10
15	List of Bodies for the Implementation of the Scheme	10
16	List of Certified Products	10
17	Owner of the SHAMCI Trade Mark	11
18	Updating the SHAMCI General Certification Scheme Rules	11

	19	Disclaimer	11
	20	ANNEXES	12
20.1		<i>ANNEX A1 Requirements - collectors</i>	12
		20.1.1 Required tests– collectors	12
		20.1.2 Pass criteria and classification - collectors	13
		20.1.3 Optional tests:	15
20.2		<i>ANNEX A2 Requirements - solar water heaters</i>	15
		20.2.1 Required tests - solar water heaters	15
		20.2.2 Pass criteria - solar water heaters	16
		20.2.3 Other requirements	20
20.3		<i>ANNEX B1. DOCUMENTATION OF THE SOLAR COLLECTOR</i>	21
		20.3.1 Drawings and data sheet	21
		20.3.2 Marking, labeling and packaging	22
		20.3.3 Installer instruction manual - collector	22
20.4		<i>ANNEX B2. DOCUMENTATION OF THE SOLAR WATER HEATER</i>	23
		20.4.1 General	23
		20.4.2 Installer instruction manual - solar water heater	23
		20.4.3 Documents for the user - solar water heater	25
20.5		<i>ANNEX C1. COLLECTOR DATA SHEET</i>	26
20.6		<i>ANNEX. SOLAR WATER HEATER DATA SHEET C2</i>	26
20.7		<i>SURVEILLANCE TEST &amp; FACTORY INSPECTION REPORT. ANNEX D</i>	26
20.8		<i>ANNEX E. SPECIAL TEST</i>	26
		20.8.1 Compliance with registered values	27

### 1 About SHAMCI

The Solar Heating Arab Mark and Certification Initiative (SHAMCI) is quality certification scheme for the solar thermal products and services in the Arab region. The project provides a regional industrial and regulatory compliance framework for policy makers, industrial sector, and end-consumers. The project promotes adopting standard quality measures, accreditation systems and quality labels across the Arab region.

#### 1.1 Pa SHAMCIrtners



### 2 Preface

This document defines the SHAMCI certification scheme, and gives the rules for certification of solar collectors and solar water heaters for the Arab States .

The SHAMCI Certification Scheme Rules are elaborated by the SHAMCI Network and any changes in the scheme rules shall be approved by the SHAMCI Network .

A network has formed with the name of SHAMCI to prepare the certification rules for SWHs in the Arab region, the rules developed in cooperation with SWT, Stuttgart University. Latest versions of the SHAMCI General Certification Scheme Rules and annexes are available from **www.shamci.net**

### 3 Introduction

The SHAMCI<sup>1</sup> Certification Scheme Rules gives the requirements for SHAMCI certification of solar collectors and solar water heaters - and define the test methods to be used to check if requirements are fulfilled. Using same test methods and same conformity attestation it is possible to compare certified test results and products on the same basis.

### 4 Definition of Scope

#### 4.1 Products covered by the scheme

The scheme covers the following products:

- Solar thermal collectors as defined in scope of ISO 9806
- Solar water heating systems as defined in scopes of ISO 9459-2 and ISO 9459-5

#### 4.2 concerned List of standards

The test methods from the following standards are available for the SHAMCI certification scheme:

##### 4.2.1 Solar collectors

- ISO 9806 “Solar energy — Solar thermal collectors — Test methods”

##### 4.2.2 Solar water heaters

The following two test methods are available for performance testing of solar water heaters. No other test methods for characteristics covered by these test methods shall be used.

ISO 9459-2 - Solar heating -- Domestic water heating systems -- Part 2:  
Outdoor test methods for system performance characterization and yearly performance prediction of solar-only systems

ISO 9459-5 - Solar heating -- Domestic water heating systems -- Part 5:  
System performance characterization by means of whole-system tests and computer simulation

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<sup>1</sup> SHAMCI Network it's a virtual network has been created under The Arab Council of Electricity, consists of a group of Arab & Foreign experts specialized in solar energy, and representatives from Governmental and Private sectors, and related organizations.

The following test methods are available for testing of other characteristics than performance of solar water heaters. No other test methods for characteristics covered by the test methods below shall be used.

- EN 12976-2 - Thermal solar systems and components - Factory made systems - Part 2: Test methods

The standards are available from national standardization bodies and from the ISO web page: <http://www.iso.org>.

## 5 Attestation of Conformity

The conformity attestation is based on 3<sup>rd</sup> party<sup>2</sup> (independent) testing and inspection - see table 1.

Attestation of Conformity			
Activity group	Activity	Actor	
		Manufacturer	3 <sup>rd</sup> party
Testing / inspection	Initial type testing		x
	Sampling for initial type testing		x
	Biannual detailed product inspection		x
Factory production control	Factory production control (QMS)	x	
	Initial inspection of factory production control		x
	Annual inspection of factory production control		x

Table.1: SHAMCI attestation of conformity is based on 3<sup>rd</sup> party testing and inspection.

<sup>2</sup>3<sup>rd</sup> party is a party independent of the manufacturer (1<sup>st</sup> party) and the buyer (2<sup>nd</sup> party).

QMS: Quality management system

X indicates the required activity and actor

## 6 Requirements for Involved Bodies

The bodies which can be engaged in the SHAMCI certification scheme are:

- Certification bodies
- Test labs
- Inspection bodies

### 6.1 General requirements

The general requirements are that:

- Certification bodies shall be approved by the SHAMCI Network.
- Test labs and inspection bodies shall be recognized by one or more certification bodies

### 6.2 Specific requirement for the different bodies

Besides the general requirements mentioned above the following requirements apply:

#### 6.2.1 Certification bodies

Certification bodies shall - as a minimum - have:

- Experience from certification of solar collectors and solar water heaters in other certification schemes.
- A management system in accordance with ISO/IEC 17065

#### 6.2.2 Test labs

- Test labs shall have accreditation (ISO 17025) for testing of solar collectors and solar water heaters according to standards mentioned in "3.2 List of standards concerned". Until 1<sup>st</sup> January 2017 the SHAMCI network can approve a test lab for SHAMCI testing as an alternative to accreditation.

#### 6.2.3 Factory inspectors

- Inspection bodies shall have at least 3 years' experience with ISO 9001 level factory production control.

## 7 Requirements for Products

Collectors and solar water heaters shall fulfill requirements given in ANNEX - A.

- Requirements for collectors are given in ANNEX A1.
- Requirements for the solar water heaters are given in ANNEX A2.

## 8 Specification of the Manufacturer's Application File

The manufacturer and/or applicant shall supply the certification body with the information as required in the application form of the certification body. The application form is available from the certification body.

This information must include the following documentation required in:

- Solar collectors: ANNEX B1
- Solar water heaters: ANNEX B2

## 9 Selection of Type Test Samples

Selection of products for initial type testing according to relevant standard(s) (see section 3.2) is made by the factory inspector under the responsibility of the certification body.

The test samples for initial type testing are taken out of the current production or from the stock of the manufacturer. The inspector points out the test samples and records their serial numbers. The manufacturer shall prove through his factory production control and quality management system conformity of the test sample with the series production.

A series production exists when a least 10 collectors or systems are produced with the same materials and the same manufacturing technologies in the same way and all major production processes are performed in presence of the inspector.

At least 10 collectors or systems of the same type more than the number of test samples picked must be available in the stock for picking the sample(s) to be tested.

## 10 Factory Production Control and Initial Inspection of Manufacturing Site

Initial inspection of the manufacturing site shall be done by a factory inspector fulfilling requirements in section 5. With this initial inspection it is checked whether the manufacturing site fulfills the following requirements:

- The manufacturer shall operate a quality system covering the production line of the product for which the license to use the SHAMCI is granted and which should be based on the quality standards which are at least of the level of the ISO 9000 series of standards.
- In granting the license, the certification body shall take into account the existence of any quality system certificate issued by a certification body that is accredited by a member of the International Accreditation Forum (IAF).
- The quality management system shall cover the production line according to inspector's criteria.
- The inspection procedure and checklist given in Annex D shall be used.

In case the manufacturer is ISO 9001 certified by a certifier accredited by a national accreditation body being a member of IAF (International Accreditation Forum) ([www.iaf.nu](http://www.iaf.nu)) an SHAMCI factory inspection is only required every second year provided the ISO 9001 report is made available to the certifier.

Based on conclusions of previous audits, interim inspections can be requested by the certifier.

## 11 Surveillance

The required surveillance procedures are:

- The factory inspections/assessments shall include the checking of the documentation of the related FPC at least once a year
- Selecting samples for surveillance tests at least every second year. The surveillance test is a detailed physical inspection of the product and a comparison with the specifications of the original type tested sample. The procedure for the detailed physical inspection given in Annex D shall be used. The surveillance test shall be done at least every second year. The test samples for surveillance testing are taken out of the current production or from the stock of the manufacturer. The inspector points out the test samples and records their serial numbers.

## 12 Collector Families

### 12.1 Collector families

If the manufacturer produces the “same” collector in different lengths and/or widths (i.e. the only difference between two collectors is the length and/or the width) the collector is considered the same subtype (within the same collector “family”). In this case only one sample of the smallest and one sample of the largest module shall be taken and tested<sup>3</sup>. The largest module shall be subject to all the tests required, and the smallest shall be subject to a thermal performance test<sup>4</sup>. The performance figures used for this type shall be the performance figures corresponding to the measured instantaneous efficiency having the lowest integral in the interval of the reduced temperature<sup>5</sup> from 0 – 0.1 K/(W/m<sup>2</sup>). In other words, the efficiency curve used for this subtype shall be the one embracing the smallest area.

Durability and reliability tests shall be carried out on collectors representing the major features of the collector family. E.g. collector families with collectors having several glass covers separated by bars. If the largest size of the collector - the test laboratory can test - is smaller than the smallest size of the family representing the weakest point another testing laboratory shall carry out the respective tests.

Note: Custom built collectors (collectors built on site) are so far not dealt with in the SHAMCI certification scheme rules - but may be included at any time when decided by the SHAMCI Network.

### 12.2 Use of different collector components with same characteristics

Absorber coatings listed at the SHAMCI web site as interchangeable may be used.

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<sup>3</sup> The module sizes are compared based on aperture area. Aperture area is defined in EN/ISO 9488. The inspector shall inspect all the different sizes of the type to verify conformity.

<sup>4</sup> The definition of the biggest collector and the smallest collector is done at the initial test. If later a bigger size or smaller size is added to the collector family this is resulting in a new definition for the existing family. If there is a new biggest collector added this will require performance testing and reliability testing of this collector. If there is a new smallest collector added this will require performance testing on the smallest collector.

<sup>5</sup> The reduced temperature and the instantaneous efficiency are defined in ISO 9806.

Collector glazing listed at the SHAMCI web site as interchangeable may be used.

### 13 Changes in products – re-testing

The SHAMCI license for marking the product is not valid if the product is changed/modified. However, depending on the modifications, it might not be necessary to carry out a complete new initial type test. In order to keep the license, the manufacturer shall supply the certification body with a revised “manufacturers application file” noting that the product is a modification of an already certified product (specifying exactly which one) and specifying exactly which modification(s) will be made.

The certification body will then assess the necessity of re-tests/supplementary tests.

Depending on the degree of changes in the production process, the certification body will evaluate if a new initial inspection of the production line is needed.

If the certification body approves documentation and the possible required testing and inspection, the manufacturer can to mark the modified products.

### 14 Complaints

Complaints concerning the conformity of a certified product are handled by the certification body according to its normal procedures. Serious complaint shall be reported to the SHAMCI Network by the responsible certification body. In connection with a complaint a “Special test” can be performed - see ANNEX E.

### 15 List of Bodies for the Implementation of the Scheme

An updated list of certification bodies and approved inspection bodies and testing laboratories shall be available at the SHAMCI web site: www.shamci.net. The SHAMCI Secretariat shall update the list when required.

### 16 List of Certified Products

An updated list of certified products giving information on product characteristics and performance in a fixed format (see Annex C) shall be available at the SHAMCI web site: www.shamci.net. The SHAMCI Secretariat shall update the list when required based on inputs from the SHAMCI certification bodies.

### **17 Owner of the SHAMCI Trade Mark**

The owner of the SHAMCI mark is the SHAMCI Network.

Note: Legal body needed

### **18 Updating the SHAMCI General Certification Scheme Rules**

The SHAMCI scheme rules should be updated - if necessary - once every 2 years taking into account the decisions made in the meantime.

### **19 Disclaimer**

The SHAMCI Network does not take responsibility for any damage, accident or loss of money or honor which may be caused by implementation of these scheme rules or caused by use or handling of certified products.

Note: To be checked with legal experts.

## 20 ANNEXES

SHAMCI annexes are available in a separate sheet. All annexes are available on www.shamci.net

### List of annexes:

ANNEX A1	Requirements - collectors
ANNEX A2	Requirements - solar water heaters
ANNEX B1	DOCUMENTATION OF THE SOLAR COLLECTOR
ANNEX B2	DOCUMENTATION OF THE SOLAR WATER HEATER
ANNEX C1	COLLECTOR DATA SHEET
ANNEX C2	SOLAR WATER HEATER DATA SHEET
ANNEX D	SURVEILLANCE TEST & FACTORY INSPECTION REPORT
ANNEX E	SPECIAL TEST

### 20.1 collectors -ANNEX A1 Requirements

#### 20.1.1 Required tests– collectors

The collector shall be subject to the following series of tests done in the listed sequence as defined in ISO 9806:

- Internal pressure
- Leakage test (air collectors only)
- High-temperature resistance
- Exposure
- External thermal shock
- Internal thermal shock

- Rain penetration (only glazed collectors)
- Freeze resistance (only collectors claimed to be freeze resistant)
- Mechanical load
- Impact resistance
- Thermal performance
- Pressure drop measurement
- Final inspection

### 20.1.2 Pass criteria and classification - collectors

The pass criteria and classifications are given for each test in the paragraphs below.

The term "no major failure", denotes that none of the following occurs:

- Fluid channel leakage (in case of liquid heating collectors only) or such deformation that permanent contact between absorber and cover is established;
- Breaking or permanent deformation of cover or cover fixing;
- Breaking or permanent deformation of collector fixing points or collector box;
- Vacuum loss, such that vacuum or sub-atmospheric collectors shall be classified according to the definition in ISO 9488 (only applicable for vacuum and sub-atmospheric collectors);
- Accumulation of humidity in form of condensate on the inside of the transparent cover of the collector exceeding 10 % of the aperture area. In case of an open loop air heating collector for limited periods of time this criterion maybe exceeded.

NOTE: The evaluation of accumulation of humidity for application of the pass criteria should be applied only on the following tests: - External Thermal Shock

#### 20.1.2.1 Internal pressure test for fluid channels

The test pressure shall be as specified in ISO 9806. In the case of fluid channels made of organic materials, climate conditions according to ISO 9806 shall be applied. After the internal pressure test, the collector shall not show any major failure as defined in beginning of section 3.1.2 of the present document.

#### 20.1.2.2 Leakage test

When tested in accordance with ISO 9806, the collector shall not show any major failure as defined in beginning of section 3.1.2 Results shall be reported as stated in ISO 9806. Leakage at maximum operating pressure shall be reported.

NOTE: This test is applicable only for air collectors.

#### **20.1.2.3 High temperature resistance**

When tested in accordance with ISO 9806, the collector shall not show any major failure as defined in beginning of section 3.1.2.

#### **20.1.2.4 Exposure**

When tested in accordance with ISO 9806, the collector shall not show any major failure as defined in beginning of section 3.1.3 and none of each potential problems of their components shall be graded 2 on the scale given in ISO 9806. Climate class shall be specified.

#### **20.1.2.5 External thermal shock**

When tested in accordance with ISO 9806, the collector shall not show any major failure as defined in beginning of section 3.1.2. Climate class shall be specified.

#### **20.1.2.6 Internal thermal shock**

When tested in accordance with ISO 9806, the collector shall not show any major failure as defined in beginning of section 3.1.2. Climate class shall be specified.

#### **20.1.2.7 Rain penetration**

When tested in accordance with ISO 9806, the collector shall not show any major failure as defined in beginning of section 3.1.2.

NOTE: This test is applicable only for glazed collectors.

#### **20.1.2.8 Freeze resistance test**

This test shall be carried out only in the cases specified in ISO 9806. The pass criterion is no major failure as defined in beginning of section 3.1.2 after three freeze-thaw cycles.

#### **20.1.2.9 Mechanical load test**

When tested in accordance with ISO 9806 the cover, the collector box and the fixings between collector box and mounting system shall not show any major failure as defined in beginning of section 3.1.2. The permissible and the maximum positive and negative pressure shall be published and recorded in the installer manual.

#### **20.1.2.10 Resistance test**

When tested in accordance with ISO 9806 the cover, the collector box and the fixings between collector box and mounting system shall not show any major failure as defined in beginning of section 3.1.2 The method used shall be reported. If ice balls are used the highest values of ball diameter and velocity not

causing damage to the collector shall be reported. If steel balls are used the highest height causing damage to the collector shall be reported.

### 20.1.2.11 Thermal performance

When tested in accordance with ISO 9806, the collector shall not show any major failure as defined in beginning of section 3.1.2 Thermal performance shall be reported according to ISO 9806. For PVT collectors also the operating mode of the electrical loop (open/ closed circuit or MPP tracked) shall be reported.

### 20.1.3 Optional tests:

- Pressure drop measurement (ISO 9806)
- Reaction to fire (EN13501-1)
- External fire performance (EN 13501-5)
- Surface temperature

Requirements related to these optional tests are not defined so far in the SHAMCI scheme rules - but may be defined elsewhere.

## 20.2 ANNEX A2 Requirements - solar water heaters

### 20.2.1 Required tests - solar water heaters

The collector part in the solar water heater shall fulfill requirements given in ANNEX A1 except for requirements related to:

- Internal pressure (all systems excepted)
- Exposure (only systems where the collector cannot be tested separately)
- Internal thermal shock (only systems where the collector cannot be tested separately)
- Freeze resistance (all systems excepted)
- Thermal performance (all systems excepted)

The solar water heater as a whole shall be subject to tests described in the standards:

- ISO 9459-2 or ISO 9459-5:
  - A. Complete test of performance including prediction of long-term performance
- EN 12976-2:
  - A. Freeze resistance/protection (5.1);
  - B. Over temperature protection / scald protection / materials (5.2);

- C. Pressure resistance (5.3);
- D. Water contamination (5.4);
- E. Lightning protection (5.5);
- F. Safety equipment (5.6);
- G. Ability to cover the load (5.9); (only solar-plus-supplementary systems)
- H. Reverse flow protection (5.10);
- I. Electrical safety (5.11);

NOTE: Numbers in bracket refers to sections in EN 12976-2:2012.

### 20.2.2 Pass criteria - solar water heaters

The pass criteria related to testing of the collector part of the system are given in ANNEX A1.

The pass criteria for related to testing of the solar water heater as a whole are given below:

#### 20.2.2.1 Freeze resistance

##### General

The manufacturer shall state a minimal allowed temperature for the system. The parts of the system that are exposed to the outdoors shall be able to withstand freezing to this specified temperature without any permanent damage.

The manufacturer shall describe the method of freeze protection used for the system.

Any indoor components that are to be installed in places where temperatures can drop below 0°C shall be protected against freezing.

The freezing mechanism shall be tested in accordance with 5.1 of EN 12976-2:2012.

##### Freeze protection by means of anti-freeze fluid

The manufacturer shall define the composition of the heat transfer fluid, including additives, allowed for the system.

Precautions shall be taken to prevent the antifreeze fluid from deterioration as a result of high temperature conditions. These precautions shall be checked in accordance with 5.2 of EN 12976-2:2012.

**NOTE** In general the minimal allowed temperature of the system is equal to the freezing point of the antifreeze fluid. If the concentration of some antifreeze fluids - like glycols - exceeds a certain limit, they can freeze without damaging the system. In this case the minimal allowed temperature can be lower than the freezing point of the antifreeze fluid.

### 20.2.2.2 Over temperature protection

#### General

The system shall have been designed in such a way that prolonged high solar irradiation without heat consumption does not cause any situation in which special action by the user is required to bring the system back to normal operation.

When the system has a provision to drain an amount of drinking water as a protection against overheating, the hot water drain shall be constructed in such a way that no damage is done to the system or any other materials in the house by the drained hot water. The construction shall be such that there is no danger to inhabitants from steam or hot water from the drain. *Note: Draining drinking water to prevent overheating is not a recommended solution.*

When the overheating protection of the system is dependent on electricity supply and/or cold water supply, this shall be stated clearly in the instructions and on the system.

#### Scald protection

When the system is tested in accordance with 5.2 of EN 12976-2:2012, no steam shall escape from any tapping point. When this test has been performed with other than the highest irradiations this shall be mentioned in the documentation for the user.

For systems in which the temperature of the domestic hot water delivered to the user can exceed 60 °C, the assembly instructions shall mention that an automatic cold water mixing device or any other device to limit the tapping temperature to at most 60 °C +/- 5°C shall be installed on the solar heating system or elsewhere in the domestic hot water installation.

This device shall be able to withstand the maximum possible domestic hot water temperature from the solar heating system.

#### Over temperature protection for materials

The system shall have been designed in such a way that the maximal allowed temperature of any material in the system is never exceeded.

NOTE Care should be taken in cases where under stagnation conditions steam or hot water can enter the collector pipes, pipe work, distribution network or heat exchanger).

### **20.2.2.3 Reverse flow protection**

The system shall contain provisions in order to prevent increased heat loss resulting from reverse flow in any circuit. This shall be checked in accordance with 5.10 of EN 12976-2:2012.

### **20.2.2.4 Pressure resistance**

The storage tank and heat exchangers in this tank shall withstand 1.5 times the manufacturer's stated maximum individual working pressures.

When tested in accordance with 5.3 of EN 12976-2:2012 to the above pressures, there shall be no visible permanent damage or leakage of the system components and interconnections. After the waiting period in the test, the hydraulic pressure shall not have dropped more than 10 % from the value measured at the start of the waiting period.

The drinking water circuit shall withstand the maximum pressure required by national/European drinking water regulations for open or closed drinking water installations.

The system shall have been designed in such a way that the maximal allowed pressure of any materials in the system is never exceeded.

Every closed circuit in the system shall contain a safety valve. This safety valve shall withstand the highest temperature that can be reached at its location. It shall conform to EN 1489. If thermostatic valves are used, these shall conform to EN 1490.

### **20.2.2.5 Electrical safety**

If the system contains any electrical devices, these shall conform to EN 60335-1 and EN 60335-2-21.

### **20.2.2.6 Safety equipment**

#### Safety valves

Each section of the collector array, which can be shut off, shall be fitted with at least one safety valve. ICS systems shall be fitted with at least one safety valve,

which may be integrated with an inlet combination. The safety valve shall resist the temperature conditions which it is exposed to, especially the highest temperature that can occur. The safety valve shall resist the heat transfer medium. The safety valve shall be dimensioned such that it can release the highest flow of hot water or steam that can occur. The dimension of the safety valve(s) shall be proved by suitable means.

The safety valves shall conform to EN 1489.

### Safety lines and expansion lines

If the system is equipped with a safety line, this safety line shall not be capable of being shut off.

If the system is equipped with a safety line and an expansion line, the safety line and expansion line shall be dimensioned such, that for the highest flow of hot water or steam that can occur, at no place in the collector loop the maximum allowed pressure is exceeded due to the pressure drop in these lines. The dimension of the safety line and expansion line shall be proved by suitable means.

The expansion line and the safety line shall be connected and laid in such a way that any accumulations of dirt, scale or similar impurities are avoided.

### Blow-off lines

If the system is equipped with blow-off lines, these blow-off lines shall be laid in such a way that they cannot freeze up and that no water can accumulate within these lines. The orifices of the blow-off lines shall be arranged in such a way that any steam or heat transfer medium issuing from the safety valves does not cause any risk for people, materials or environment.

The system shall be checked according to 5.6.3 of EN 12976-2:2012.

### **20.2.2.7 Resistance to external influences**

The components, which are exposed to the effect of weather, shall resist weathering and shall be designed, constructed and fastened in such a way that they can withstand the weather.

In respect of lightning protection, the system should conform to IEC 61024-1.

## 20.2.3 Other requirements

### 20.2.3.1 Supporting frame

Maximum allowable load for supporting frame shall be stated by manufacturer

### 20.2.3.2 Materials

The design and materials in the system shall be such that there is no possibility of deforming, clogging or lime deposit in its circuits that will drastically influence the system performance and safety.

With regard to corrosion, Annex B of EN 12976-2:2012 gives information to assist manufacturers in selecting the materials used in the collector loop.

### 20.2.3.3 Heat exchangers

If the system is intended for use in areas with high water hardness and at temperatures above 60 °C, heat exchangers in contact with drinking water shall be designed such that scaling is prevented or there shall be a facility for cleaning.

### 20.2.3.4 Control system, sensors

When present, the collector temperature sensor shall withstand stagnation conditions as specified in ISO 9806 without drifting by more than 1 K.

When present, the store temperature sensor shall withstand 100 °C without reduction of the accuracy by more than 1 K.

The location and installation of all temperature sensors shall ensure a good thermal contact with the part of which the temperature shall be measured. The temperature sensors shall be insulated against ambient.

### 20.2.3.5 Hydraulic safety

Each section of the collector array, which can be shut off, shall be fitted with at least one safety valve. ICS systems shall be fitted with at least one safety valve, which may be integrated with an inlet combination. The safety valve shall resist the temperature conditions which it is exposed to, especially the highest temperature that can occur. The safety valve shall resist the heat transfer medium. The safety valve shall be dimensioned such that it can release the highest flow of hot water or steam that can occur. The dimension of the safety valve(s) shall be proved by suitable means.

If the system is equipped with a safety line, this safety line shall not be capable of being shut off.

If the system is equipped with a safety line and an expansion line, the safety line and expansion line shall be dimensioned such, that for the highest flow of hot water or steam that can occur, at no place in the collector loop the maximum allowed pressure is exceeded due to the pressure drop in these lines. The dimension of the safety line and expansion line shall be proved by suitable means.

The expansion line and the safety line shall be connected and laid in such a way that any accumulations of dirt, scale or similar impurities are avoided.

If the system is equipped with blow-off lines, these blow-off lines shall be laid in such a way that they cannot freeze up and that no water can accumulate within these lines. The orifices of the blow-off lines shall be arranged in such a way that any steam or heat transfer medium issuing from the safety valves does not cause any risk for people, materials or environment.

### **20.2.3.6 Resistance to external influences**

The components, which are exposed to the effect of weather and environments, shall resist weathering and shall be designed, constructed and fastened in such a way that they can withstand the weather and attacks from insects, birds and animals.

### **20.2.3.7 Electrical safety**

If the system contains any electrical devices, these shall conform to EN 60335-1 and EN 60335-2-21.

## **20.3 ANNEX B1. DOCUMENTATION OF THE SOLAR COLLECTOR<sup>6</sup>**

### **20.3.1 Drawings and data sheet**

The solar collector submitted for test shall be accompanied by:

- a set of drawings describing the solar collector's dimensions and structure
- a list of materials used in the solar collector
- important physical and optical properties

Drawings shall have a number, date of issue and possible revision date.

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<sup>6</sup> Annex B1 is a slightly modified version of the requirements for documentation given in EN 12975-1.

These documents shall be filled by the test institute for at least the period of time that the solar collector type is traded by the manufacturer.

NOTE The manufacturer is usually obliged to keep these drawings for at least the period of time that the warranty of the solar collector type is valid.

### 20.3.2 Marking, labeling and packaging

Solar collectors shall carry a visible and durable label with the following data:

- Name of manufacturer;
- Type;
- Serial number;
- Year of production;
- Gross area of solar collector;
- Dimensions of solar collector;
- Maximum operation pressure;
- Stagnation temperature at 1000 W/m<sup>2</sup> and 30 °C;
- Volume of heat transfer fluid; (liquid heating solar collectors only)
- Optical efficiency,  $\eta_{a0}$
- First order heat loss coefficient,  $ka_1$  (W/(m<sup>2</sup>K))
- Second order heat loss coefficient,  $ka_2$  (W/(m<sup>2</sup>K<sup>2</sup>))
- Maximum start temperature (air heating solar collectors only)
- Weight of empty solar collector;
- Made in:.....

### 20.3.3 Installer instruction manual - collector

Solar collectors shall be accompanied by an installer instruction manual, if traded as stand-alone components. When they are part of a complete system, the system installation manual can cover the complete system. In that case no separate manual for the solar collector shall be required. The instruction manual shall at least contain the following information:

- Dimensions and weight of the solar collector, instructions about the transport and Handling of the solar collector; stagnation temperature of the solar collector.
- Description of the mounting procedure.
- Recommendations about lightning protection.
- Instructions about the coupling of the solar collectors to one another and the connection of the solar collector field to the heat transfer circuit, including dimensions of pipe connections for solar collector arrays up to 20 m<sup>2</sup>.

Recommendations about the heat transfer media which may be used (also with respect to corrosion) and precautions to be taken during filling, operation and service.

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- Maximum operation pressure, the pressure drop and the maximum and minimum tilt angle.
- Permissible wind and snow load.
- Maintenance requirements.

If the solar collector is traded as a component and sold directly to customers, all relevant documentation concerning personal safety, maintenance and handling of the product shall be made available to the customer in the national language of the country where it is sold.

NOTE: The stagnation temperature shown at solar collector label and in installer instruction manual should be given in 10°C resolution.

### 20.4 ANNEX B2. DOCUMENTATION OF THE SOLAR WATER HEATER<sup>7</sup>

#### 20.4.1 General

With each Factory Made solar heating system, the manufacturer or official supplier shall deliver documents for assembly and installation (for the installer) and documents for operation (for the user). These documents shall be written in the official language(s) of the country of sale. These documents shall include all instructions necessary for assembly and operation, including maintenance, and draw attention to further requirements and technical rules that are concerned.

#### 20.4.2 Installer instruction manual - solar water heater

The assembly instructions shall be appropriate to the system and include information concerning:

- Technical data, at least those with respect to:
  - A. Layout of the system.
  - B. Location and nominal diameters of all external connections.
  - C. an overview with all components to be delivered (such as solar collector, storage tank, support structure, hydraulic circuit, back-up provisions, control system and accessories), with information on each component: type, electrical power, dimensions, weight, marks and mounting.

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<sup>7</sup> Annex B2 is a slightly modified version of the requirements for documentation given in EN 12976-1.

- D. Maximum operating pressure of all fluid circuits in the system, such as the collector circuit, the domestic hot water line and the auxiliary heating circuit (in Pa).
- E. Working limits: admissible temperatures, pressures etc. throughout the system.
- F. Type of corrosion protection.
- G. Type of heat transfer fluid.
- Packing and transport of the whole system and/or components and way of storage (outdoors, indoors, packed, not packed);
- Guidelines with recommendations concerning:
  - A. Mounting surfaces.
  - B. Distances to walls and safety with regard to frost.
  - C. The way the entrance of piping into the building shall be finished (resistance against rain and moisture).
  - D. The procedure to be followed for thermal insulation of pipes.
  - E. The roof integration of the collector (if appropriate).
  - F. For drain-back or drain-down systems, the minimal pipe slope and any other instructions necessary to ensure proper draining of the collector circuit.
  - G. Climate class.
  - H. Permissible wind and snow load.
  - I. Recommendations about lightning protection.
- If a support frame that is normally mounted outdoors is part of the system, the maximum values for snow load and mean wind velocity - and the statement that the system may only be installed in locations with lower values for these loads.
- Method for pipe work connections.
- Types and sizes of the safety and security devices and their draining. The assembly instruction shall demand that any pressure relief valves from which steam can escape during normal or stagnation conditions shall be mounted, in such a way that no injuries, harm or damage can be caused by the escape of steam. When the system has a provision to drain an amount of drinking water as a protection against overheating, the hot water drain shall be constructed in such a way that no damage is done to the system or any other materials in the building by the drained hot water;

The necessary control and safety devices including the wiring diagram, including the need for:

- A. a thermostatic mixing valve which limits the draw-off temperature to 60 °C, when this is required
- B. adequate means for preventing backflow from all circuits to drinking main supplies;
  - Reviewing, filling and starting up of the system;
  - Commissioning of the system;
  - A checklist for the installer to check proper functioning of the system;
  - The lowest temperature at which the system can withstand freezing;

### 20.4.3 Documents for the user - solar water heater

The operating instructions shall include information concerning:

- Existing safety and security components and their thermostat adjustment where applicable.
- Implementation of the system drawing particular attention to the facts that:
  - A. Prior to putting the system in operation it shall be checked that all valves are properly working and the system is filled with water and/or antifreeze fluid completely or according to the manufacturer's instructions.
  - B. In the event of any failure condition a specialist shall be called in.
- Regular operation of safety valves.
- Precautions with regard to the risk of frost damage and/or overheating.
- The manner of avoiding failure when starting the system under frost or possible frost conditions.
- Decommissioning of the system.
- Maintenance of the system by a specialist, including frequency of inspections and maintenance and a list of parts that need to be replaced during normal maintenance.
- Performance data for the system:
  - A. The recommended load range for the system (l Collector/day) at specified temperature.
  - B. The thermal performance and solar fraction of the system.
  - C. The annual electricity consumption for pumps, control systems and electrical valves of the system for the same conditions as specified for the thermal performance, assuming a yearly pump operating time of the collector pump of 2000 h.
  - D. If the system contains devices for freeze protection that cause electrical consumption, the electrical power of these devices (in W) and their characteristics (e.g. switch-on temperatures).

- E. For a “solar-plus-supplementary system”, the maximum daily hot water load which can be met by the system without any contribution from solar energy.
- The required solar irradiation on the plane of the collector or the minimum solar lamp irradiance at the plane of the collector for which overheating protection of the system has been tested and, the requirement that the system shall not be used in climate zones with higher irradiation values than these values.
  - When the overheating protection of the system is dependent on electricity and/or cold water supply and/or the system being filled with drinking water, the requirement to never switch off the electricity supply and/or the main water suppliers, or that the system is not drained when there is high solar irradiation.
  - The fact that drinking water may be drained from the system during high irradiation situations, if this method is used to prevent overheating.
  - The lowest temperature at which the system can withstand freezing.
  - Type of heat transfer fluid.
  - In case of solar heating systems with emergency auxiliary heaters, instructions shall be issued that this emergency heater shall only be used for emergency heater purposes.

### 20.5 ANNEX C1. COLLECTOR DATA SHEET

Draft to be elaborated - could be based on Solar Keymark datasheet?

See e.g.: <http://www.dincertco.de/logos/011-7S1877%20F.pdf>

Get updated version from: [www.shamci.org](http://www.shamci.org) or SHAMCI certification body.

### 20.6 C2 R WATER HEATER DATA SHEETSOLA . ANNEX

Draft to be elaborated - could be based on Solar Keymark datasheet?

See e.g.: <http://www.dincertco.de/logos/011-7S1583%20A.pdf>

### 20.7 INSPECTION REPORT. ANNEX D SURVEILLANCE TEST & FACTORY

Draft to be elaborated - could be based on Solar Keymark documents?

See: [http://www.estif.org/solarkeymarknew/images/downloads/network/skn\\_n0132r0.doc](http://www.estif.org/solarkeymarknew/images/downloads/network/skn_n0132r0.doc)

Get updated version from: [www.shamci.org](http://www.shamci.org) or SHAMCI certification body.

### 20.8 ANNEX E. SPECIAL TEST

In connection with a complaint concerning the conformity of the product, a special test can be ordered through the certification body by anyone, if the

## SHAMCI General Certification Scheme Rules

www.shamci.net

fulfillment of the requirements of the certification program or the registered values (see section below) of a certified product is doubted.

The special test is normally to be made as a type test and in agreement with the manufacturer by a second approved testing laboratory listed in paragraph 8. If only one or a few points of the certification program are challenged, the certification body decides after consulting the testing laboratory if the special test can be made as a partial or supplementary test.

If the tested product does not fulfill the requirements and/or does not comply with the registered values, the legal person holding the SHAMCI license of the product in question has to carry the costs of the special test.

If the tested product fulfills the requirements and complies with the registered values, the costs have to be carried by the party which questioned the fulfillment of the requirements or registered values and ordered the test through the certification body.

If the special test shows that the failure of the product to conform to the requirements and/or registered values is due to random manufacturing error or transport damage, the testing laboratory has to take a second sample. The result of this test is the obliging result for the special test.

The legal person holding the SHAMCI license or a person authorized by the legal person holding the SHAMCI license must have the opportunity to take part during the whole procedure of the special test. He must be informed of the results of the test without delay to have the chance to react directly.

If the special test states deviations from the requirements and/or the registered values, the certification body requires the legal person holding the SHAMCI license to rectify the faults within a certain limited time which should not exceed one month, depending on the extent and manner of the fabrication. Thereafter the testing laboratory performs a new special test, the extent and manner being determined by the certification body consulting the testing laboratory.

### 20.8.1 Compliance with registered values

#### Collectors (ISO 9806):

- The integral of the measured instantaneous efficiency at the special test shall be more than 90% of the already registered integral in the interval of the reduced temperature from 0 – 0,1 K/(W/m<sup>2</sup>). The

reduced temperature and the instantaneous efficiency are defined ISO 9806.

### Solar water heaters (ISO 9459-2 & ISO 9459-5):

- Solar-plus-supplementary systems: The calculated  $Q_{aux,net}$  based on the special test shall be less than 110% of the originally calculated  $Q_{aux,net}$ .  $Q_{aux,net}$  is defined in ISO 9459-2 & ISO 9459-5. The calculations to be compared shall be based on the region climate data and the design load already given by the manufacturer.
- Solar-only and solar preheat systems: The calculated  $f_{sol}$  based on the special test shall be more than 90% of the originally calculated  $f_{sol}$ .  $f_{sol}$  is defined in ISO 9459-2 & ISO 9459-5. The calculations to be compared shall be based on the region climate data and the design load already given by the manufacturer.



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