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Solar Heating Arab Mark and Certification Initiative

شمسي SHAMCI

المشروع العربي لشهادات الأنظمة الشمسية الحرارية

Solar Heating Arab Mark and Certification Initiative (SHAMCI) CERTIFICATION SCHEME RULES

For solar collectors and solar water heaters

UNDP

RCREEE

Regional Center for Renewable Energy and Energy Efficiency

المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة

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For solar collectors and solar water heaters

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Contents

List of abbreviations 3
1 About SHAMCI 4
1.1 SCHAMCI Partners ..... **Error! Bookmark not defined.**
2 Preface 4
3 Introduction 4
4 Definition of Selected Terms 4
4.1 SHAMCI Network 4
4.2 SHAMCI Secretariat 4
4.3 Conformity Body 5
4.4 Certification Body 5
4.5 Inspection Body 5
4.6 Initial inspection 5
4.7 Periodic Inspection 5
4.8 Quality Management System (QMS) 5
4.9 Test Labs 5
4.10 Conformity 5
4.11 SHAMCI mark 5
4.12 Solar Collector 5
5 Products Covered by the Scheme 6
5.1 List of Standards Concerned 6
6 Attestation of Conformity 6
7 Requirements for Involved Bodies 7
7.1 General Requirements all Bodies 7
7.2 Requirements for Certification Bodies 7
7.3 Test labs 8
7.4 Inspection Bodies 9
8 Requirements for Products 9
9 Specification of the Manufacturer's Application File 9
10 Factory Production Control and Initial Inspection of Manufacturing Site 10
11 Selection of Type Test Samples 10
12 Surveillance 10
13 Collector Families 11
13.1 Collector Families 11
13.2 Use of different collector components with same characteristics 11
14 Changes in products – re-testing 11
15 Complaints 12
16 Harmonized reporting format for SHAMCI reports and certificates 12
17 Authorization of Bodies 12
17.1 Authorization of Certification Bodies for SHAMCI certification 12
17.2 Authorization of Test Labs for SHAMCI Testing 12
17.3 Authorization of Inspection Body for SHAMCI Inspection 12
18 List of SHAMCI Operating Bodies 13
19 List of Certified Products 13
20 Owner of the SHAMCI Trade Mark 13
21 Updating the SHAMCI Certification Scheme Rules 13
22 Disclaimer 13
23 References 13
24 List of ANNEXES 14

List of abbreviations

IAF:	International Accreditation Forum (www.iaf.nu)
EN:	European Norm (European Standard)
IEC:	International Electrotechnical Commission (www.iec.ch)
ISO:	International Organization for Standardization (www.iso.org)
QMS:	Quality Management System
RCREEE:	Regional Center for Renewable Energy & Energy Efficiency (www.recree.org)
SHAMCI:	Solar Heating Arab Mark and Certification Initiative (www.shamci.net)
SWT:	Solar- und Wärmetechnik Stuttgart (www.swt-technologie.de)

1 About SHAMCI

The Solar Heating Arab Mark and Certification Initiative (SHAMCI) is a 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. This project was initiated by the Regional Center for Renewable Energy and Renewable Energy in cooperation with the League of Arab States and the Arab Industrial development and Mining Organization.

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 been formed with the name of SHAMCI Network to prepare the certification rules for SWHs in the Arab region, the rules are developed in cooperation with SWT, Stuttgart University and SolarKey International. Latest versions of the SHAMCI Certification Scheme Rules and annexes are available from www.shamci.net

3 Introduction

The SHAMCI 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 Selected Terms

4.1 SHAMCI Network

The SHAMCI Network is the framework for development, implementation and maintenance of the Solar Heating Arab Mark and Certification Initiative (SHAMCI). The Network consists of a group of regional and international experts, working under the umbrella of the Arab Ministerial Council for Electricity according to decree 217 of the twenty-eighth session of the Executive Office of the Ministerial Council of the Arab Electricity dated 8/1/2013. The Network includes representatives from certification bodies and testing laboratories and other relevant institutions from the Arab countries as well as observers from the private sector.

4.2 SHAMCI Secretariat

The SHAMCI Secretariat is managing and supporting the SHAMCI Network. It is hosted by the Regional Center for Renewable Energy & Energy Efficiency (RCREEE). RCREEE is acting as the legal body for the SHAMCI Network. The SHAMCI Secretariat in coordination with the Chairman of the Network is representing the Network and sign agreements at regional Arab and international level. The SHAMCI Secretariat manages the budget of the Network and the SHAMCI Secretariat in terms of revenues and expenses, and prepares the financial and technical reports to be presented to the network in the periodic meetings.

4.3 Conformity Body

The term of conformity body in this document denotes all relevant bodies responsible for the procedures to grant SHAMCI mark: Certification bodies, inspection bodies and testing laboratories.

4.4 Certification Body

The certification body is the body authorized for granting SHAMCI mark for solar collectors and solar water heaters. Certification bodies are specialized in quality control and conformity attestation.

4.5 Inspection Body

The inspection body (or the inspector) inspects the manufacturer's production lines and quality management systems. He is responsible for the initial inspection and periodic inspection and he select samples of the product for the testing labs.

4.6 Initial inspection

An initial physical inspection of the manufacturer's production line and the allocated quality management system and procedures. The initial inspection is done by the inspection body, who is then checking if the manufacturer and the production meets the requirements in the certification scheme.

4.7 Periodic Inspection

Inspection of production line is done periodically to check if the manufacturer always fulfils requirements in the certification scheme.

4.8 Quality Management System (QMS)

The procedures applied in an industrial facility on the production lines according to a specific quality management system in order to achieve continuously a certain quality level.

4.9 Test Labs

Test labs do the testing of collectors and solar water heaters according to the standards mentioned in this set of rules.

4.10 Conformity

The solar collectors and solar water heaters shall be in conformity with the requirements of the certification scheme rules and concerned standard specifications – meaning that they shall fulfil all the requirements.

4.11 SHAMCI mark

The SHAMCI (Solar Heating Arab Mark and Certification Initiative) SHAMCI mark is an attestation by the certification body, that the product fulfils requirements in the certification scheme and the relevant standards – a conformity attestation. The certification body gives the conformity attestation based on the inspection bodies' inspections of the production line and of the applied quality management system plus the test labs' testing of the product.

4.12 Solar Collector

A solar collector is a device designed to absorb solar radiation and to transfer the thermal energy so produced to a fluid passing through it [ISO 9488].

5 Products Covered by the Scheme

The scheme covers the following products:

- Solar thermal collectors as defined in scope of ISO 9806. ISO 9806 covers liquid heating collectors as well as air heating collectors, including concentrating collectors (tracking – as well as non-tracking).
- Solar water heating systems as defined in scopes of ISO 9459-2 and ISO 9459-5

5.1 List of Standards Concerned

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

5.1.1 Solar collectors

- ISO 9806 "Solar energy — Solar thermal collectors — Test methods"

5.1.2 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

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 for purchase from national standardization bodies and ISO standards are available as well from the ISO web page: http://www.iso.org.

6 Attestation of Conformity

The conformity attestation is based on 3rd party[1] (independent) testing and inspection - see table 1.

Attestation of Conformity			
Activity group	Activity	Actor	
		Manufacturer	3rd 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 3rd party testing and inspection. QMS: Quality management system. X indicates the required activity and actor

[1] 3rd party is a party independent of the manufacturer (1st party) and the buyer (2nd party).

7 Requirements for Involved Bodies

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

- Certification bodies
- Test labs
- Inspection bodies

The requirements for the bodies are defined in two steps/periods:

- An implementation period until end 2020
- The time after implementation – from beginning 2021

The requirements after implementation (from beginning 2021) will be accreditation of all involved bodies:

- Certification bodies according to: ISO/IEC 17065:2012. Conformity assessment -- Requirements for bodies certifying products, processes and services
- Inspection bodies according to: ISO/IEC 17020:2012. Conformity assessment -- Requirements for the operation of various types of bodies performing inspection
- Test laboratories according to: ISO/IEC 17025:2005. General requirements for the competence of testing and calibration laboratories

In the implementation period until end 2020 the requirements will be based on the requirements given in the above listed standards, but somehow relaxed – and without requirement for accreditation.

If a body has achieved the relevant accreditation already before the end of the implementation period, such accreditation will of course give the body access to SHAMCI certification / testing / inspection.

7.1 General Requirements all Bodies

The general requirements are that:

- Certification bodies shall be authorized for SHAMCI certification by the SHAMCI Network
- Test labs and inspection bodies shall be recognized by one or more certification bodies which are authorized for SHAMCI certification by the SHAMCI Network

7.2 Requirements for Certification Bodies

Annex I “Readiness Criteria for SHAMCI” describes the requirements for certification bodies.

An overview of the requirements for certification bodies is given in table 1 – and more details are given below in 7.2.1 and 7.2.2.

Field of requirement	Until end of 2020	From beginning of 2021
Internal staff requirements	Specific requirements given in section 3 below.	Requirements as given in ISO/IEC 17065 – accredited by accreditation body member of IAF
External resources requirements: Testing	Specific requirements given in Annex I of SHAMCI Certification Scheme Rules	
External resources requirements: Inspection	Specific requirements given in Annex I of SHAMCI Certification Scheme Rules	
All others requirements	Requirements as given in ISO/IEC 17065 – declared by signature of certification body	

Table 2. Overview of requirements for certification bodies

7.2.1 Requirements until end of 2020

Until end of 2020 some specific requirements are defined for experience of internal staff and use of external resources for testing and inspection:

- In the interim period until 31st of December 2020, it is a requirement that the person in charge of certification (signature on certificate/license) shall document at **least 5 year's experience** with accredited product certification. The documentation of experience is done by filling in table 2 shown below.
- Specific requirements until end of 2020 for external resources related to testing and inspection are given in SHAMCI Certification Scheme Rules Annex I.

Name and present position:		
Period	Certification Body	Products
yyyy-mm-dd to yyyy-mm-dd	*Name of certification body*	*Product 1, Product 2, ..*

Table 3. Documentation of experience with certification for the person in charge of certification

Apart from this, all other requirements given in ISO/IEC 17065 [1] shall be fulfilled – and shall be declared by signature of the certification body (accreditation is not required).

Section 3 in Annex I describes main parts of the *ISO/IEC 17065:2012. Conformity assessment -- Requirements for bodies certifying products, processes and services.*

7.2.2 Requirements from beginning of 2021

From beginning of 2021 accreditation according to ISO/IEC 17065 by accreditation body member of IAF will be required including in the scope:

- Testing of collectors according to ISO 9806 [2]
- Testing of solar water heaters according to ISO 9459-2 [3] and/or ISO 9459-5 [4] and EN 12976-2 [5]
- Inspection of production lines for solar collectors
- Inspection of production lines for solar water heaters

See also Annex I "Readiness Criteria for SHAMCI".

7.3 Requirements for Test labs

Annex I "Readiness Criteria for SHAMCI" describes the requirements for certification bodies.

7.3.1 Requirements until end of 2020

Until end of 2020 some specific requirements are defined SHAMCI test labs with respect to:

- Required tests: See section 3 of Annex I
- Technical equipment: See section 4 of Annex I
- Quality management system and staff qualifications at test labs: See section 5 of Annex I

7.3.2 Requirements from beginning of 2021

From beginning of 2021 accreditation according to ISO/IEC 17025 [7] by accreditation body which is member of IAF will be required including in the scope:

- Testing of collectors according to ISO 9806 [2]
- Testing of solar water heaters according to ISO 9459-2 [3] and/or ISO 9459-5 [4] and EN 12976-2 [5]

7.4 Requirements for Inspection Bodies

7.4.1 Requirements until end of 2020

In the interim period until 31st of December 2020, it is a requirement that the person in charge of inspection (signature on inspection reports) shall be able to document at least five ISO 9001 inspections of at least three different production lines for different products. The documentation of experience is done by filling in table 1 shown below.

Name and present position:		
Date	Inspection Body	Inspection report
yyyy-mm-dd	*Name of certification body*	*Title of inspection report*

Table 4. Documentation of experience for the person in charge of inspection

7.4.2 Requirements from beginning of 2021

From beginning of 2021 accreditation according to:

- For independent inspection bodies: ISO/IEC 17020 [1]
- For certification bodies with in-house inspectors: ISO/IEC 17065 [2]

by accreditation body which is member of IAF (International Accreditation Forum) will be required, the following shall be including in the scope of the accreditation:

- Inspection of production lines for solar collectors
- Inspection of production lines for solar water heaters

8 Requirements for Products

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

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

9 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.

There is nothing preventing each certification body to design their application form according to their own requirements under the condition that this information must include the following documentation required in:

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

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 mentioned in section 7. With this initial inspection it is checked whether the manufacturing site fulfils 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), a 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 Selection of Type Test Samples

Selection of products for initial type testing according to concerned standard(s) (see section 5) 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 at 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.

12 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.

13 Collector Families

13.1 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. The largest module shall be subject to all the tests required, and the smallest shall be subject to a thermal performance test. 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 from 0 – 0.1 K/ (W/m²). In other words, the efficiency curve used for this subtype shall be the one embracing the smallest area in this interval.

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.

13.2 Use of different collector components with same characteristics

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

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

14 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 mark the modified products.

15 Complaints

Complaints concerning the conformity of a certified product are handled by the certification body according to its normal procedures. Serious complaints 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.

16 Harmonized reporting format for SHAMCI reports and certificates

Results from type testing shall be given in the format specified in the SHAMCI annexes C1 (Collector datasheet) and C2 (Solar Water Heater datasheet).

The report format for inspection reports given in SHAMCI scheme rules Annex E shall be followed.

A template for a SHAMCI certificate is given in Annex I of SHAMCI Certification Scheme Rules.

17 Authorization of Bodies

17.1 Authorization of Certification Bodies for SHAMCI certification

Until 31st December 2020 the SHAMCI Network, based on the signed declaration from the certification body (see section 3), finally authorizes the certification body for SHAMCI certification.

After 1st January 2021 the SHAMCI Network, based on the accreditation certificate, finally authorizes the certification body for SHAMCI certification. The accreditation certificate shall be published at the SHAMCI website.

17.2 Authorization of Test Labs for SHAMCI Testing

A test lab shall have recognition from a SHAMCI certification body for SHAMCI testing. The certification body shall check if the test lab fulfils the requirements in the SHAMCI Certification Scheme Rules including Annex I – based on an application documenting that the requirements are fulfilled.

The test lab is finally authorized for SHAMCI testing by the SHAMCI Network, based on a recommendation from at least one SHAMCI certification body – documentation from the test lab shall be available to all SHAMCI certification bodies upon request.

After 1st January 2021, the accreditation certificate of the test lab shall be published at the SHAMCI website.

17.3 Authorization of Inspection Body for SHAMCI Inspection

An inspection body shall have recognition from a SHAMCI certification body for SHAMCI inspection. The certification body shall check if the inspection body fulfils the requirements in the SHAMCI Certification Scheme Rules including Annex I – based on an application documenting that the requirements are fulfilled.

The inspection body is finally authorized for SHAMCI inspection by the SHAMCI Network, based on a recommendation from at least one SHAMCI certification body – documentation from the inspection body shall be available to all SHAMCI certification bodies upon request.

After 1st of January 2021, the accreditation certificate of the inspection body shall be published at the SHAMCI website.

18 List of SHAMCI Operating Bodies

An updated list of authorized certification bodies and recognized 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.

19 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.

20 Owner of the SHAMCI Trade Mark

The owner of the SHAMCI mark is the SHAMCI Network. The network is legally represented by RCREEE as its secretariat.

21 Updating the SHAMCI 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.

22 Disclaimer

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

23 References

[1] ISO/IEC 17065:2012. Conformity assessment -- Requirements for bodies certifying products, processes and services
[2] ISO 9806:2013 Solar energy — Solar thermal collectors — Test methods
[3] ISO 9459-2 :1995 Solar heating -- Domestic water heating systems -- Part 2: Outdoor test methods for system performance characterization and yearly performance prediction of solar-only systems
[4] ISO 9459-5:2007 Solar heating -- Domestic water heating systems -- Part 5: System performance characterization by means of whole-system tests and computer simulation
[5] EN 12976-2:2006. Thermal solar systems components. Factory made systems. Test methods
[6] ISO/IEC 17020:2012. Conformity assessment -- Requirements for the operation of various types of bodies performing inspection
[7] ISO/IEC 17025:2005. General requirements for the competence of testing and calibration laboratories

24 List of ANNEXES

SHAMCI annexes are available in a separate document. All annexes are available from www.shamci.net.

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	FACTORY PRODUCTION CONTROL
ANNEX E	INSPECTION REPORTS
ANNEX F	SPECIAL TEST
ANNEX G	International standards adopted in AIDMO for SWH
ANNEX H	Checklist for test labs concerning availability of standards and competence
ANNEX I	Readiness Criteria for SHAMCI, Certification Body-Testing Facility-Inspectors

Solar Heating Arab Mark and Certification Initiative (SHAMCI) CERTIFICATION SCHEME RULES

Annexes

Contents

OVERVIEW OF SHAMCI ANNEXES: 2
ANNEX A1 - REQUIREMENTS FOR COLLECTORS 3
1.1 PASS CRITERIA - COLLECTORS 3
1.2 REQUIRED TESTS 3
1.3 OPTIONAL TESTS 5
ANNEX A2. REQUIREMENTS FOR SOLAR WATER HEATERS 6
1.4 PASS CRITERIA - SOLAR WATER HEATERS 6
1.5 REQUIRED TESTS - SOLAR WATER HEATERS 6
1.6 OTHER REQUIREMENTS 9
ANNEX B1 - DOCUMENTATION OF THE SOLAR COLLECTOR 11
1.7 DRAWINGS AND DATA SHEET 11
1.8 MARKING, LABELLING AND PACKAGING 11
1.9 INSTALLER INSTRUCTION MANUAL - COLLECTOR 11
ANNEX B2 - DOCUMENTATION OF THE SOLAR WATER HEATER 13
1.10 GENERAL 13
1.11 INSTALLER INSTRUCTION MANUAL - SOLAR WATER HEATER 13
1.12 DOCUMENTS FOR THE USER - SOLAR WATER HEATER 14
ANNEX C1 - COLLECTOR DATA SHEET 16
ANNEX C2 - SOLAR WATER HEATER DATA SHEET 17
ANNEX D - FACTORY PRODUCTION CONTROL 18
ANNEX E - INSPECTION REPORTS 19
ANNEX F. SPECIAL TEST 20
1.13 COMPLIANCE WITH REGISTERED VALUES 20
ANNEX G - INTERNATIONAL STANDARDS ADOPTED IN AIDMO FOR COLLECTORS & SWHS 21
ANNEX H - CHECKLIST FOR TEST LABS CONCERNING AVAILABILITY OF STANDARDS AND COMPETENCE 23

*The part of the SHAMCI Certification Scheme Rules together with these annexes are available from **www.shamci.net**.*

Overview of SHAMCI 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	FACTORY PRODUCTION CONTROL
ANNEX E	INSPECTION REPORTS
ANNEX F	SPECIAL TEST
ANNEX G	International standards adopted in AIDMO for SWH
ANNEX H	Checklist for test labs concerning availability of standards and competence

ANNEX A1 - Requirements for Collectors

1.1 Pass Criteria - Collectors

The pass criteria and classifications are given for each test in the paragraphs in section 1.2 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 may be exceeded.

NOTE: The evaluation of accumulation of humidity for application of the pass criteria should be applied only for the following tests:

- External Thermal Shock test
- Rain penetration test

1.2 Required tests

The collector shall be subject to the following series of tests done in the listed sequence as defined in ISO 9806: 2013:

- Internal pressure
- 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
- Final inspection

1.2.1 Internal pressure test for fluid channels

The test pressure shall be as specified in ISO 9806: 2013 item (6) 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.

1.2.2 Leakage test

When tested in accordance with ISO 9806: 2013 item (7), 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.

1.2.3 High temperature resistance

When tested in accordance with ISO 9806: 2013 item (9), the collector shall not show any major failure as defined in beginning of section 3.1.2.

1.2.4 Exposure

When tested in accordance with ISO 9806: 2013 item (11), 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.

1.2.5 External thermal shock

When tested in accordance with ISO 9806: 2013 item (12), the collector shall not show any major failure as defined in beginning of section 3.1.2. Climate class shall be specified.

1.2.6 Internal thermal shock

When tested in accordance with ISO 9806: 2013 item (13), the collector shall not show any major failure as defined in beginning of section 3.1.2. Climate class shall be specified.

1.2.7 Rain penetration

When tested in accordance with ISO 9806: 2013 item (14), 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.

1.2.8 Freeze resistance test

This test shall be carried out only in the cases specified in ISO 9806: 2013 item (15). The pass criterion is no major failure as defined in beginning of section 3.1.2 after three freeze-thaw cycles.

1.2.9 Mechanical load test

When tested in accordance with ISO 9806: 2013 item (16) 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.

1.2.10 Resistance test

When tested in accordance with ISO 9806: 2013 item (17) 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.

1.2.11 Thermal performance

When tested in accordance with ISO 9806:2013 item (20), 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 the operating mode of the electrical loop (open / closed circuit or MPP tracked) shall also be reported, and mentioning if the absorber of the hybrid collector is close connected to the electricity generator and whether there is any extra glazing in front. This collector shall be treated as unglazed, during thermal performance testing

1.2.12 Rupture or collapse test (air heating collectors only)

When tested in accordance with ISO 9806: 2013 item (8), the collector shall not show any major failure as defined in beginning of section 3.1.2

The results shall be reported as required in A.5 in ISO 9806: 2013

1.2.13 Final inspection

When tested in accordance with ISO 9806: 2013 item (18), the collector used for the test shall be dismantled and inspected. All abnormalities shall be documented and accompanied by photographs. The collector and all of its components shall be described and should be photographed and no major failure", denotes that none of the listed in item (18)- ISO 9806 occurs.

1.2.14 Standard stagnation temperature of liquid heating collectors

When tested in accordance with ISO 9806: 2013 item (10), the collector shall not show any major failure as defined in beginning of section 3.1.2

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.

ANNEX A2. Requirements for solar water heaters

1.4 Pass criteria - solar water heaters

The pas 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 in section 2.2 below.

1.5 Required tests - solar water heaters

The collector part in the solar water heater shall fulfil 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 12976-2:2006.

1.5.1 Freeze resistance

1.5.1.1 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 12976-2:2006.

1.5.1.2 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 12976-2:2006.

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.

1.5.2 Over temperature protection

1.5.2.1 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.

1.5.2.2 Scald protection

When the system is tested in accordance with 5.2 of EN 12976-2:2006, 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.

1.5.2.3 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).

1.5.3 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 12976-2:2006.

1.5.4 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 often 12976-2:2006 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.

1.5.5 Electrical safety

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

1.5.6 Safety equipment

1.5.6.1 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.

1.5.6.2 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.

1.5.6.3 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 12976-2:2006.

1.5.7 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.

1.6 Other requirements

1.6.1 Supporting frame

Maximum allowable load for supporting frame shall be stated by the manufacturer.

1.6.2 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 12976-2:2006gives information to assist manufacturers in selecting the materials used in the collector loop.

1.6.3 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.

1.6.4 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.

1.6.5 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.

1.6.6 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.

1.6.7 Electrical safety

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

ANNEX B1 - DOCUMENTATION OF THE SOLAR COLLECTOR

1.7 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.

These documents shall be filed 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.

1.8 Marking, labelling 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/m2 and 30 ºC;
- Volume of heat transfer fluid; (liquid heating solar collectors only)
- Optical efficiency, ηa0
- First order heat loss coefficient, ka1 (W/(m²K)
- Second order heat loss coefficient, ka2 (W/(m²K²)
- Maximum start temperature (air heating solar collectors only)
- Weight of empty solar collector;
- Made in:.....

1.9 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 m²

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.

- 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.

ANNEX B2 - DOCUMENTATION OF THE SOLAR WATER HEATER[1]

1.10 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.

1.11 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.
  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.

[1]Annex B2 is a slightly modified version of the requirements for documentation given in EN 12976-1.

- 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

1.12 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.

ANNEX C1 - COLLECTOR DATA SHEET

See separate document. (Based on page 1 Solar Keymark collector data sheet)

Get updated version from: www.shamci.org or SHAMCI certification body.

ANNEX C2 - SOLAR WATER HEATER DATA SHEET

See separate document. (Based on Solar Keymark system data sheet)

Get updated version from: www.shamci.org or SHAMCI certification body.

ANNEX D - Factory Production Control

Based on ISO 9001 and **Solar Keymark Scheme Rules Annex E**). See separate document.

ANNEX E - INSPECTION REPORTS

Report templates for factory production and physical inspection based on **Solar Keymark Scheme Rules Annex A1b**. See separate document.

ANNEX F. 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 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.

1.13 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/m²). 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 Qaux,net based on the special test shall be less than 110% of the originally calculated Qaux,net. Qaux,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 fsol based on the special test shall be more than 90% of the originally calculated fsol. fsol 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.

Annex G - International standards adopted in AIDMO for collectors & SWHs

Standards	Entitled	Standards adopted by AIDMO
ISO 9806-1 : 1994	Test methods for solar collectors -- Part 1: Thermal performance of glazed liquid heating collectors including pressure drop	AIDMO ISO 9806-1 : 2008
ISO 9806-2 : 1995	Test methods for solar collectors -- Part 2: Qualification test procedures	AIDMO ISO 9806-2 : 2008
ISO 9806-3 : 1995	Test methods for solar collectors -- Part 3: Thermal performance of unglazed liquid heating collectors (sensible heat transfer only) including pressure drop	Does not exist
ISO 9806 (DIS) (it will replace the Three parts mentioned above)	Solar energy — Solar thermal collectors — Test methods	Does not exist
ISO 9488 : 1999	Solar energy. Vocabulary	Does not exist
ISO 9459-1 : 1993	Solar heating -- Domestic water heating systems -- Part 1: Performance rating procedure using indoor test methods	AIDMO ISO 9459-1
ISO 9459-2 : 1995	Solar heating -- Domestic water heating systems -- Part 2: Outdoor test methods for system performance characterization and yearly performance prediction of solar-only systems	AIDMO ISO 9459-2 : 2008
ISO 9459-3 : 1997	Solar heating -- Domestic water heating systems -- Part 3: Performance test for solar plus supplementary systems	AIDMO ISO 9459-3 : 2008
ISO 9459-5 : 2007	Solar heating -- Domestic water heating systems -- Part 5: System performance characterization by means of whole-system tests and computer simulation	Does not exist
EN 12976-2 : 2006	Thermal solar systems and components - Factory made systems - Part 2: Test methods	Does not exist
EN 12976-1 : 2006	Thermal solar systems and components. Factory made systems. General requirements	Does not exist
EN13501-1 : 2007	Fire classification of construction products and building elements-Part1: Classification using data from reaction to fire tests	Does not exist
EN 13501-5 : 2012	Fire classification of construction products and building elements. Classification using data from external fire exposure to roofs tests	Does not exist
ISO 9845 -1 : 1992	Solar energy -- Reference solar spectral irradiance at the ground at different receiving conditions -- Part 1: Direct normal and hemispherical solar irradiance for air mass 1,5	AIDMO ISO 9845 -1: 2008
ISO 9847 : 1992	Solar energy -- Calibration of field pyranometers by comparison to a reference	AIDMO ISO 9847 : 2009

Standards	Entitled	Standards adopted by AIDMO
	pyranometer	
EN 1489 : 2000	Building valves. Pressure safety valves. Tests and requirements	Does not exist
EN 1490:2000	Building valves. Combined temperature and pressure relief valves. Tests and requirements.	Does not exist
EN 60335-1 : 2012	Household and similar electrical appliances. Safety. General requirements	1
EN 60335-2-21 : 2003	Household and similar electrical appliances. Safety. Particular requirements for storage water heaters	2 AIDMO IEC 60335-2-21 : 2008
EN 12975-1: 2006	Thermal solar systems and components. Solar collectors. General requirements	Does not exist
EN 12975-2 : 2006 (it will be replaced by ISO 9806)	Thermal solar systems and components - Solar collectors - Part 2: Test methods	Does not exist
ISO/IEC 17025 : 2005	General requirements for the competence of testing and calibration laboratories	Does not exist
ISO/IEC 17065 : 2012 (this standard has already replaced ISO/IEC Guide 65 and EN 45011)	Conformity assessment -- Requirements for bodies certifying products, processes and services	Does not exist
ISO/IEC 17020 : 2012	Requirements for the operation of various types of bodies performing inspection	Does not exist

Annex H - Checklist for test labs concerning availability of standards and competence

Name of Standard	Standard code	Availability of standards Y/N	Competence of testing team Y/N	Comments
Solar thermal collector	ISO 9806			
Solar water heaters (performance tests)	ISO 9459-2			
Solar water heaters (performance tests)	ISO 9459-5			
Solar water heaters (other characteristics tests)	EN 12976-2			
Vacuum and sub-atmospheric collectors dimensions: 2013	ISO 9488: 8.6 & 8.7			
Pressure drop measurement *Optional for liquid heating collectors*	ISO 9806			
Reaction to fire *Optional – depending on national regulation*	EN 13501-1			
External fire performance *Optional – depending on national regulation*	EN 13501-5			
Thermostatic valves	EN 1490			
Safety valve	EN 1489			
Electrical devices	EN 60335-1 EN 60335-2-21			
Lightning protection *Optional – depending on national regulation*	IEC 61024-1			

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UNEP

Back in 2009, the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP) launched a joint programme entitled "Global Solar Water Heating Market Transformation and Strengthening Initiative" (GSWH) with funding from the Global Environment Facility (GEF).

The GSWH initiative supported the update the Solar Heating Arab Mark and Certification Initiative (SHAMCI) certification scheme rules and its annexes including the Readiness Criteria for the Certification Bodies , Testing Facilities and Inspectors.