D3.1 – Checklists for the reliability requirements of Factory Made Systems / Custom Built Systems

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This document contains checklists for verification of requirements for Factory Made Systems and Custom Built Systems and for decision on applicable tests.

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1 Scope

This document presents simple criteria in the form of checklists to facilitate the decision process of Test Laboratories/Certification bodies on the conformity to requirements in Standard EN 12976-1 and in prEN 12977-1:2010.

2 Referenced standards

EN 253, District heating pipes — Preinsulated bonded pipe systems for directly buried hot water networks — Pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene

EN 307, Heat exchangers — Guidelines to prepare installation, operating and maintenance instructions required to maintain the performance of each type of heat exchangers

EN 806 1, Specifications for installations inside buildings conveying water for human consumption — Part 1: General

EN 806 2, Specification for installations inside buildings conveying water for human consumption — Part 2: Design

EN 809, Pumps and pump units for liquids — Common safety requirements

EN 1151-1, Pumps — Rotodynamic pumps — Circulation pumps having a rated power input not exceeding 200 W for heating installations and domestic hot water installations — Part 1: Non-automatic circulation pumps, requirements, testing, marking

EN 1489, Building valves — Pressure safety valves — Tests and requirements

EN 1490, Building valves — Combined temperature and pressure relief valves — Tests and requirements

EN 1991 1 3, Eurocode 1 — Actions on structures — Part 1 3: General actions — Snow loads

EN 1991 1 4, Eurocode 1: Actions on structures — Part 1 4: General actions — Wind actions

EN 1993 1 1, Eurocode 3: Design of steel structures — Part 1 1: General rules and rules for buildings

EN 1999 1 1, Eurocode 9: Design of aluminium structures — Part 1 1: General structural rules

EN 12828, Heating systems in buildings — Design for water-based heating systems

EN 12975-1:2006, Thermal solar systems and components – Solar collectors – Part 1: General Requirements

EN 12975-2:2006, Thermal solar systems and components – Solar collectors – Part 2: Test methods

EN 12976-1:2000, Thermal solar systems and components – Factory made systems – Part 1: General Requirements

EN 12976-2:2000, Thermal solar systems and components – Factory made systems – Part 2: Test methods

prEN 12977 2:2010, Thermal solar systems and components — Custom built systems — Part 2: Test methods for solar water heaters and combisystems

EN 12977 3, Thermal solar systems and components — Custom built systems — Part 3: Performance test methods for solar water heater stores

prEN 12977 4, Thermal solar systems and components — Custom built systems — Part 4: Performance test methods for solar combistores

prEN 12977 5, Thermal solar systems and components — Custom built systems — Part 5: Performance test methods for control equipment

EN 60335 1, Household and similar electrical appliances — Safety — Part 1: General requirements (IEC 60335-1:2001, modified)

EN 60335 2 21, Household and similar electrical appliances — Safety — Part 2-21: Particular requirements for storage water heaters (IEC 60335 2 21:2002, modified)

ISO 9459 1:1993, Solar heating — Domestic water heating systems — Part 1: Performance rating procedure using indoor test methods

EN ISO 9488, Solar energy – Vocabulary (ISO 9488:1999)

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

ISO 9459-5: 1995, Solar Heating – Domestic water heating systems – Part 5: System performance characterization by means of whole-system tests and computer simulation

ISO/TR 10217, Solar energy — Water heating systems — Guide to material selection with regard to internal corrosion

Other relevant documents:

SKN-N0136-R0- Systems, Parts lists, drawings and specifications, Solar Keymark Systems. (see Annex A1)
SKN-N0120-R0 – Collectors, Parts lists, drawings and specifications, Solar Keymark Collectors. (see Annex A2)
SKN-N0157R0 – Guideline for the assessment of the solar collector and solar system technical documentation.

3 Requirements for evaluation of conformity

3.1 Factory Made Systems

Table 1 shows the list of requirements for Factory Made Systems in the present version of EN 12976 (2006) and gives guidance to the adequate procedure for evaluation of conformity of each requirement.

The column “Requirement” is mostly a transcription of text of the standard and for this reason is in italic. The words ***shall*** and ***should*** are in bold and underlined to give emphasis to the requirement.

3.2 Custom Built Systems

Table 2 shows the list of requirements for Custom Built systems in the present version of prEN 12977-1 (2010) and gives guidance to the adequate procedure for evaluation of conformity of each requirement.

The column “Requirement” is mostly a transcription of text of the standard and for this reason is in italic. The words ***shall*** and ***should*** are in bold and underlined to give emphasis to the requirement.

According to the standard, a physical test of the system is not need.

Custom Built solar heating systems are either uniquely built, or assembled by choosing from an assortment of components. Systems of this category are regarded as a set of components. The components are separately tested and test results are integrated to an assessment of the whole system. Requirements for Custom Built solar heating systems are given in prEN 12977-1, test methods are specified in prEN 12977 -2, EN 12977-3, prEN 12977 and -5.

In Table 2, the sentence “Check of the system by the Laboratory.” means that the check is based on the information on documentation available as defined in 6.8 (Documentation) of prEN12977-1.

Table 1 – Requirements evaluation according to EN 12976-1:2006.

Section	Requirement	Procedure
4.1. General		
4.1.1. Suitability for drinking water	*System **shall** conform to EN 806-1*	Check on documentation for installer. Documentation for the installer and owner shall have reference to the standard EN 806-1 and to the need to identify the national or local regulations.
4.1.2. Water contamination	*The system **shall** have been designed to avoid water contamination due to backflow to drinking main supplies.*	Visual check of the system by the Laboratory. Check on documentation for installer. Shall have reference to the existence of devices to prevent backflow to drinking main supplies.
4.1.3. Freeze resistance	*The parts of the system that are exposed to the outdoors **shall** be able to withstand freezing.* • Manufacturer **shall** state a minimal allowed temperature for the system. • The manufacturer **shall** describe the method of freeze protection. • In the case that antifreeze fluid is used the manufacturer **shall** define the composition of the heat transfer fluid.	Test according to EN 12976-2, section 5.1.
4.1.4. Over temperature protection. 4.1.4.1. General	*The system **shall** have been designed to withstand prolonged high solar irradiation without heat consumption and no special action is needed to bring the system back to normal operation.*	Test according to EN 12976-2, section 5.2.
	The hot water drain (if the system has a provision to drain an amount of drinking water as a protection against overheating) **shall** not damage the system or any other materials in the house.	Check on documentation for the installer.
4.1.4.2. Scald protection	*No steam **shall** escape from any tapping point.*	Test according to EN 12976-2, section 5.2.
	For systems in which the temperature of the	Test according to EN 12976-2, section 5.2. to

Section	Requirement	Procedure
	*domestic hot water delivered to the user exceeds 60ºC, assembly instructions **shall** mention that an automatic cold mixing device or any device to limit the tapping temperature to at most 60ºC±5ºC, shall be installed.*	check if temperature of water exceeds 60ºC. Check on documentation for the installer – see 4.6.2.
4.1.4.3. 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.*	Check information given by the manufacturer according to Annex A1.
4.1.5. Reverse flow protection	*The system **shall** contain provisions in order to prevent increased heat loss resulting from reverse flow in any circuit.*	Test according to EN 12976-2, section 5.10.
4.1.6. Pressure resistance	*The storage tank and heat exchangers in this tank **shall** withstand 1.5 times the manufacturer's stated maximum individual working pressures.*	Test according to EN 12976-2, section 5.3. There shall be no visible permanent damage or leakage of the system components and interconnections. Pressure shall not drop more then 10%.
	*When non-metallic materials are used in any circuit, this circuit **shall** withstand the above-mentioned pressures for at least one hour when tested at high temperature in accordance to EN 12975-1.*	Test according to EN 12976-2, section 5.3. and EN 12975-1, section 5.2.
	*The drinking water circuit **shall** withstand the maximum pressure required by national/European drinking water regulations for open and closed drinking water installations.*	Check on documentation for installer. Documentation for the installer and owner shall have reference to the national/European local regulations.
	*The system **shall** have been designed in such a way that the maximal allowed pressure of any materials in the system is never exceeded.*	Check information given by the manufacturer according to Annex A1.
	*Every closed circuit in the system **shall** contain a safety valve.*	Check information given by the manufacturer according to Annex A1.

Section	Requirement	Procedure
	*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.*	Check declarations of conformity to EN 1489 and EN 1490.
4.1.7. Electrical safety	*If the system contains any electrical devices, these **shall** conform to EN 60335-1 and EN 60335-2-21.*	Check declarations of conformity of the system to EN 60335-1 and EN 60335-2-21. *It is recommended that for demonstration of conformity, a report from an accredited test laboratory is available.*
4.2. Materials	*Any parts of the system to be mounted outdoors **shall** be resistant to UV radiation and other weather conditions over the prescribed maintenance interval.* *All materials used in the collector loop **should** conform to ISO/TR 10217 in order to avoid internal corrosion.*	Check declarations for the manufacturer on: - the resistance of materials to UV for use outdoors; - verification that all materials are in accordance to ISO/TR 10217.
4.3. Components and pipework		
4.3.1. Collector	See section 4.1 of this document	
4.3.2. Supporting frame	The manufacturer shall state maximum possible loads, in accordance with EN 1993-1-1 (steel) and EN 1991-1-1 (aluminium). This shall be mentioned in the documents for the installer.	Check information given by the manufacturer according to Annex A1. Check if the manufacturer documented static calculation for the supporting frame according to EN1993-1-1 (steel) or to prEN1999-1-1 (aluminium). Check documentation for the installer.
4.3.3. Piping	The materials of the collector loop shall conform to ISO/TR 10217. *The design and materials in the system **shall** be such that there is no possibility of*	Check information given by the manufacturer according to Annex A1 and A2. - Check there is not possibility of clogging and lime deposit (design of the system and materials used) Check declarations for the manufacturer on:

Section	Requirement	Procedure
	deforming, clogging or lime deposit in its circuits that will drastically influence the system performance and safety. *Circulation pumps in the system **shall** conform to EN 809 and EN 1151.*	- verification that all materials are in accordance to ISO/TR 10217. - conformity of circulation pumps with EN 809 and EN 1151. It is recommended that for demonstration of conformity, the pump shall be CE marked and the respective declaration of the manufacturer shall be available to the test laboratory/certification body.
4.3.4. Heat exchangers	*If the system is intended for use in areas with high water hardness and at temperatures above 60ºC, heat exchangers in contact with drinking water **shall** be designed in such a way that scaling is presented or there shall be facility for cleaning.*	Check on documentation for installer and owner. Documentation for the installer and owner shall have reference to the areas of use of the system in relation to hardness of water. Check of the system by the Laboratory. Check if scaling is prevented (when the system is used in areas with high water hardness and at temperatures above 60°C).
4.3.5. Control system	*When present, the collector temperature sensor **shall** withstand stagnation conditions as specified in EN 12975-2 without drifting by more than 1K.* *When present, the store temperature sensor **shall** withstand 100ºC without altering by more than 1K.* *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 sensor **shall** be insulated against ambient.*	Check information given by the manufacturer according to Annex A1. Check if information on the sensors shows behaviour according to requirements. *It is recommended that requirements according to prEN 12977-5:2010 are verified.* Visual observation of the system for location of sensors.
4.4. Safety equipment		The manufacturer shall give information according to Annex A1
4.4.1. Safety valves	*Each section of the collector array, which can be shut off, **shall** be fitted at least one safety valve.*	Test according to EN 12976-2, section 5.6.1. - Check the system documentation to verify that each

Section	Requirement	Procedure

	ICS systems shall be fitted with at least one safety valve.
	*The safety valve **shall** resist the temperature conditions which it is exposed to, especially the highest temperature that is exposed to.*
	*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.*
		collector circuit or group of collector circuits is fitted with at least one safety valve.
		- Check the specification of the safety valves, whether the materials conform to:
		  - resist the temperature conditions which it is exposed to, especially the highest temperature that can occur.
		  - resist the heat transfer medium.
		
		- Check whether the size of the safety valve is correct in order that it can release highest flow of hot water or steam that can occur. The dimension of the safety valve(s) shall be proved by suitable means.[1]
		- Check whether the temperature of the heat transfer medium at the release pressure of the safety valve exceeds the maximum allowed temperature of the heat transfer medium.
		- Check if declaration of conformity of the safety valves according to EN 1489 was presented.

4.4.2. 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.*	Test according to EN 12976-2, section 5.6.2. - Check the system documentation to verify that safety and expansion lines, if any, cannot be shut-off. - Check the internal diameter of the expansion line, if any, to verify if, 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. [2]

[1] It was considered that “proved by suitable means” needs clarification. This will be included in deliverable D3.2 (Guide).
[2] It was considered that “proved by suitable means” needs clarification. This will be included in deliverable D3.2 (Guide).

Section	Requirement	Procedure
	*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.*	- Check the system documentation to verify that the expansion line and the safety line, if any, are connected and laid in such a way that any accumulation of dirt, scale or similar impurities are avoided.
4.4.3. 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.*	Test according to EN 12976-2, section 5.6.3. - Check the hydraulic scheme and system documentation to verify that the blow-off lines, if any, 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.
4.5. Resistance to external influences	*In respect of lightning protection, the system **should** conform to prEN 61024-1.*	It is recommended to check if documentation to the installer and owner has reference to lightning protection.
4.6. Documentation 4.6.2. and 4.6.3. Documents for the installer and for the user.	*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**.* See 4.6.2 and 4.6.3 for detail.	See section 5.1 of this document
4.7. Labelling		See section 5.1 of this document

Section	Requirement	Procedure
4.8. System performance	The thermal performance of the system ***shall*** be tested according to one of the two test methods specified in 5.8 of EN 12976-2:2006. The performance ***shall*** be reported to the user in the format as specified in Annex A of EN 12976-2:2006 (see also 4.6.3).	Test according to EN 12976-2, section 5.8.

Table 2 – Requirements evaluation according to prEN 12977-1:2010.

	Requirement	Procedure
6.2. General		
6.2.1. Suitability for drinking water	*See EN 806-1 and EN 806-2.*	Check on documentation for installer: It is recommended that Documentation for the installer and owner have reference to the standards EN 806-1 and EN 806-2 and to the need to identify the national or local regulations.
6.2.2. Water contamination	*The system has to be designed to avoid water contamination from backflow from all circuits to cold supply.*	Check of the system by the Laboratory. Check on documentation for installer: Shall have reference to the existence of devices to prevent backflow to drinking main supplies.
6.2.3. Freeze resistance	*See EN 12976-1.*	Check of the system by the Laboratory. Check requirements according to EN 12976-1.[3] Any physical test necessary should be covered by the tests of the components of the system.
6.2.4. High-temperature protection 6.2.4.1. Scald protection	*Systems in which the temperature of the domestic hot water delivered to the user can exceed 60 °C, **shall** be fitted with an automatic cold water mixing device or any other device to limit the temperature to at maximum 60 °C shall be installed.*	Check on documentation for installer: Shall have reference to the existence of devices to limit the temperature of the domestic hot water if the temperature delivered can exceed 60°C. Maximum temperature in the collector is the stagnation temperature (test according to EN12975-2, annex C).
6.2.4.2. High-temperature protection for materials	*The design of the system **shall** ensure that the highest permissible temperatures to which the system components may be exposed are not exceeded, taking into account also pressure conditions if relevant* *Maximum temperature in the collector is the collector stagnation temperature according to the EN 12975-2 test report.*	Check information given by the manufacturer according to Annex A1.

[3] See Table 1 of this document.

	Requirement	Procedure
6.2.5. Reverse circulation protection	*The installation of the system as described in the hydraulic scheme **shall** ensure that no unintentional reverse flow occurs in any hydraulic loop of the system.*	Check of the system by the Laboratory. Check on documentation for installer: Shall include the hydraulic scheme
6.2.6. Pressure resistance	*The storage tank and heat exchangers **shall** withstand at least 1,5 times the manufacturer's stated maximum individual working pressures.*	Check of the system by the Laboratory. The storage tank shall be pressure tested and the result of test shall be available to the laboratory. A test according to section 5.3 of EN 12976-2:2006 shall be performed if there is no other evidence of storage tank pressure resistance.
	*The drinking water circuit **shall** withstand the maximum pressure required by national/European drinking water regulations for open-vented or closed drinking water installations.*	Check on documentation for installer. Documentation for the installer and owner shall have reference to the national/European local regulations.
	*The system **shall** have been designed in such a way that the maximal allowed pressure of any materials in the system is never exceeded, taking into account temperature conditions if relevant.*	Check information given by the manufacturer according to Annex A1.
	*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.*	Check information given by the manufacturer according to Annex A1. Check declarations of conformity to EN 1489 and EN 1490.
6.2.7. Electrical safety	*See EN 60335-1 and EN 60335-2-21.* *There **shall** be means to interrupt manually the*	The manufacturer shall present declaration of conformity of the system to EN 60335-1 and EN 60335-2-21. Check of the system by the Laboratory:

	Requirement	Procedure
	power supply to the pump(s).	
6.3. Materials	*It **shall** be stated in the documentation for the installers that materials exposed to weathering shall be resistant to UV radiation, rodents (e.g. birds) and other weather conditions over a prescribed life time.* *All materials used in the collector loop **should** comply with ISO/TR 10217 in order to avoid any internal corrosion.*	Check declarations for the manufacturer on: - the resistance of materials to UV for use outdoors; - verification that all materials are in accordance to ISO/TR 10217.
6.4. Components and pipework		
6.4.1. Collector and collector array	The collector ***shall*** meet the requirements given in EN 12975-1. For parts and joints of the collector array see 6.4.8. Rows of collectors: mass flow rate per unit collector area of each row should not exceed 20% of the nominal flow rate per unit collector area of the whole array (unless another limit is stated by the manufacturer).	Collectors: Check if collectors conform to EN 12975-1. (Test according to EN 12975-2) Part and joints: See 6.4.8 Rows of collectors: Check characteristics of collector field in the manufacturer's documentation given according to Annex A.
6.4.2. Supporting frame	*Manufacturer **shall** state the maximum possible loads for their metallic supporting frame, in accordance with EN 1993-1-1 and EN 1999-1-1. For non metallic supporting frames the maximum acceptable load **shall** be stated. This **shall** be mentioned in the documents for the installer.* *Allowance of installing the system depends on national or local regulations; see guidelines in EN1991-1-3 (snow) and EN1991-1-4 (wind).*	Check information given by the manufacturer according to Annex A1. Check if the manufacturer documented static calculation for the supporting frame according to EN1993-1-1 (steel) or to prEN1999-1-1 (aluminium). Check documentation for the installer.
6.4.3. Collector and other loops	*Collector and other loops **shall** be able to withstand expansion/contraction due to thermal mechanical influences.*	Check of the system by the Laboratory. Check on documentation for installer: Shall state procedure to guarantee solution for

	Requirement	Procedure
		expansion/contraction due to thermal and mechanical influences
6.4.4. Circulation pumps	*See EN 809, EN 1151-1 and EN 12977-5*	Check declarations for the manufacturer on: - conformity of circulation pumps with EN 809 and EN 1151. It is recommended that for demonstration of conformity, the pump shall be CE marked and the respective declaration of the manufacturer shall be available to the test laboratory/certification body.
6.4.5. Expansion vessels		Check the system design: in some designs they can be not necessary (e.g. drain-back systems)
6.4.5.2 Open-vented expansion vessels	*Each open system **shall** be provided with an expansion vessel, the volume of which **shall** be dimensioned such that it is capable of absorbing at least the entire expansion of the heat transfer medium between the lowest and the highest possible operating temperature.* *Each expansion vessel shall be provided with a connection to atmosphere, which cannot be shut off, and with a spill line.*	Check of the system by the Laboratory: Check system layout and design. Check that connection to the atmosphere can not be shut off.
6.4.5.3 Closed expansion vessels	*Requirements only for small systems:* *The expansion device of the collector loop **shall** be dimensioned in such a way that even after an interruption of the power supply to the circulation pump in the collector loop just when solar irradiance is maximum, operation can be resumed automatically after power is available again and the absorber is filled again with liquid, i.e. vapour has re-condensed.* *The expansion vessel **shall** be able to compensate for the thermal expansion in the*	Check of the system by the Laboratory: Check system layout and design

	Requirement	Procedure
	whole loop plus the volume of the heat transfer medium in the whole collector array including all connection pipes between the collectors plus 10 % of this volume. *Alternatively, when the system does not automatically resume operation after stagnation conditions, a warning **shall** be added to the operating instructions.* *The manufacturer's instructions **shall** be followed.*	Check on documentation for installer:
6.4.6 Heat exchangers	*See EN 307.* *If the system is intended to be used 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 means for cleaning.* *Any heat exchanger(s) between the collector loop and the hot water supply system **should** not reduce the collector efficiency due to an increase of the collector's operating temperature by more than the following criterion indicates:* *When the solar gain of the collector has reached its highest possible value, the reduction of the collector efficiency induced by the heat exchanger **should** not exceed 10 % (absolute) – method for calculating this reduction is given in prEN 12977-2. If more than one heat exchanger is installed, this value should also not*	Check of the system by the Laboratory: Recommended conformity with EN307. Check on documentation for installer and owner. Documentation for the installer and owner shall have reference to the areas of use of the system in relation to hardness of water. Check if scaling is prevented (when the system is used in areas with high water hardness and at temperatures above 60°C) Check if the reduction of the collector efficiency induced by the heat exchanger (or the sum of heat exchangers installed) does not exceed 10%. Procedure described in prEN 12977-2

	Requirement	Procedure
	be exceeded by the sum of reductions induced by each of them. The criterion also applies if a load-side heat exchanger is part of the system. *Note: In small systems with only one heat exchanger, the heat transfer capacity rate should not be less than 40W/(K.m²).*	
6.4.7 Water stores	*Stores of small custom built solar systems for hot water **should** be tested as described in EN 12977-3.* *Stores of small custom built solar combisystems **should** be tested as described in EN 12977-4* **Note:** No requirements for large systems.	Small custom built solar systems for DHW: It is recommended that tests according to EN12977-3 are performed. Small custom built solar combisystems: It is recommended that tests according to prEN12977-4 are performed. In both cases the stand-by heat loss capacity rate should not exceed the value given by equation (1), section 6.4.7, EN12977-1.
6.4.8. Pipework	*The pipe length of the system **shall** be as short as possible.* *The pipes and fittings **shall** be selected from materials that are compatible with the components included in each loop, according to the fluid of the loop as specified in ISO/TR 10217.* *The design of the system and the used materials **shall** be such that there is no possibility of clogging and lime deposit in its circuits which would significantly deteriorate the system performance in the life time.* *The pipework for drinking water **shall** comply with the requirements specified in EN 806-1 and -2.* *The materials for pipes and fittings **shall** be suitable to withstand the maximum operating*	Check of the system by the Laboratory: - Pipe length shall be as short as possible - Check materials compatibilities and fluid according to ISO/TR 10217 - Check there is not possibility of clogging and lime deposit (design of the system and materials used) - Pipework for drinking water according to requirements specified in EN 806-1 and -2. - Check if materials shall be suitable to withstand maximum temperature and pressure conditions

	Requirement	Procedure
	temperature (stagnation conditions) and pressure. *The pipework **shall** withstand thermal expansion without any damage or detrimental deformation.* *Venting of the system (removal of unwanted gasses) shall be possible.* *No automatic vents **shall** be placed in parts of the collector loop where vapour can occur (e.g. the top of the collector array), except where a manual valve is placed between the pipe and the automatic vent, this valve being closed during normal operation of the system, or except a warning is added to the operating instructions, indicating that the system does not automatically resume operation after stagnation conditions (see also 6.4.3).*	- Check if pipework shall withstand thermal expansion - Check if venting of the system is possible. If automatic vents are used, it may be necessary to include an warning in operating instructions indicating that the system does not automatically resume operation after stagnation conditions.
6.4.9. Thermal insulation	*The thermal insulation of all connecting pipes and other components of the system should comply with the requirements given in EN 12828.* *The collector loop **should** be insulated without any gaps between the components. Thermal bridges, e.g. incorrectly installed mounting clamps should be avoided.* *The thermal insulation of the pipework **shall** be from materials which are resistant to the maximum temperature of the circuit and deformation and which remain operative.* *If the insulation is installed outside, it **shall** be protected against (or resistant to) solar radiation,*	Check of the system by the Laboratory: - It is recommended to comply with requirements described in EN12828 - Thermal bridges and gaps between the components should be avoided - Material shall be able to withstand maximum temperature and deformation. - In outdoor conditions, the insulation shall be able to withstand solar radiation, environmental conditions,

	Requirement	Procedure
	environmental conditions, ozone and any mechanical impact/deformation. *Insulated pipes for underground installation **shall** comply with EN 253.*	ozone and any impact/deformation - Insulation shall comply with EN 253 in underground pipes
6.4.10. Control equipment	*Requirements for control equipment (see prEN 12977-5).*	Tests and requirements according to prEN 12977-5.
6.5. Safety equipment and indicators		
6.5.1. Safety valves	*Each section of the collector array, which can be shut off, shall be fitted at least one safety valve.* *ICS systems **shall** be fitted with at least one safety valve.* *The safety valve **shall** resist the temperature conditions which it is exposed to, especially the highest temperature that is exposed to.* *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.*	Check of the system by the Laboratory: - Each section of the collector array which can be shut off, shall be fitted with at least one safety valve - Valves shall resist temperature conditions and shall be suitable for the heat transfer medium - Shall be dimensioned to release the highest flow (hot water o steam). - Dimension shall be proved **Note:** No procedure described to prove the dimension [4].
6.5.2. 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*	Check of the system by the Laboratory: - Safety line shall not be capable of being shut off or deformed - Shall be dimensioned taking into account the highest flow rate (hot water or steam) that can occur so that the maximum allowed pressure is not exceed at any place in the collector loop - Dimensions of the safety and expansion lines shall be

[4] It was considered that “proved by suitable means” needs clarification. This will be included in deliverable D3.2 (Guide).

	Requirement	Procedure
	*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.*	proved - Check junction of the expansion and safety line. It shall be free of impurities, dirt, etc. **Note:** No procedure described to prove the dimension [5].
6.5.3. 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.*	Check of the system by the Laboratory: - Shall be laid so that they cannot freeze up and any water can be accumulated - Orifices shall be arranged so that steam or heat transfer medium from safety valves can not cause any risk
6.5.4. Store insulation valve	*Stores of large custom built systems with a volume of more than 20 m^3 **shall** be fitted with isolation valves or other suitable devices to stop unintentional outflow of the store contents in cases of system failure.*	Check of the system by the Laboratory: stores with a volume of more than 20m^3 - Shall be isolated with valves or other devices to stop unintentional outflow of the contents in cases of system failure
6.5.5 Indicators 6.5.5.1. Indicators for collector loop flow 6.5.5.2. Pressure gauge	*The system **should** be fitted with any indicator for the collector loop flow. This can be either a flow rate indicator or two thermometers which indicate the actual flow and return temperatures of the collector loop.* *For the indication of the system pressure,*	Check of the system by the Laboratory: - It is recommended that the system is fitted with indicators for the collector loop flow - Check if the collector loop(s) are fitted with a pressure

[5] It was considered that “proved by suitable means” needs clarification. This will be included in deliverable D3.2 (Guide).

	Requirement	Procedure
	*collector loops **shall** be fitted with a pressure gauge at a clearly visible spot of the installed system. The allowable working range of the system pressure shall be indicated.*	gauge at a clearly visible spot of the installed system. Pressure range shall be indicated.
6.5.5.3. Heat meter	*No requirements for small custom built systems. For large custom built systems at least the collector loop **should** be equipped with a heat meter.*	- It is recommended that Large custom built systems are equipped with a heat meter at least at the collector loop. No requirements for small systems related to heat meter
6.6. Installation 6.6.1 Roof tightness	*If collectors are installed on the roofs of buildings, the weather tightness of the roof cover **shall** not be impaired.*	Check of the system by the Laboratory: Check installers documentation - Weather tightness of the roof shall not be impaired (in case of collectors installed on the roofs).
6.6.2. Lightning	*The system **should** meet the requirements given in EN 62305-1.*	- It is recommended to check if documentation to the installer and owner has reference to lightning protection.
6.6.3. Snow and wind loads	*If parts of the system are installed outdoors, they shall be resistant to snow and wind loads according to EN 1991-1-3 and EN 1991-1-4. The manufacturer shall state the maximum values for s_k (snow load) and v_m (mean wind velocity) according to EN 1991-1-3 and EN 1991-1-4. The system may only be installed at locations, where the values of s_k and v_m determined according to EN 1991-1-3 and EN 1991-1-4 are lower than the maximum values stated by the manufacturer. This shall be mentioned in the documents for the installer (see also 6.8.3).*	Check information given by the manufacturer according to Annex A1. Check if the manufacturer documented static calculation for the supporting frame according to EN1993-1-1 (steel) or to prEN1999-1-1 (aluminium). Check documentation for the installer.
6.7. Initial operation and	*No requirements for small custom built systems.*	

	Requirement	Procedure
commissioning	*Before initial operation of a large custom built system it **shall** be ensured that:* *– the installed system complies with the requirements of this document;* *– corresponding fittings are adjusted and the adjustments are recorded;* *– the supervisor of the system, if there is one, is instructed.* *Large systems **should** be tested as specified in prEN 12977-2 and monitored as specified in prEN 12977-2*	Only for large custom built systems, before initial operation, check by the Laboratory. It is recommended that a plan for monitoring is available for analysis be the Laboratory.
6.8. Documentation	*The manufacturer or official supplier **shall** deliver documents for assembly, installation and commissioning (for the installer) and documents for operation (for the user).*	See section 5.2 of this document.

	Requirement	Procedure
6.8.2 Assortment file for small systems	*The documentation describing an assortment of small systems **should** include the following information:* *a) All proposed system configurations including related hydraulic and control schemes and specifications to enable the user to understand the operating mode of the system.* *b) A list of all components to be included into the above system configurations, with full reference to dimension and type. The identification of the listed components shall be easy and unambiguous.* *c) A reference to all required component test reports according to 6.9.* *d) A list of proposed combinations of dimension options within each system configuration.* *e) Diagrams or tables stating the system performance under reference conditions for each proposed combination of dimension options within each system configuration.* *The reference conditions **should** be completely specified including the assumptions made on heat load(s) and weather data; the heat load(s) assumed should cover the range between 0,5 and 1,5 times the design load specified by the manufacturer.*	It is recommended that that the Assortment file is checked by the Laboratory.

	Requirement	Procedure
6.8.3 Documentation for small systems	*All components of each small custom built ystem **shall** be provided with a set of understandable assembly and operating instructions as well as service recommendations. This documentation **shall** include all instructions necessary for assembly, installation, operation and maintenance. These instructions shall include all information as listed in EN 12976-1.* *A commissioning pressure resistance test (leak test) has to be described in the documentation for the installer.* *The documents **shall** be kept at a visible place, protected from heat, water and dust.*	See section 5.2 of this document.
6.8.4 Documentation for large systems	*Each large custom built system **shall** be provided with a set of assembly and operating instructions as well as service recommendations. This documentation **shall** include all instructions necessary for assembly, installation, operation and maintenance and all records of initial operation and commissioning according to 6.7.* *A commissioning pressure resistance test has to be described in the documentation for the installer.* *The documents shall be kept at a visible place, protected from heat, water and dust.* *6.8.4.2 Documents in respect of dimensioning* *6.8.4.3 Documents for assembly and installation* *6.8.4.4 Documents for operation*	Check of documentation by the Laboratory. See section 5.2 of this document.

	Requirement	Procedure
6.9. System performance	*Small systems **should** be performance tested as described in prEN 12977-2. The test results **should** be listed in a test report in accordance with prEN 12977-2:2010, Clause 8.* *No requirements for large custom built systems, however if monitoring of the system is considered, it is recommended to use the methods for large systems described in prEN 12977-2.*	It is recommended that a test according to prEN 12977-2, section 6.8 for small systems is performed. No requirements for large systems. It is recommended that a plan for monitoring is available for analysis by the Laboratory.
6.10. Water wastage	*Systems that have a tank volume less than 500 l **should** be tested and reported according to prEN 12977-2 with regard to water wastage.*	Test according to prEN 12977-2, section 6.9 for systems with a tank volume less than 500 litres

4 Applicable Tests

4.1 Factory Made Systems

Factory Made Systems can have different working principles. For evaluation of conformity to the EN 12976, different tests will be applicable.

Checklists are presented in separated tables considering the classification of the systems according to its relevance to reliability tests (also referred as function and durability tests) and its relevance to thermal performance tests.

Table 3 – indicates which reliability tests, as they are listed now in EN12976-2, are applicable according the relevant classification of systems for this type of tests.

Table 4 – shows the proposal for interpretation of the present status of section 4.3.1. of EN 12976-1 and also possible future revision of this section of the standard.

Note: Clarification on the testing procedures of Reliability tests will be included in deliverable D3.2 (Guide).

Table 5 – indicates which thermal performance tests are applicable considering the relevant classification of systems for this type of tests.

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Table 3 – Applicable reliability tests according to relevant system classification.

		Function and Durability tests according to EN 12976-2									
		Freeze resistance test	Over temperature protection	Pressure resistance	Reverse flow protection	Conformity check in accordance to EN 1717 (water contamination)	Conformity check concerning the potable water qualification of the solar system	Conformity check of lightning protection	Conformity check of the safety equipment	Conformity check of electrical safety	Check on documentation of the system
- Thermosyphon	Collector Separable	x	x	x	x	x	x	x	x	x	x
	Collector Not Separable	(x)	x	x	- (a)	x	x	x	x	x	x
- Forced Circulation		x	x	x	x	x	x	x	x	x	x
- Integrated Collector Storage		(x)	x	x	- (a)	x	x	x	x	x	x
		(x) Presently just a recomendation									
		(a) Thermal Preformance Test reflects influence of reverse flow									

Table 4 – Applicable collector reliability tests according to relevant system classification.

		Function and Durability tests according to EN 12975-2									
		Internal pressure test	High-temperature resistance test	Exposure test	Stagnation temperature	External thermal shock test	Internal thermal shock test	Rain penetration test	Mechanical load test	Final inspection	Impact resistance test
- Thermosyphon	Collector Separable	All tests performed in the collector									Optional
		-	-	-	-	-	-	-	x (c)	-	Optional
	Collector Not Separable	-	x	- (a)	- (b)	x	-	x	x (c)	x	Optional
- Forced Circulation		All tests performed in the collector									Optional
- Integrated Collector Storage		-	x	- (a)	- (b)	x	-	x	x (c)	x	Optional
		(a) EN 12976-2 indicates that the instalation Manual for the system shall specify that the empty system shall be protected against prolonged exposure to solar radiation. If this is not referred the test should be performed.									
		(b) The information on highest temperature that can occur can be obtained in the over-temperature protection test.									
		(c) Development of a new mechanical load test will be necssary in this cases.									

Table 5 – Applicable thermal performance tests according to relevant system classification.

	Thermal performance measurement according to **ISO 9459-5**					Thermal performance measurement according to **ISO**				**Ability to cover the load**
	S Sol A	S Sol B	S Store	S Aux	IAM procedure	Input - Output Diagram	Storage heat loss	Mixing draw-off	IAM procedure	
- Solar only or preheat	x	x	x	-	(x)	x	x	x	(x)	-
- Solar plus supplementary	x	x	x	x	(x)	-	-	-	-	x
(x) not necessary for systems with flat plate collector										

5 Checklist for Labeling and Documentation.

Recommendations for evaluation of requirements on Labeling and Documentation according to sections 4.6 and 4.7 of EN 12976-1, are presented in Table 6, 7 and Table 8.

These recommendations integrated a document presented to the Solar Keymark Network including also the recommendations for Solar Thermal Collectors according to sections 7.2 and 7.3 of EN 12975-1.

Table 6 – Information that shall be included in the documents for the installer according to 4.6.2 of EN 12976-1.

Requirement			*Recommendations for evaluation*
a) Technical data	1) Layout of the system		The Layout of the system shall include all main components: Collectors, Storage Tank, Valves, probes of control device and make clear reference to the circulation of the heat transfer fluid and mains water. Dimensions of the connections and connecting pipes can be added to the diagram for fulfilment of requirement 2.
	2) Location and nominal diameters of all external connections		See recommendations above.
	3) An overview with all components to be delivered, with information on each component	Collector	Shall include all information as required by clause 7.3 of EN 12975-1:2006+A1:2010.
		Storage tank	Shall Include information on external dimensions, nominal volume, and weight when empty.
		Support structure	Shall include information on all the components of the support structure and procedure to mount it.
		Hydraulic circuit	Shall include information on all the components – pipes and diameters.
		Back-up provisions	Applicable to solar plus supplementary systems. Shall include layouts of connection of the Solar Thermal System to back up.
		Control/System regulation	Shall include description of the control system and operation mode. Trade mark and model shall be given.
		Other accessories	When applicable shall be described including relevant technical information.

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	4) maximum operating pressure of all fluid circuits in the system (in Pa)	Collector circuit	Values shall be in agreement to the information on the test report for the pressure resistance test.
		Tap water circuit	Values shall be in agreement to the information on the test report for the pressure resistance test.
		Auxiliary heating circuit	Values shall be given.
	5) Working limits	Temperatures	Values shall be given.
	6) Type of corrosion protection		Shall include description of any devices used in the storage tank for corrosion protection, e.g. anode and recommended maintenance
	7) Type of heat transfer fluid		Shall include clear reference to the heat transfer fluid used by composition and/or trade mark. Recommended percentages of anti-freeze fluid, when applicable shall be given as a function of the temperature.
b) Packing and transport of the whole system and storage conditions	Packing details	system Components	Shall include clear description of the packing used for the system and components
	Transport details	system Components	Shall include clear description of precautions to be taken for transport of the system and its components.
	Indication of storing conditions (indoors/outdoors) (Packed/not packed)		Shall include clear description of precautions to be taken for storage of the system and its components.
c) Installation guidelines with recommendations concerning:	1) Mounting surfaces		Shall include general information on the correct orientation of a solar thermal system taking into account the location and possibility to have shadows on the collector
	2) distance to walls and safety with regard		Value of minimum distance to walls shall be specified.

	to frost	Recommendation regarding thermal insulation for outdoor connecting pipes shall be included.
	3) the way the entrance of piping into the building shall be finished (resistance against rain and moisture)	Shall include an example on how to introduce the hot and cold water pipes into the building without risking to have entrance of water that will cause damage to the building.
	4) the procedure to be followed for thermal insulation of pipes	Shall include an example on how to make the thermal insulation of the pipes
	5) The roof integration of the collector	When applicable (for roof integrated collectors) the procedure and necessary components shall be described.
	6) for drain-back and drain-down systems, the minimal pipe slope and any other instructions necessary to ensure proper draining of the collector circuit.	When applicable, all the necessary instructions for correct installation of the referred systems shall be given.
d) Support structures	Indication of maximum values of sK (snow load) and vm (average wind velocity) according to EN 1993-1-1 (Steel) and prEN 1999-1-1 (Aluminum).	Values SK and vm shall be given. A declaration from the manufacturer justifying the calculated values shall be delivered to the Certification Body/Test Laboratory.
	Statement that the system may only be installed in places with lower values then sK and vm.	Shall have a statement indicating this warning.
e) Method for pipe work connections		Shall include an example on how to make the pipe work connections for the system
f) Types and sizes of the safety and security devices and their draining		Shall include detailed description of types and sizes of the safety and security devices. Manufacturer shall deliver the technical data sheets of safety and security devices to the Certification Body /Test Laboratory.

	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.	Shall include an example on how to make the drainage of water in order that no damage is done to the system or any other materials in the building by the drained hot water.
g) Control and safety devices	Including the wiring diagram	Shall include electrical diagrams when applicable
	Including the need for a thermostatic mixing valve which limits the draw-off temperature to 60ºC, when this is required according to 4.1.4.2; (required for systems in which the temperature of the domestic hot water delivered to the user can exceed 60 °C. The limit for tapping temperature +/- 5 degrees)	Shall include reference to the use of a thermostatic mixing valve and exemplify its installation in the diagram referred in a) 1)
h) Reviewing, filling and starting up of the system		One section of the document referring this subject. Shall include clear procedure for the installer to follow during the referred operations
i) Commissioning of the system		One section of the document referring this subject. Shall include clear procedure of the information that the installer shall give to the owner during commissioning of the system.
j) A checklist for the installer to check proper functioning of the system		One section of the document referring this subject.
k) Minimal temperature to which the system can withstand freezing.		If antifreeze fluid is used, the minimal temperature shall be given as a function of percentage of antifreeze fluid.

l) The required total solar radiation for which overheating will happen	The requirements that the system shall not be used in climate zones with higher irradiation values than these value.	Shall have a table referring these values, according to test report.
	The requirements that the system shall not be used in climate zones with higher irradiation values than these value.	Shall have a statement referring this warning.

Table 7 – Information that shall be included in the documents for the user according to 4.6.3 of EN 12976-1.

Requirement		*Recommendations for evaluation*
a) Existing safety and security components and their thermostat adjustments where applicable.		Limit values for safety and security components; Adjustable parameters values of thermostat.
b) Implementation of the system drawing particular attention to the facts:	1) 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	Should have a checklist for an easy verification of these steps.
	2) in the event of any failure condition a specialist shall be called in	Space reserved in document to include the contacts of a specialist, in case of any failure.
c) Regular operation of safety valves.		Should refer the periodicity for verification; Description of the procedure for the regular check of the safety valves.
d) Precautions with regard to the risk of frost damage and/or overheating.		One section of the document referring these subjects.
e) The manner of avoiding failure when starting the system under frost or possible frost conditions.		One section of the document referring this subject.
f) Decommissioning of the system.		One section of the document referring this subject. Shall include sentence indicating that National Regulations shall be taken in consideration by User.
g) Maintenance of the system by a specialist	Including frequency of inspections and maintenance	Shall be referred the frequency for inspection and maintenance. It is recommended that the document includes a checklist in order to record the dates of inspections (by the user) and maintenance (by the specialist).

	A list of parts that need to be replaced during normal maintenance	It is recommended that this list is according to the checklist for the maintenance, referring all items that need to be replaced during normal maintenance.
h) Performance data for the system	1) the recommended load range for the system (l/day) at specified temperature	Shall have a table referring these values, according to test report.
	2) The thermal performance and solar fraction of the system according to 5.9 of EN 12976-2:2006, for loads in the specified recommended load range	Shall have a table referring these values, according to test report.
	3) 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 2000h	Only applicable for forced circulation systems. Shall have a table referring these values, according to test report.
	4) 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)	Shall include this information.
	5) 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, according to EN 12976-2:2006	Shall have a table referring these values, according to test report.

i) The required total solar radiation for which overheating will happen:	The required total solar radiation on the plane of the collector or the minimum solar lamp intensity at the plane of the collector for which overheating protection of the system has been tested according to 5.2. of EN 12976-2:2006.	Shall have a table referring these values, according to test report.
	The requirements that the system shall not be used in climate zones with higher irradiation values than these value.	Shall have a statement referring the value according to test report.
j) 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:	1) Never switch off the electricity supply.	Shall have a statement indicating this warning.
	2) Never switch off the mains water supply.	Shall have a statement indicating this warning.
	3) Never drain the system when there is high solar irradiation.	Shall have a statement indicating this warning.
k) The fact that drinking water may be drained from the system during high irradiation situations, if this is the method to prevent overheating.		Shall have a statement indicating this advice.
l) The minimal temperature to which the system can withstand freezing.		Shall have a statement indicating this warning.
m) Type of heat transfer fluid.		One section of the document referring this subject. Shall include clear reference to the heat transfer fluid used by composition and/or trade mark. Recommended percentages of anti-freeze fluid, when applicable shall be given as a function of the temperature.

n) In case of solar systems with emergency heaters, instructions shall be issued that this emergency heater shall only be used for emergency heater purposes.	Shall have a statement indicating this warning.

Table 8 – Information that shall be included in the marking of the system (visible) according to 4.7. of EN 12976-1

Requirements	*Recommendations for evaluation*
a) Name of manufacturer or responsible supplier of the system	The name on the Label is either the name of the Manufacturer or of the OEM.
b) System type indication	The type of system is: - Termossyphon (pre-heat/solar only/ solar plus supplementary); - Forced circulation (pre-heat/solar only/ solar plus supplementary); - ICS (pre-heat/solar only/ solar plus supplementary);
c) Manufacturing or serial number	
d) Year of manufacture – this may be included in the production or serial number in coded or clear form	This may be included in the production or serial number in coded or clear form.
e) Absorber and aperture area of the collector in m^2	
f) Nominal capacity of the storage vessel in l	
g) Design pressure of the drinking water circuit in kPa	The pressure refers to the Maximum operation pressure - Tank side. Shall be according to test report and Technical Annex of the SK Certificate.
h) Collector heat transfer medium to be used	Equal to the heat transfer medium indicated in Documents for the user.

i) Permissible operating pressure of the collector heat transfer medium in kPa or, in case the system has an open or vented collector circuit, a statement to this effect		The pressure refers to the Maximum operating pressure - Collector side. Shall be according to test report and Technical Annex of the SK Certificate.
j) When the overheating protection of the system is dependent on: **electricity** or **cold water supply and/or** the system being filled with drinking water	1) A warning to this effect shall be marked on the system.	An independent label shall have a statement with this warning.
	2) In the case of dependency on the electricity supply, the mains plug of the system shall also be clearly marked to this effect	An independent label shall have a statement with this warning.
k) Electrical power of all electrical components	1) Electrical resistance of the deposit	Label shall have present the value in watt (W).
	2) Control System	Label shall have present the value in watt (W).

6 Information required from the manufacturer.

To support decision of conformity to requirements, detailed information from the manufacturer is needed.

In Annex A1 and Annex A2 of this document two checklists prepared in the frame of Solar Keymark Network are included.

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ANNEX A1 – Document **SKN_N0136_R0** – Systems

SKN_N0136_R0

Parts list, drawings and specifications, Solar Keymark Systems

Parts list
For each of the systems of a certification series parts list (bill of materials) must be made available to the inspector / test institute. The parts list shall include all parts of the systems, any changes done to the systems initially tested and the date of revision.

Engineering drawings
Each of the systems of a certification series must be accompanied by a set of engineering drawings of the collectors and storage tanks. The have to be fully dimensioned, including sectional views. Drawings shall have a number, date of issue and possible revision date. The drawings of the collectors have to fulfill the requirements of "SKN_N0120R0 Annex A".

Specifications
The components listed below must be described and specified using data sheets (alternatively the specification can be documented in the corresponding drawings or manuals) that contain at least the following information.

System ☐ System layout (functional principle)
Collector ☐ all specifications according to "SKN_N0120R0 Annex A"
Heat transfer fluid ☐ Type of liquid ☐ Water mixing percent ☐ Density ☐ Heat capacity ☐ Freeze protection
Pipes/piping and pipe insulation ☐ Type of pipes and insulation ☐ Material of pipes and insulation ☐ Dimensions of pipes and insulation ☐ Heat conductivity of insulation
Storage tank and tank insulation ☐ Type and tank orientation ☐ Tank material ☐ Tank dimensions ☐ Location of all tank connections ☐ Total tank volume ☐ Supplementary heated tank volume ☐ Tank height

System specifications 1/3

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☐ Inside coating ☐ Type of corrosion protection ☐ Heat loss coefficient of storage tank ☐ Insulation material ☐ Thickness of insulation ☐ Heat conductivity of insulation ☐ Heat loss coefficient of storage tank
Heat exchanger(s) ☐ Type (mantel, spiral, external) ☐ Material ☐ Dimensions ☐ Heat transfer coefficient (or at least heat exchanger surface)
Controller(s) and sensor(s) ☐ Type of controller(s) ☐ Dimensions ☐ Number and type of inputs and outputs ☐ Settings (control algorithm, overheating protection, flow-rate control,...) ☐ Specifications of power supply (operating voltage and frequency) ☐ Type of fuse(s) ☐ Power consumption (with/without activated display) ☐ Firmware version ☐ Type of sensor(s) ☐ Dimensions of sensor(s) ☐ Location(s) of sensor(s) ☐ Certifications
Pump(s) ☐ Type ☐ Drawings with dimensions ☐ Materials (housing, shaft, impeller, bearing,...) ☐ Pump characteristic curve(s) (flow rate/head/power input) ☐ Type of fluid(s) ☐ Temperature limits of fluid ☐ Pessure limits ☐ Settings (power level,...) ☐ Specifications of power supply (operating voltage and frequency) ☐ Power consumption (Min./Max. power consumption) ☐ Certifications
Supplementary heating ☐ Type ☐ Dimensions ☐ Settings ☐ Temperature limits

System specifications 2/3

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☐ Pessure limits ☐ Specifications of power supply (operating voltage and frequency) ☐ Power consumption (Min./Max. power consumption) ☐ Certifications
Hydraulics/safety equipment ☐ Parts list of all pipes, valves, safety equipment ☐ Dimensions ☐ Temperature limits of all parts ☐ Pressure limits of all parts ☐ Settings (if applicable) ☐ Specifications of power supply (if applicable) ☐ Power consumption (if applicable) ☐ Certifications (if applicable)
Mounting frame ☐ Type of Installation / angle of inclination ☐ Dimensions ☐ Basic schedule ☐ Material of frame ☐ surface treatment of frame ☐ static calculation documented evidence of conformity according to EN1993-1-1 (steel) or to prEN1999-1-1 (aluminium)

Remarks:

- If several sizes of the same system are certified, all documents have to be submitted for all the individual systems.
- In case of special system designs the delivery of additional documents might be required.
- The documents are kept strictly confidential by the inspector / test institute. If possible we ask you to submit these drawings by email in pdf format and as hard copy by mail.
- The documents must be supplied to the inspector / test institute either in the language of the country that the inspector / test institute is located or in English.

System specifications 3/3

ANNEX A2 – Document **SKN_N0120R0AnnexA** – Collectors

SKN_N0120R0AnnexA

Annex A
Parts list, drawings and specifications, Solar Keymark Collectors

Parts list
For each of the collectors of a certification series parts list (bill of materials) must be made available to the inspector / test institute. The parts list shall include all parts of the collector, any changes done to the collector initially tested and the date of revision.

Engineering drawings
Each of the collectors of a certification series must be accompanied by a set of engineering drawings fully dimensioned, including sectional views. Drawings shall have a number, date of issue and possible revision date. These drawings have to include at least the following:

Flat plate collector	Evacuated tube collector
□ General view	□ General view
□ Casing	□ Tube
□ Absorber	□ Absorber
□ Transparent cover	□ Reflector
□ Insulation	□ Heat transfer sheet
	□ Heat pipe
	□ Manifold

Specifications
The components listed below must be described and specified using data sheets (alternatively the specification can be documented in the corresponding drawing) that contain at least the following information.

Absorber (flat plate absorber and evacuated tube absorber) □ Material □ Thickness □ absorption and emission of the absorber coating
Transparent cover (flat plate absorber and evacuated tube absorber) □ Material □ Type (e.g. toughened glass, etc.) □ Thickness □ Surface properties (e.g. structure, coatings, etc.) □ solar transmission at normal incidence (air mass 1.5)
Insulations (flat plate absorber and evacuated tube absorber) □ Material □ Type (e.g. open porous, closed porous, etc.)

☐ Thickness ☐ Density ☐ thermal conductivity
Casing (flat plate absorber and evacuated tube absorber) ☐ Material ☐ Surface treatment
Heat pipe (evacuated tube absorber) ☐ Material ☐ used medium ☐ fluid content ☐ pressure
reflector (evacuated tube absorber) ☐ Material ☐ Surface treatment (polished, coated, etc.) ☐ reflectivity
Heat conductive paste (evacuated tube absorber) ☐ Information about the use of heat conductive paste ☐ technical specifications

Remarks:

- If several sizes of the same collectors are certified, all documents have to be submitted for all the individual collectors.
- In case of special collector designs the delivery of additional documents might be required.
- The documents are kept strictly confidential by the inspector / test institute. If possible we ask you to submit these drawings by email in pdf format and as hard copy by mail.
- The documents must be supplied to the inspector / test institute either in the language of the country that the inspector / test institute is located or in English.