BS EN 12977-1:2012

BSI Standards Publication

Thermal solar systems and components — Custom built systems

Part 1: General requirements for solar water heaters and combisystems

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National foreword

This British Standard is the UK implementation of EN 12977-1:2012. It supersedes DD CEN/TS 12977-1:2010 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RHE/25, Solar Heating.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Installations solaires thermiques et leurs composants - Installations assemblées à façon - Partie 1: Exigences générales pour chauffe-eau solaires et installations solaires combinées

Thermische Solaranlagen und ihre Bauteile - Kundenspezifisch gefertigte Anlagen - Teil 1: Allgemeine Anforderungen an Solaranlagen zur Trinkwassererwärmung und solare Kombianlagen

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This document (EN 12977-1:2012) has been prepared by Technical Committee CEN/TC 312 “Thermal solar systems and components”, the secretariat of which is held by ELOT.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2012, and conflicting national standards shall be withdrawn at the latest by October 2012.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified above. CEN [and/or] CENELEC shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN/TS 12977-1:2010.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

a) Drinking water quality

In respect of potential adverse effects on the quality of drinking water intended for human consumption caused by the product covered by this document, it should be noted that

1) this document provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA,

2) while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

b) Factory made and custom built solar heating systems

EN 12976-1, EN 12976-2, EN 12977-1, EN 12977-2, EN 12977-3, EN 12977-4 and EN 12977-5 distinguish two categories of solar heating systems:

1) factory made solar heating systems; and

2) custom built solar heating systems.

The classification of a system as factory made or custom built is a choice of the final supplier, in accordance with the following definitions.

1) Factory made solar heating systems are batch products with one trade name, sold as complete and ready to install kits, with fixed configurations. Systems of this category are considered as a single product and assessed as a whole.

   If a factory made solar heating system is modified by changing its configuration or by changing one or more of its components, the modified system is considered as a new system. Requirements and test methods for factory made solar heating systems are given in EN 12976-1 and EN 12976-2.

2) 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 EN 12977-1, test methods are specified in EN 12977-1, EN 12977-2, EN 12977-3, EN 12977-4 and EN 12977-5. Custom built solar heating systems are subdivided into two categories:

   i) large custom built systems are uniquely designed for a specific situation. In general, they are designed by HVAC engineers, manufacturers or other experts;

   ii) small custom built systems offered by a company are described in a so-called assortment file, in which all components and possible system configurations, marketed by the company, are specified. Each possible combination of a system configuration with components from the assortment is considered as one custom built system.

Table 1 shows the division for different system types.

Table 1 — Division for factory made and custom built solar heating systems

Factory made solar heating systems (EN 12976-1 and EN 12976-2)	Custom built solar heating systems (EN 12977-1, EN 12977-2, EN 12977-3, EN 12977-4 and EN 12977-5)
Integral collector-storage systems for domestic hot water preparation	Forced circulation systems for hot water preparation and/or space heating/cooling, assembled using components and configurations described in a documentation file (mostly small systems)
Thermosiphon systems for domestic hot water preparation	
Forced circulation systems as batch product with fixed configuration for domestic hot water preparation	Uniquely designed and assembled systems for hot water preparation and/or space heating/cooling (mostly large systems)

NOTE 1 Forced circulation systems can be classified either as factory made or as custom built, depending on the market approach chosen by the final supplier.

NOTE 2 Both factory made and custom built systems for domestic hot water preparation are performance tested under the same set of basic reference conditions as specified in EN 12976-2:2006, Annex B and in EN 12977-2:2012, Annex A. In practice, the installation conditions may differ from these reference conditions.

NOTE 3 Solar heating systems for both heating and cooling can so far not be performance tested; if the cooling option is not considered then the solar heating can be performance tested as a space heating system.

1 Scope

This European Standard specifies requirements on durability, reliability and safety of small and large custom built solar heating and cooling systems with liquid heat transfer medium in the collector loop for residential buildings and similar applications.

This document also contains requirements on the design process of large custom built systems.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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, *Thermal solar systems and components — Solar collectors — Part 2: Test methods*

EN 12976-1:2006, *Thermal solar systems and components — Factory made systems — Part 1: General requirements*

EN 12977-2:2012, *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*

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

EN 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, modified)*

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

EN 62305-1, *Protection against lightning — Part 1: General principles (IEC 62305-1)*

EN ISO 9488:1999, *Solar energy — Vocabulary (ISO 9488:1999)*

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12975-1:2006, EN 12976-1:2006 and EN ISO 9488:1999 and the following apply.

3.1
assortment
complete list of components (collectors, stores, controllers, pumps, etc.) which a company offers for its solar heating systems

Note 1 to entry: For the purpose of this document, the assortment is restricted to components used for small custom built solar heating systems marketed by a company.

3.2
assortment file
technical documentation file for small custom built systems of a company, which includes:

— the complete assortment for small custom built systems;

— the complete description of all system configurations;

— the complete description of all marketed combinations of system configurations and components including the component dimensions and number of units;

— further technical information

3.3
blow-off line
connecting line between the outlet of the safety valve and the environment (preferably an open vessel at atmospheric pressure)

3.4
collector array
group of collectors that are closely connected in series, in parallel or in combination of both modes, with one hydraulic input and one hydraulic output

3.5
control equipment
controllers, sensors, pumps, actuators, etc. used for controlling a solar heating system; this system includes optional auxiliary heaters and other parts of the space heating system, for heat generation and distribution

Note 1 to entry: Requirements and test methods for control equipment are given in EN 12977-5.

3.6
expansion line
<systems with closed expansion vessels> connecting line between the collectors and the pressure expansion vessel

<systems with open expansion vessels> connecting line between the collector array and the open expansion vessel

3.7
flow rate
circulation rate

3.8
large custom built system
solar heating system for the purpose of hot water preparation and/or space heating/cooling, which is designed for a specific situation by combining various components to a unique system

Note 1 to entry: In general, the collector area is greater than 30 m² and the store volume is greater than 3 m³.

3.9
safety line
<systems with closed expansion vessels> connecting line between the collector array and the safety valve

<system with open expansion vessels> connecting line between the collector array and the open expansion vessel

3.10
safety valve
temperature and/or pressure limiting valve

3.11
small custom built system
modular solar heating system of the remote storage type for the purpose of hot water preparation and/or space heating and/or cooling

Note 1 to entry: The system has a well-identified configuration (see 3.13). It is assembled from components chosen from the market and described in an assortment file prepared by a company.

Note 2 to entry: In general, the assortment file includes the possible system configurations, the assortment of components and their possible combinations and dimensions. The "company" may be the manufacturer of all or of parts of the components in the assortment; this company may also be only a consulting engineer who just produces the technical documentation and purchases the components from suppliers.

Note 3 to entry: In general, the collector area is greater than 1 m^2 and less than 30 m^2 and the store volume is less than 3 m³.

Note 4 to entry: The system can be tested by experimentally testing the components and predicting the system performance for different combinations of components by computer simulation.

3.12
solar combisystem
solar heating system providing both hot water and space heating

3.13
system configuration
characteristics of a solar heating system including its hydraulic scheme (hydraulic connections between the collector array, the store(s) and other components) and its control concept

Note 1 to entry: Systems differing by any other parameter, by the type or dimensions of the used components or the controller settings are considered to have the same configuration.

3.14
water wastage
amount of water not warm enough to count in the tapping (unheated water standing in pipes and fittings which are integrated into the water tank at the hot side of the draw-off piping)

4 Symbols and abbreviations

$(UA)_{sb,s,a}$ stand-by heat loss capacity rate of the store, in Watts per Kelvin;

V_n nominal volume of the store, in litres

5 System classification

5.1 Small custom built systems

Small custom built systems are classified as described in ISO 9459-1:1993, Clause 5. According to the purpose of these systems, the additional classification in Table 2 applies.

Table 2 — Classes of small custom built systems according to their purpose

Class	Purpose
A	domestic hot water preparation only
B	space heating only
C	domestic hot water preparation and space heating
D	others (e.g. including cooling, swimming pool heating)

5.2 Large custom built systems

Large custom built systems are classified in accordance with Table 3.

Table 3 — Classification of large systems

Class	Purpose
A	A system in which the store(s) and the collector array(s) are located in one building for which the heat/cool is provided. No seasonal store and no heat/cool distribution network outside the building are included.
B	A system which consists of a central heating/cooling plant and one or more collector array(s). The heat/cool is transported via a heat/cool distribution network to the heating plant and/or to other buildings. No seasonal store is included.
C	A large custom built system which mainly consists of one or more large collector array(s) and in which the heat/cool is transferred to a seasonal store or directly into a heat/cool distribution network.
D	Others

6 Requirements

6.1 Introduction

Subsequent requirements refer to the test methods given in EN 12977-2 and EN 12977-5.

NOTE Regarding large systems, the wording "no requirements on … however it is recommended that …" does not imply the need for a test method in EN 12977-2.

6.2 General

6.2.1 Suitability for drinking water

See EN 806-1 and EN 806-2.

6.2.2 Water contamination

The system has to be designed to avoid water contamination from backflow from all circuits to cold supply.

6.2.3 Freeze resistance

See EN 12976-1.

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 a maximum of 60 °C shall be installed.

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, also taking into account pressure conditions if relevant.

Maximum temperature in the collector is the collector stagnation temperature according to the EN 12975-2 test report.

NOTE 1 Care should be taken in cases where under stagnation conditions steam or hot water can enter the collector pipes, pipework, distribution network or heat exchanger (see [4]).

NOTE 2 Maximum temperature in the rest of the collector loop depends on safety valve pressure setting and the actual fluid.

NOTE 3 Guidelines for the determination of the highest temperature – depending on safety valve and fluid – should be provided.

6.2.5 Reverse circulation prevention

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.

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.

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

The system shall have been designed in such a way that the maximum allowed pressure of any material in the system is never exceeded, taking into account temperature conditions if relevant.

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.

NOTE 1 In addition, collector arrays of large custom built systems should be designed in a way so that they can also withstand high-pressure peaks of short duration, e.g. arising from sudden evaporation of liquid within the collectors at the beginning of stagnation.

NOTE 2 If, due to stagnation, considerable heat transfer medium quantities in the collector array evaporate, pressure peaks may occur due to high flow velocities of steam or liquid. These pressure peaks may significantly exceed the release pressure of the safety valve.

6.2.7 Electrical safety

See EN 60335-1 and EN 60335-2-21.

There shall be means to interrupt manually the 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 rodents, birds, UV radiation and other weather conditions over a prescribed lifetime.

All materials used in the collector loop should comply with ISO/TR 10217 in order to avoid any internal corrosion.

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.

NOTE 1 Care should be taken in order to ensure long-term durability and tightness of the collector joints.

If the collector array includes several parallel connected rows of collectors, the maximum divergent of the 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 explicitly stated by the manufacturer.

NOTE 2 In general, balanced flow can be reached by means of hydraulic adjustment of collectors and tubes. If this is not possible, the flow can be controlled by suitable fittings.

6.4.2 Supporting frame

The 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.

Installation fo the system is dependent on national requirements. Guidelines can be found in EN 1991-1-3 and EN 1991-1-4.

6.4.3 Collector and other loops

Collector and other loops shall be able to withstand expansion/contraction due to thermal mechanical influences.

6.4.4 Circulation pumps

See EN 809, EN 1151-1 and EN 12977-5.

6.4.5 Expansion vessels

6.4.5.1 General

For certain system designs, e.g. drain-back systems, a separate expansion vessel is not necessary, on condition that the integrated expansion facility is adequately designed to fulfil its task, in terms of volume, temperature and pressure resistance.

6.4.5.2 Open-vented expansion vessels

Each open system shall be provided with an expansion vessel or similar means, the volume of which shall be dimensioned so 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 or alternative means shall be provided with a spill line and with a connection to atmosphere, which cannot be shut off.

6.4.5.3 Closed expansion vessels

— Small systems

The expansion device of the collector loop shall be dimensioned in such a way that even when solar irradiance is at a maximum after an interruption of the power supply to the circulation pump in the collector loop, operation can be resumed automatically after power is available again and the absorber is refilled with liquid, i.e. vapour has re-condensed.

The expansion vessel shall be able to compensate for the thermal expansion in the whole loop plus the volume of the heat transfer medium in the whole collector array. This includes 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.

— Large systems

There are no requirements for large systems. However, it is recommended that expansion devices for such systems are designed to take into account all potential thermal expansion.

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 so that scaling is prevented or there shall be a means for cleaning.

NOTE 1 High temperature difference between the metal surface of the heat exchanger and the surrounding drinking water mainly causes scaling. This can be avoided by increasing the heat exchanger area.

Owing to an increase in the collector's operating temperature by more than the following criterion, any heat exchanger(s) between the collector loop and the hot water supply system should not reduce the collector efficiency 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). A method for calculating this reduction is given in EN 12977-2. If more than one heat exchanger is installed, this value should also not be exceeded by the sum of reductions induced by each one of them. This criterion also applies if a load-side heat exchanger is part of the system.

NOTE 2 If only one heat exchanger is used between the collector loop and the store of a small custom built system, the heat transfer capacity rate of the heat exchanger per unit collector area should not be less than 40 W/(K × m²) under typical operating conditions.

6.4.7 Water store(s)

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.

The stand-by heat loss capacity rate, $(UA)_{S,a,sb}$ of stores of small custom built systems should not exceed the value given by Equation (1):

$$(\mathrm{UA})\,\mathrm{sb,s,a} = 0{,}16\sqrt{V_{\mathrm{n}}} \qquad (1)$$

where

$(\mathrm{UA})_{\mathrm{sb,s,a}}$ is the stand-by heat loss capacity rate of the store, in Watts per Kelvin;

V_{n} is the nominal volume of the store, in litres (total volume of store as stated by manufacturer).

There is no requirement on the heat loss rate of stores of large custom built systems. However, it is recommended that Equation (1) be applied to such systems as well.

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's performance during it's lifetime.

The pipework for drinking water shall comply with the requirements specified in EN 806-1 and EN 806-2.

The materials for pipes and fittings shall be suitable to withstand the maximum operating 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 where 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).

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. For example, where thermal bridges are concerned, 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, resistant to deformation and which remain operative. If the insulation is installed outdoors, it shall be protected against (or resistant to) solar radiation, environmental conditions, ozone and any mechanical impact/deformation.

Insulated pipes for underground installation shall comply with EN 253.

6.4.10 Control equipment

See EN 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 with at least one suitable safety valve of suitable dimension. 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 so 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.

6.5.2 Safety lines and expansion lines

The safety line shall not be capable of being shut off or deformed in such a way that would reduce its discharge capacity below that necessary to maintain system pressures below the stated maximum for hot water or steam escaping from the safety lines.

The safety line and expansion line shall be dimensioned so that for the highest flow rate of hot water or steam that can occur, the maximum allowed pressure is not exceeded at any place in the collector loop, also taking into consideration the pressure drop in these lines. The dimensions of the safety line and expansion line shall be proved by calculation or experimental means.

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

6.5.3 Blow-off lines

The 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 life, materials or environment.

6.5.4 Store isolation 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.

6.5.5 Indicators

6.5.5.1 Indicators for collector loop flow

The system should be fitted with an indication method for confirming the collector loop circulation. This could be a flow rate indicator, two thermometers which indicate the actual flow and return temperatures of the collector loop or another appropriate method.

6.5.5.2 Pressure gauge

For the indication of the system pressure in case of filled systems, 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.

6.5.5.3 Heat meter

There are no requirements for small custom built systems.

For large custom built systems, at least the collector loop should be equipped with a 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.

6.6.2 Lightning

The system should meet the requirements given in EN 62305-1.

NOTE In EN 12976-2 a revised version of the requirements in EN 62305-1 is given in respect of solar heating systems.

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).

6.7 Initial operation and commissioning

There are no requirements for small custom built systems.

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 EN 12977-2 and monitored as specified in EN 12977-2.

NOTE These procedures described in EN 12977-2 are optional.

6.8 Documentation

6.8.1 General

The manufacturer or official supplier shall deliver documents for assembly, installation and commissioning (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. In particular, guidelines for check and maintenance of the collector loop fluid shall be given.

For small systems, a technical documentation describing the assortment proposed by the company having established the file according to 6.8.2 should be available. Documentation according to 6.8.3 shall be provided with each system.

For large systems, the full documentation of the system according to 6.8.4 shall be provided.

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 in 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.

6.8.3 Documentation for small systems

Each component of the small custom built system shall be provided with a set of clear 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 in a visible place, protected from heat, water and dust.

6.8.4 Documentation for large systems

6.8.4.1 General

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

The documentation should include

a) all load assumptions made (offering a set of values in a range spanning ± 30 % around the selected average load),

b) full reference to the weather data used,

c) full record of the dimensioning method used for collector area, store device(s) and heat exchanger including all assumptions (e.g. the desired solar fraction) and the full reference to any simulation programme used,

d) full record of the procedures used for hydraulic dimensioning of the collector loop and its components,

e) full record of the procedures used for the prediction of the system thermal performance including the full reference to any simulation programme used.

6.8.4.3 Documents for assembly and installation

The documents shall comply with EN 12976-1:2006, 4.6.2, a), e) to h), j) and k).

The description of assembly and installation of the system shall enable a proper installation in accordance with the system drawings.

6.8.4.4 Documents for operation

The documentation shall comply with EN 12976-1:2006, 4.6.2, a), f) and g).

The documents shall also include

a) hydraulic and electrical schemes of the system,

b) a description of the safety system with reference to location and adjustment of the safety components,

NOTE Guidance should be given for a check of the system before taking it into operation again after one or more safety valves have been released.

c) intended action in the case of system failure or hazard which is specified in the safety concept,

d) a description of the control concept and the control system including the location of the control components (e.g. sensors). The control components should be included in the hydraulic scheme of the system,

e) maintenance instructions including start-up and shut-down of the system,

f) a check on function and performance.

6.9 System performance

Small systems should be performance tested as described in EN 12977-2. The test results should be listed in a test report in accordance with EN 12977-2:2012, Clause 8.

There are 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 EN 12977-2.

6.10 Water wastage

Systems with a storage volume smaller than 500 l should be tested and reported according to EN 12977-2 with regard to water wastage.

Bibliography

[1] EN 1717, *Protection against pollution of potable water in water installations and general requirements of devices to prevent pollution by backflow*

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[5] *Empfehlungen zur Nutzung von Sonnenenergie / Recommandations pour l'utilisation de l'énergie solaire*. Swissolar, Zurich, Switzerland, 2nd edition, www.swissolar.ch

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