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Toplotni sončni sistemi in sestavni deli - Industrijsko izdelani sistemi - 1. del: Splošne zahteve

Thermal solar systems and components - Factory made systems - Part 1: General requirements

Thermische Solaranlagen und ihre Bauteile - Vorgefertigte Anlagen - Teil 1: Allgemeine Anforderungen

Installations solaires thermiques et leurs composants - Installations préfabriquées en usine - Partie 1: Exigences générales

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Contents

Page

Tables

Figures

European foreword

This document (EN 12976-1:2017) 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of an identical text or by endorsement, at the latest by July 2017, and conflicting national standards shall be withdrawn at the latest by July 2017.

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

This document supersedes EN 12976-1:2006.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

Most significant changes in EN 12976-1:2017 and EN 12976-2:2017 since the 2006 editions of both parts:

The first edition of the EN 12976 series was published in 2000. The standard series provided an important basis for the assessment of the performance as well as the reliability and durability of Factory made solar thermal systems. In the past 15 years or so several important technological developments and changes of the framework conditions, such as e.g. the aspect of requiring “Energy Labelling”, the EN 12976 series underwent several important changes.

The following modifications are the most important ones that have been implemented in this new edition of EN 12976-1:

— safety valves: new requirement that safety valves shall conform with EN 1489;

— resistance to external influences: consideration that the solar components can impact on the performance and durability of essential building elements, e.g. roofs and facades;

— labelling: harmonisation with ErP;

— Annex C (new): definition of system families; possible range of variations within one system type.

EN 12976, *Thermal solar systems and components — Factory made systems*, is currently composed with the following parts:

— *Part 1: General requirements*;

— *Part 2: Test methods*.

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

Introduction

Drinking water quality:

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the product covered by this standard:

a) this standard provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA;

b) it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

Factory Made and Custom Built solar heating systems:

The standards 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: **Factory Made** solar heating systems and **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.

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 for which a new test report is necessary. Requirements and test methods for Factory Made solar heating systems are given in EN 12976-1 and EN 12976-2.

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 12977-2, EN 12977-3, EN 12977-4 and EN 12977-5. Custom Built solar heating systems are subdivided into two categories:

— **Large Custom Built systems** are uniquely designed for a specific situation. In general HVAC engineers, manufacturers or other experts design them.

— **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 and EN 12977–3)
Integrated collector storage systems for domestic hot water preparation	Forced-circulation systems for hot water preparation and/or space heating, assembled using components and configurations described in an assortment 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 (mostly large systems)

NOTE Forced circulation systems can be classified either as Factory Made or as Custom Built, depending on the market approach chosen by the final supplier.

Both Factory Made and Custom Built systems are performance tested under the same set of reference conditions as specified in EN 12976–2:2017, Annex B, and in EN 12977–2:2012, Annex A. In practice, the installation conditions may differ from these reference conditions.

A Factory Made system for domestic hot water preparation may have an option for space heating, however this option should not be used or considered during testing as a Factory Made system.

1 Scope

This European Standard specifies requirements on durability, reliability and safety for Factory Made solar heating systems. The standard also includes provisions for evaluation of conformity to these requirements. Concept of system families is included, as well.

The requirements in this standard apply to Factory Made solar systems as products. The installation of these systems including their integration with roofs or facades is not considered, but requirements are given for the documentation for the installer and the user to be delivered with the system (see also 4.6).

External auxiliary water heating devices that are placed in series with the Factory Made system are not considered to be part of the system. Cold water piping from the cold water grid to the system as well as piping from the system to an external auxiliary heater or to draw-off points is not considered to be part of the system. Piping between components of the Factory Made system is considered to be part of the system. Any integrated heat exchanger or piping for space heating option (see Introduction, last paragraph) is not considered to be part of the system.

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 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 (all parts), *Pumps — Rotodynamic pumps — Circulation pumps having a rated power input not exceeding 200 W for heating installations and domestic hot water installations*

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

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

EN 1991-1-1, *Eurocode 1: Actions on structures — Part 1-1: General actions — Densities, self-weight, imposed loads for buildings*

EN 1991-1-3:2003, *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 12897, *Water supply — Specification for indirectly heated unvented (closed) storage water heaters*

EN 12975-1:2006+A1:2010, *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 12976-2:2017, *Thermal solar systems and components — Factory made systems — Part 2: Test methods*

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

EN 12977-5:2012, *Thermal solar systems and components — Custom built systems — Part 5: Performance test methods for control equipment*

EN 13831:2007, *Closed expansion vessels with built in diaphragm for installation in water*

EN 15092, *Building valves— Inline hot water supply tempering valves — Tests and requirements*

CEN/TR 16355, *Recommendations for prevention of Legionella growth in installations inside buildings conveying water for human consumption*

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

EN 60335-2 (all parts), *Household and similar electrical appliances — Safety (IEC 60335-2 series)*

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

EN ISO 9806, *Solar energy — Solar thermal collectors — Test methods (ISO 9806)*

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

3 Terms and definitions

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

3.1
expansion line
connecting line between the collectors and the pressure expansion vessel in the case of systems with closed expansions vessels; or connecting line between the collector array and the open expansion vessel in the case of systems with open expansion vessels

3.2
safety line
connecting line between the collector array and the safety valve in the case of systems with closed expansion vessels; or connecting line between the collector array and the open expansion vessel in the case of systems with open expansion vessels

3.3
blow-off line
connecting line between the outlet of the safety valve and the environment

3.4
factory-made solar system
packaged solar energy system for the purpose of hot water preparation only, either of the close-coupled or remote-store type, consisting of either one integral component or of a uniform set and configuration

of components, produced under conditions which are presumed uniform, and offered for sale under the same trade name

Note 1 to entry Components used for external mounting on or integration with essential building elements, e.g. roofs or facades, will require additional testing to demonstrate the suitability of application.

4 Requirements

4.1 General

4.1.1 Safety

The system shall fulfil general safety requirements, e.g. care shall be taken to avoid protruding sharp edges on the outside of the system.

4.1.2 Suitability for drinking water

The system shall conform to EN 806-1 and EN 806-2.

NOTE See 4.6.2 c) 7) and 4.6.3 b) 3).

4.1.3 Water contamination

The system shall be designed to avoid water contamination/ or growth of legionella for backflow from all circuits to drinking main supplies following guidelines set forth within the Technical Report CEN/TR 16355, highlighting the effect of temperature, the range in which the legionella is not able to proliferate and heat treatment methods for the purpose of disinfection.

4.1.4 Testing of resistance towards mechanical load

The manufacturer shall define which maximum load the system can withstand. For testing the resistance of not-separable solar thermal systems, EN 12976-2:2017, 5.5 shall be applied.

Test values applied to the cover, the collector box and the fixings between collector box and mounting system should be representative of the maximum loading likely to be experienced in the country where supplied.

4.1.5 Freeze resistance

4.1.5.1 General

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

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

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

The freezing resistance shall be tested in accordance with EN 12976-2:2017, 5.1.

4.1.5.2 Freeze protection and safety precautions with antifreeze fluid

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

In general where water vapour is produced in the collector array when the heat transfer liquid containing antifreeze fluid no longer flows through the collector and the sun is shining (stagnation conditions), the whole liquid content of the collector array shall be pushed out of the array within a few

minutes from the beginning of boiling in the collectors. The liquid shall flow out of the array through both the inlet and the outlet connections pipe work. For this purpose, the check valve shall be located in such a way that the expansion line of the collector array is not blocked by the check valve. The design of the collector shall enable the expulsion of the whole liquid content.

The manufacturer shall define the composition of the heat transfer fluid, including additives, allowed for the system. Precautions shall be taken to prevent the antifreeze fluid from deterioration as a result of high temperature conditions. These precautions shall be checked in accordance with EN 12976-2:2017, 5.2.

NOTE 1 If the expulsion of the whole liquid content of the collector array is not possible, water vapour is produced for a long period and condensates somewhere in the collector loop. This is a considerable heat transfer that can damage the parts on which vapour condensation occurs. Also, vapour production in large quantity in the collector arrays leads to higher concentrations of the antifreeze fluid and this fluid may become corrosive. Finally, some antifreeze fluids may solidify when concentration increases at high temperature. This may hinder any further fluid flow after stagnation has ceased.

NOTE 2 In general, the lowest allowed temperature of the system is equal to the freezing point of the antifreeze fluid. If the concentration of some antifreeze fluids - like glycols - exceeds a certain limit, they can freeze without damaging the system. In this case the lowest allowed temperature can be lower than the freezing point of the antifreeze fluid.

4.1.6 Over temperature protection

4.1.6.1 General

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

When the system has a provision to drain an amount of drinking water as a protection against overheating, the hot water drain shall be constructed in such a way that no damage is done to the system or any other materials in the house by the drained hot water. The construction shall be such that there is no danger to inhabitants from steam or hot water from the drain (see 4.6.2).

When the overheating protection of the system is dependent on electricity supply and/or cold water supply, this shall be stated clearly in the instructions and on the system (see 4.6.3 and 4.7).

NOTE For detailed information on the stagnation behaviour of solar thermal systems, please refer to a report of IEA SHC Task 26 on Solar Combisystems, prepared by Robert Hausner and Christian Fink, November 2002, http://task45.iea-shc.org/data/sites/1/publications/IEA-SHC-T45.A.2-INFO-Collector-loop-reqs.pdf.

4.1.6.2 Scald protection

When the system is tested in accordance with EN 12976-2:2017, 5.2, no steam shall escape from any draw-off point. When this test has been performed with other than the highest irradiations this shall be mentioned in the documentation for the user (see 4.6.3).

For systems in which the temperature of the domestic hot water delivered to the user can exceed 60 °C, the assembly instructions shall mention that an automatic cold water mixing device or any other device to limit the tapping temperature to at most 60 °C ± 5 °C shall be installed on the solar heating system or elsewhere in the domestic hot water installation (see also 4.6.2).

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