

NEW EUROPEAN STANDARDS FOR SOLAR HEATING SYSTEMS -- TOWARDS OPTIMISED SOLAR COMBISYSTEMS FOR SPACE HEATING AND DOMESTIC HOT WATER PREPARATION

J.-M. Suter

Suter Consulting, P.O. Box 130, CH-3000 Bern 16

ABSTRACT

Since autumn 1999, eight new European standards successively came into force as a result of the work done by the Technical Committee CEN/TC 312 *Solar thermal systems and components*. The new standards define terminology and general requirements applicable to solar collectors, storage tanks and solar heating systems. They also prescribe and describe the test procedures to check the requirements' fulfilment. For sure, they will have a significant impact on the solar industry; parallel to market extension on an international basis, industrialisation will go on and bring the awaited cost reduction. In the second part of the paper, current research activities within Task 26 of the Solar Heating and Cooling Programme of the International Energy Agency are reported. In this framework, researchers and industry representatives from ten countries are jointly developing test methods for the so-called solar combisystems; combisystems deliver heat for both space heating and domestic hot water preparation. Another objective of Task 26 is the optimisation of such combisystems. Currently, about twenty different combisystem types may be found on the market place in the participating countries. A coloured brochure describing these systems is available on the web as well as a hardcopy in the ten countries.

RESUME

Huit nouvelles normes européennes sont entrées successivement en vigueur depuis l'automne 1999, couronnant six ans de travaux du Comité technique CEN/TC 312 *Installations solaires thermiques et leurs composants*. Ces normes définissent la terminologie en la matière, les exigences applicables aux capteurs, aux stocks et aux installations solaires et les méthodes d'essai à utiliser pour vérifier que les produits répondent à ces exigences. Elles auront certainement un impact sur la branche et feront progresser son industrialisation, parallèlement à l'extension des marchés sur une base internationale; en conséquence, les prix devraient chuter. Dans une deuxième partie, l'article aborde les travaux de recherche en cours au sein de la Tâche 26 du Programme de chauffage et climatisation solaire de l'Agence internationale de l'énergie. Chercheurs et industriels de dix pays y développent conjointement des méthodes d'essai applicables aux installations solaires combinées pour le chauffage et l'eau chaude et optimisent ces équipements. Il y a actuellement, dans les pays de la Tâche 26, une vingtaine de types différents d'installations combinées sur le marché qui sont décrites dans une brochure quadrichrome, disponible dans les pays participant aux travaux ainsi que sur internet.

ZUSAMMENFASSUNG

Acht neue europäische Normen sind seit Herbst 1999 sukzessiv in Kraft getreten; somit ist die erste Phase der Arbeiten des Technischen Komitees CEN/TC 312 *Thermische Solaranlagen und ihre Bauteile* abgeschlossen. Die neuen Normen definieren die Terminologie, die Anforderungen an Sonnenkollektoren, Speichern und Solaranlagen sowie die bei der

Prüfung dieser Anforderungen anzuwendenden Verfahren. Sie dürften einen bedeutenden Einfluss auf die Branche haben und ihre Industrialisierung parallel zur Öffnung des Markts auf internationaler Basis beschleunigen; folglich dürften die Preise sinken. In einem zweiten Teil berichtet der Artikel über laufende Forschungsarbeiten im Rahmen der Task 26 des Programms Solarheizung und -kühlung der Internationalen Energie-Agentur. Forscher aus zehn Ländern erarbeiten gemeinsam unter Mitwirkung der Industrie Testverfahren für kombinierte Solaranlagen zur Raumheizung und Warmwasseraufbereitung; parallel werden solche Solaranlagen optimiert. Gegenwärtig befinden sich auf dem Markt in den beteiligten Ländern rund zwanzig verschiedene Typen von Kombianlagen. Ihre Beschreibung findet man in einer farbigen Broschüre, die auf dem Internet und als gedrucktes Dokument in den zehn Ländern erhältlich ist.

1. THE NEW EUROPEAN STANDARDS FOR SOLAR HEATING SYSTEMS

A powerful tool for the promotion of solar heating systems is the existence of technical standards and regulations for these industrial products. These technical specifications permit the quality improvement of products and, consequently, the increase of the consumer's confidence to this technology. Starting 1994, the Technical Committee CEN/TC 312 *Solar thermal systems and components* has worked out seven new European standards (Table 1). In addition, a terminology standard has been worked out in co-operation with the Technical Committee ISO/TC 180 *Solar energy*, leading to the world-wide applicable, trilingual standard EN ISO 9488. For now, only EN 12975-2 has not yet been published, a final editorial correction round being necessary; all seven other documents are available in English, French or German. Like all standards, the new European standards for solar heating systems are available from the national standardization institutes. For Switzerland, contact www.snv.ch

EN ISO 9488	Solar energy – Vocabulary / Energie solaire – Vocabulaire / Sonnenenergie – Vokabular
EN 12975-1	Thermal solar systems and components – Collectors – Part 1: General requirements
EN 12975-2	Thermal solar systems and components – Collectors – Part 2: Test methods
EN 12976-1	Thermal solar systems and components – Factory-made systems – Part 1: General requirements
EN 12976-2	Thermal solar systems and components – Factory-made systems – Part 2: Test methods
ENV 12977-1	Thermal solar systems and components – Custom-built systems – Part 1: General requirements
ENV 12977-2	Thermal solar systems and components – Custom-built systems – Part 2: Test methods
ENV 12977-3	Thermal solar systems and components – Custom-built systems – Part 3: Performance characterisation of stores

Table 1: The new European standards for solar heating systems.

Solar heating systems have been divided into factory-made systems and custom-built systems. The classification of a system as factory-made or custom-built is a choice of the final supplier, in accordance to 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 configuration. Systems of this category are considered as a single product and assessed as a whole. If a factory-made 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.

Custom-built 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 the test results are integrated to an assessment of the whole system. Custom-built systems are subdivided into two categories: (i) Large custom-built systems are uniquely designed for a specific situation. They are in general 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.

The eight new European standards are enforced as national standards in the 19 member-countries of CEN. On this basis, the development and implementation of common European certification schemes are currently underway. Through the oncoming enforcement of the Bilateral Agreements between the European Union and Switzerland, European certificates will be accepted in Switzerland and Swiss certificates in the EU. As a result, further promotion of solar heating systems may be expected throughout Europe.

Personal comments

As the head of the Swiss delegation to CEN/TC 312 and of the Project Team 3 in charge of drafting ENV 12977, the author expresses in this paragraph his personal view on the work done since 1994. First, it has to be stressed that the new standards are of high level. Through difficult negotiations among the national delegations, a number of sustainable compromises have been achieved. What regards Switzerland, the main objective of the delegation was to pass essential quality requirements and proved features of good-quality solar collectors and systems into the European standards, in order to prevent low-cost, low-quality products from entering the market. In this opportunity, the reference source document has been the well-known 'Solarordner' by Swissolar [1], which presents in a user-friendly way the comprehensive know-how of the Swiss solar industry (solar heating, photovoltaics, solar architecture). The Swiss know-how found a positive resonance within CEN/TC 312; the new European standards are compatible with [1].

Creating the first group of standards for custom-built systems has been a very challenging job. The selection of the items to be included into these standards lead to interesting but controversial discussions. In the end, several items have been deleted from ENV 12977; they are related to guidelines for installation and should be included into a future CEN document (not a standard!). At the same time, just before final approval, CEN/TC 312 decided to move the 12977 group to ENVs, i.e. experimental standards. In a few years, the experience made with these ENVs shall be reviewed and the texts updated, if necessary, before another vote is launched to move them to actual standards (EN). Today, the 12977 ENVs have been approved and the author feels that CEN/TC 312 chose the right strategy to introduce standards into this new area.

On the other hand, it has to be mentioned that some delegations in CEN/TC 312 were not prepared to move towards the necessary compromises. By sticking to their own view on crucial issues, probably because of commercial interest of some national companies, they have blocked the work progress for months. For example, the choice of the reference area for collectors has been controverted for one whole year, after similar disputes had lasted within the Technical Committee ISO/TC 180 on the same issue for several years. Ultimately, two areas (aperture area and absorber area) have been adopted by CEN/TC 312 and must both be used in European test reports. Another long-disputed issue was the distribution of solar heating systems into factory-made systems and custom-built systems, according to existing markets. A prerequisite for the achievement of a compromise in this matter was comprehensive information, to make clear for everybody that the national solar-market traditions differ from country to country and that, accordingly, different markets need different standards. Of course, market opening throughout Europe will progressively bring more uniformity.

The author regrets that the standard for collector test procedures EN 12975-2 leads to a confusing situation on the market. There is still another standard for collector testing, ISO 9806-1 to -3 [2-4]. Compared to these older but worldwide applicable documents, EN 12975-2 brings innovations like a dynamic collector test procedure; however, at the same time, it reproduces the procedures described in ISO 9806 in changing just some of the test conditions, so that the test results obtained according to the EN 12975-2 procedure adapted from ISO 9806 are not entirely compatible with those obtained by the original ISO 9806 procedure. On behalf of the Swiss solar industry, the Swiss delegation vainly demanded the full compatibility of the test procedures. Meanwhile, ISO/TC 180 has decided to review ISO 9806 in order to account for the worldwide experience gained since the publication of this standard, especially the innovative features of EN 12975-2. However, work progress is slow and the current situation is still unsatisfactory.

2. SOLAR COMBISYSTEMS

So-called solar combisystems are solar heating systems delivering heat for both space-heating purposes and domestic hot water preparation. They are less common than solar water heaters. However, they have the potential to significantly reduce greenhouse gas emissions compared to solar water heaters, as they may cover a larger fraction of the house's energy needs by solar heat, thanks to a larger collector area than in the case of water heaters. The demand for combisystems is increasing rapidly in several countries. The European Commission's view is that around 120'000 solar combisystems with 1.9 million square metres of collectors should be installed annually in the countries of the European Union alone.

So far, solar combisystems have been less optimised than solar water heaters, and, when working-out ENV 12977-2, CEN/TC 312 had to leave open the test method applicable to them. A co-operative research programme, called Task 26 *Solar Combisystems*, started by the end of 1998 within the framework of the Solar Heating and Cooling Programme of the International Energy Agency. Researchers and industrial delegates from ten countries, among them Switzerland, jointly develop test procedures for solar combisystems and optimise these systems. The author of the present paper is in charge of communication between Task 26 and the outer world. In a first step, Task 26 reviewed all combisystem types available on the ten national markets and published an overview [5]. Surprisingly, as many as twenty different generic combisystems have been found in the participating countries. A classification according to simple technical criteria was missing; a proposal for such a classification may be found in [5]. It could be taken over by CEN/TC 312 at due time

(revision of ENV 12977). Task 26 will be operated up to the end of 2002. The developed test methods will be a basis for future additions to ENV 12977-2. Therefore, a formal 'liaison' has been established between CEN/TC 312 and Task 26, maintained by the author of the present paper and its Dutch counterpart, H. Visser, from TNO Delft.

The other part of Task 26, devoted to combisystem optimisation, is of equal importance for the future development of solar-heating markets. Combisystems differ by the way they manage the storage of solar heat, and by the way they organise the flow and storage of the heat produced by the auxiliary heater [5]. So far, it is not clear yet which philosophy is the best one and which components' sizes are optimal. Task 26 has developed numerical simulation models to address these issues. It will identify the most promising generic systems and formulate recommendations for their dimensioning. Some cost considerations will be included into the optimisation process.

Task 26 will end up with a final document targeted at potential users of the Task's results: planners, architects, interested potential owners of solar combisystems.

Information on solar combisystems is available from the IEA website www.iea-shc.org/task26 including the coloured brochure [5]. A hardcopy of this brochure is available in Switzerland from the website www.energieforschung.ch.

3. CONCLUSION

In the mid-term, standards for solar heating systems as well as the reported research work on the optimisation of solar combisystems will have a significant impact on the solar heating market. Quality assurance of collectors and systems, optimised performance and costs, and more transparent system descriptions will boost the sales as a result of greater consumer's confidence and price reduction. This is, of course, in the interest of the government's policy towards reduced emissions of greenhouse gases. The author hopes that an increasing number of companies will get aware of the importance of the reported items and consider them accordingly in their development strategy.

ACKNOWLEDGEMENTS

Support by the Swiss Federal Office of Energy within the framework of the renewable energy programme is greatly acknowledged.

REFERENCES

1. Solarordner – Empfehlungen zur Nutzung von Sonnenenergie. Swissolar, Zürich, 1997 / Classeur solaire – Recommandations pour l'utilisation de l'énergie solaire. Swissolar, Zurich, 1997. [This reference document is currently being updated.]
2. ISO 9806-1 : Test methods for solar collectors — Part 1: Thermal performance of glazed liquid heating collectors including pressure drop (Dec. 1994)
3. ISO 9806-2 : Test methods for solar collectors — Part 2: Qualification test procedures (Aug. 1995)
4. ISO 9806-3 : Test methods for solar collectors — Part 3: Thermal performance of unglazed liquid heating collectors (sensible heat transfer only) including pressure drop (Dec. 1995)

5. J.-M. Suter, Thomas Letz, Werner Weiss, Jürg Inäbnit: Solar Combisystems in Austria, Denmark, Finland, France, Germany, Sweden, Switzerland, the Netherlands and the USA – Overview 2000. IEA Solar Heating and Cooling Programme, Task 26, ISBN 3-905583-00-3, 2000. [Norway joined Task 26 late, in May 2000; therefore, the Norwegian generic system is not included into the overview 2000.]