

## **Specific CEN Keymark Scheme Rules for Solar Thermal Products**



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## Introduction

These Specific CEN Keymark<sup>1</sup> Scheme Rules for Solar Thermal Products are acting as a supplement to the CEN/CENELEC INTERNAL REGULATIONS –PART 4: CERTIFICATION – 2014 [1].

Together these specific and general rules give the complete set of requirements for “Keymarking” solar thermal products covered by EN 12975, EN 12976 and EN 12977-3. Therefore, in order to get the Solar Keymark one shall follow both the general rules and these specific rules.

The basic elements/requirements of the scheme are:

- A quality system (i.e. product related factory production control) covering the production line based on the EN ISO 9000 series of standards
- Third party initial inspection of the manufacturing site (and especially the quality system management)
- Third party initial type testing sampled by independent body
- Third party periodic surveillance (i.e. periodic inspection)

The specific scheme rules are made in order to make the scheme operational for the involved parties. They are kept as close as possible to the minimum requirements for Keymark Scheme Rules as given in 4.2 of [1].

Be sure always to have the latest version of these scheme rules, available at [www.solarkeymark.org](http://www.solarkeymark.org).

## 1 Definition of scope

### 1.1 Products covered by the scheme

The scheme covers the following product main types within the work programme of CEN/TC 312 for thermal solar systems and components:

- Solar thermal collectors as defined in EN 12975 and EN ISO 9806
- Factory made solar thermal systems as defined in EN 12976
- Custom built systems as defined in EN 12977-1 and -2
- Solar water heater stores as defined in EN 12977-3
- Solar combistores as defined in EN 12977-4
- Control equipment as defined in EN 12977-5

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<sup>1</sup> The Keymark is a third-party certification system on the basis of European Standards, demonstrating to users and consumers conformity to the requirements of the relevant European Standard(s). It is granted after the satisfactory completion of a certification procedure, comprising product conformity tests (initial type tests), assessment of the documented factory production control for the related production line, production site inspection and surveillance.

Different product families are different subtypes of the respective main type. Products families are defined in section 4.

## **1.2 List of European Standards concerned**

The scheme refers to the normative requirements in the following European Standards:

- EN 12975-1: Thermal solar systems and components - Solar collectors  
— Part 1: General requirements (EN 12975-1:2006 + A1:2010: is currently under revision. Wherever this standard refers to testing according to EN 12975-2, it shall be understood as testing according to EN ISO 9806. See Annex H for testing and certification during the transition period)
- EN 12975-2: Thermal solar systems and components - Solar collectors  
— Part 2: Test methods (This standard has been substituted by EN ISO 9806. See Annex H for transition period)
- EN/ISO 9806: Solar energy -- Solar thermal collectors -- Test methods (This standard substitutes EN 12975-2 for testing of solar collectors. See Annex H for transition period)
- EN 12976: Thermal solar systems and components - Factory made systems  
— Part 1: General requirements
- EN 12976: Thermal solar systems and components - Factory made systems  
— Part 2: Test methods
- EN 12977-1: Thermal solar systems and components - Custom built systems  
— Part 1: General requirements for solar water heaters and combisystems
- EN 12977-2: 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

The scheme also refers to the procedure for calculating the output of a solar water heating system given in:

- EN 15316-4-3: Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 4-3: Heat generation systems, thermal solar systems.

The standards are available from the national standardisation bodies (list of standards available see: <http://www.cen.eu/eseach/>).

## **2 Requirements and assessment procedures for bodies engaged in certification, testing and inspection**

### **2.1 Requirements for certification, testing and inspection bodies**

The general requirements are given in [1], part 4.1.5:

“Bodies engaged in certification, testing and inspection shall fulfil the requirements of the relevant standards for their operation, e.g. EN 45000 series and EN ISO/IEC 17000 series of standards, as well as the additional requirements defined in the Keymark scheme rules...”

The additional requirements/rules in this specific scheme are:

- The certification body in agreement with the manufacturer (license applicant) employs any of the approved testing laboratories fulfilling the requirements in this scheme and listed in paragraph 8 “List of bodies for the implementation of the scheme”.
- Evaluation of testing laboratories by the certification body is not an alternative to accreditation.
- Certification bodies, testing laboratories and inspection bodies shall participate actively in the Solar Keymark Network, i.e. participate in meetings relevant for their activities in Solar Keymark certification, testing and inspection.
- Certification bodies shall make test results public available in the harmonised format agreed upon by the Solar Keymark Network – See Annex B. Updated lists of certified products shall be sent to the Solar Keymark Network manager each month.
- Inspection bodies shall use the harmonised inspection procedure and checklist agreed upon by the Solar Keymark Network – Annex A.
- Certification bodies shall collect a fee for each license issued to be transferred to the Secretariat of the Solar Keymark Network. Transfer shall take place within twelve months from the date of issuing the licence. The fee for the Solar Keymark Network is given in Annex C.

### **2.2 Handling complaints on bodies engaged in testing and inspection**

In order:

- To have a harmonized procedure for handling complaints,
- To solve complaints in an appropriate time and way,
- To maintain the high reputation of Solar Keymark,
- To ensure a fair competition between the testing laboratories, inspectors, and certification bodies,

the following procedure for complaints is applied:

- The complainant will inform the respective certification body (CB) by using the form for complaints given in the Annex I of the Solar Keymark scheme rules.
- The CB will forward the complaint to the relevant test laboratory / inspector and ask for clarification and appropriate corrective actions within a defined due time.
- The clarification and corrective action will be sent to CB for assessment.
- The CB will assess this report and decide if a special audit at the respective party or a witness audit for the inspector is required. Especially with respect to testing

laboratories, the CB should involve one of the other recognized and well experienced testing laboratories for technical support during the special audit.

- If the CB decides by itself or with recommendation of SKN certification working group that a special audit is required, the party has to pay for the audit as defined in the agreement between certification body and sub-contractors.
- If the CB agrees to the provided corrective actions and the complaint is solved, the CB will inform the complainant about the result by sending back the form.
- If the complainant is still not satisfied with the provided reply he can contact to convener of the SKN certification working group for discussion within the certification bodies working group.
- The SKN certification bodies working group will prepare a summary of all complaints and send to the SKN for presentation at next SKN meeting.

Note: This procedure how to handle complaints should be extended in the near future to other parties such as certification bodies and manufacturers.

*SKN Resolution M18.R2*

### **3 Specification of the manufacturer's application file**

The manufacturer and/or applicant shall supply the certification body with the information as required in the application form of the certification body. The application form is available from the certification body.

This information must also include the documentation required in the relevant standard:

- paragraph 7. “Collector identification” of EN 12975-1
- paragraph 4.6 “Documentation” and 4.7 “Labelling” of EN 12976-1
- paragraph 6.8 “Documentation” of EN 12977-1
- paragraph 9.2 “Description of the store” of EN 12977-3
- paragraph 7.2 “Description of the store” of EN 12977-4
- paragraph 6.7 and 12. “Documentation” of EN 12977-5

### **4 Selection and submission of type test samples**

#### **4.1 Selection**

The selection of products for initial type testing is made under the responsibility of the certification body. The test samples for initial type testing are taken out of the current production or from the stock of the manufacturer. The inspector points out the test samples and records their serial numbers. The manufacturer shall prove through his factory production control and quality management system conformity of the test sample with the series production.

A series production is existing when a least 10 collectors are produced with the same materials and the same manufacturing technologies in the same way and all major production processes are performed in presence of the inspector.



At least 10 collectors of the same type more than the number of test samples picked must be available in the stock for picking the sample(s) to be tested.

*SKN decision D4.M6.*

#### **4.1.1 Remote Random Sampling procedure.**

The following remote sampling procedures can be used:

- Internationally operating inspection companies.
- Videosampling
- Photosampling

Detailed procedures and requirements are given in document SKN\_N0126R1.

Example of: “Instructions for Completing Random Selection via Photographs is given in SKN\_N0127R0 can be performed for picking samples for Solar Keymark type testing.

*SKN decision D13.M8.*

## **4.2 Collector families and custom built collectors**

The “Thermal Performance Test” which is the basis for the collector family concept in this section includes the thermal performance AND the Incidence Angle Modifier measurement. The IAM data published in the Keymark data sheet are those taken from the collector with the relevant thermal performance data.

*SKN Resolution M19.R8*

### **4.2.1 Collector size families**

If the manufacturer produces the “same” collector in different lengths and/or widths (i.e. the only difference between two collectors is the length and/or the width) the collector is considered the same subtype (within the same collector “family”). In this case only one sample of the smallest and one sample of the largest module shall be taken and tested<sup>2</sup>. The largest module shall be subject to all the tests required in EN 12975-1 clause 5.2, and the smallest shall be subject to a thermal performance test (according to EN 12975-2 / EN/ISO 9806)<sup>3</sup>.

As an exception, the rain test can be done on any member of the family as long as the pre-exposure requirements of the standard are fulfilled and the major characteristics of the construction are the same.

*SKN Resolution M19.R11.*

The performance figures used for this type shall be the performance figures corresponding to the measured instantaneous efficiency having the lowest integral in the interval of the

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<sup>2</sup> The module sizes are compared based on aperture area. Aperture area is defined in EN/ISO 9488. The inspector shall inspect all the different sizes of the type to verify conformity.

<sup>3</sup> The definition of the biggest collector and the smallest collector is done at the initial test. If later a bigger size or smaller size is added to the collector family this is resulting in a new definition for the existing family. If there is a new biggest collector added this will require performance testing and reliability testing of this collector. If there is a new smallest collector added this will require performance testing on the smallest collector - *SKN decision D3.M8.*

reduced temperature<sup>4</sup> from 0 – 0.1 K/(W/m<sup>2</sup>). In other words, the efficiency curve used for this subtype shall be the one embracing the smallest area.

Durability and reliability tests shall be carried out on collectors representing the major features of the collector family. E.g. collector families with collectors having several glass covers separated by bars. If the largest size of the collector - the test laboratory can test - is smaller than the smallest size of the family representing the weakest point - another testing laboratory shall carry out the respective tests.

*SKN decision D2.M6.*

If a manufacturer produces the “same” flat plate collector using different combinations of materials for the absorber (i.e. Cu/Cu or Cu/Al or Al/Al or Cu/Steel or Al/Steel etc.) in different sizes, the performance of the largest and the smallest collector has to be measured at least for one combination of these materials only. Based on the result that for this collector model either the smaller or the bigger collector has the lowest integral in the interval of the reduced temperature from 0 – 0.1 K/(W/m<sup>2</sup>), for other combinations of materials only the relevant collector has to be measured again to define the applicable performance figures of this family.

*SKN decision M19.R9.*

It is not admissible to override this regulation by declaring an extended validity of a test report for a collector of a certain size to collectors of other sizes.

*SKN decision M19.R6.*

Note:

If the smallest and/or the biggest collector of a family is/are not produced anymore, the Solar Keymark certificate basically remains valid. The following applies:

- a. The published performance figures remain unchanged, even if the product defining the performance parameters of the family is not produced anymore.
- b. The list of models on the data sheet can be reduced accordingly.
- c. The test reports mentioned on the data sheet remain unchanged.
- d. The physical inspections will be made for the remaining collectors.

*SKN decision M19.R7*

#### **4.2.2 Collector glass thickness families**

If the manufacturer produces the same collector with various thickness of the cover glass (i.e. the only difference between two collectors is the thickness of the glass) the collector is considered as the same subtype (within the same collector —family). In this case sample(s) of the collector with the thinnest cover glass and sample(s) of the collector with the thickest cover glass shall be taken and tested. The collector(s) with the thinnest cover glass shall be subject to all the tests required in EN 12975-1 clause 5.2, and the collector(s) with the thickest cover glass shall be subject to a thermal performance test (clause 6 of EN 12975-2). The performance figures used for this type shall be the performance figures corresponding to the measured instantaneous efficiency having the lowest integral in the interval of the reduced temperature from 0 – 0.1 K/(W m<sup>2</sup>). In other words, the efficiency curve used for this subtype shall be the one embracing the smallest area.

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<sup>4</sup> The reduced temperature is defined in EN 12975-2, paragraph 6.1.4.8.3, and the instantaneous efficiency in 6.1.4.8.4.2.

*SKN Resolution R4.M13.*

#### **4.2.3 Custom built collectors**

Custom built collectors (built in, roof integrated collectors that do not comprise factory made modules and are assembled directly on the place of installation) are handled as described in EN 12975-1, paragraph 1 "...a module with the same structure as the ready collector is tested. The module gross area in the case of custom built collectors shall be at least 2 m<sup>2</sup>". The manufacturer has to explain the conformity of the test module with the normal production and must provide a detailed description of the components. Very large collector modules may be treated as the custom built ones, see above, if testing of the full size module is not possible.

#### **4.2.4 Separate certificates and data sheets for collectors within a family**

If the criteria of a collector family are met, separate certificates and data sheets with individual performance figures of the different collectors can be issued, provided the thermal performance is determined for each collector.

In this case, reference to all relevant test reports has to be made on each data sheet.

With regard to the fees, the different collectors are treated as different subtypes.

*SKN Resolution R3.M14.*

#### **4.2.5 Collectors with frames in different colours**

If collectors differ only by the colour of their frame, only one collector needs to be tested. The test results determined by the test of this collector are valid for all collectors differing only by the colour of their frame from the collector tested.

The collector used for testing should be the one that, has according to the manufacturer, the largest market relevance.

*SKN Resolution M14.R1*

#### **4.2.6 Family of Sydney Type Evacuated Tube Collectors**

It is possible to build a Keymark family of Sydney Type Evacuated Tube Collectors where the only difference between the collectors is the material of the absorber tubes such as different types of Steel, Copper and other metals under the condition that

- The nominal heat conductivity of the tube walls is within +/-10% ( $\lambda \cdot d \approx \text{const.}$ , where d is the wall thickness of the tubes) for all members of the family.  
(Note: To make sure that the thermal performance is not affected by the material)
- An exposure test and internal thermal shock test has been done with one collector of each type of materials.  
(Note: To make sure that there are no unexpected problems.)
- A pressure test is required for all materials with the same pressure rating for all the materials of the family.  
(Note: To make sure that there are no pressure issues because of the different tube wall thicknesses and the different welding/soldering/connector settings required for different materials.)
- The members of the family have different names depending on the tube material used.  
(Note: The end user has to know what tube material is being used (corrosion in the hydraulic loop))
- In case of heat pipes, a freeze test has to be passed for every material.

*SKN resolution M19.R4*

#### **4.2.7 Family of Evacuated Tube Collectors with different tube lengths**

It is possible to build a Keymark family of Evacuated Tube Collectors with different tube lengths under the condition that

- All collectors are made of the same tube in terms of diameter(s), material(s), coating(s) and same material strengths. The only difference is the length of the tubes.
- The smallest collector of the family is made of the shortest tubes and the biggest collector of the family is made of the longest tubes.
- (Note:
  - o Else it is possible to make a family where only one length of tube was tested.
  - o Else it is possible to make a family where the smallest and the biggest are made of the longest tubes, all in between have shorter tubes. Hence overestimating the performance of the shorter tube collectors due to the aperture-gross area ratio)

*SKN resolution M19.R5*

### **4.3 System families**

#### **4.3.1 System families (EN 12976 - Factory made systems)**

If the manufacturer produces the “same” system in different sizes, the different sizes of the system is considered being the same subtype (within the same system “family”). Detailed requirements for systems to be of the same subtype are given in Annex D.

Testing requirements for systems of the same subtype are:

- High temperature and safety tests (according to EN 12976) shall be performed on the sub system having the highest collector area to store volume ratio.
- All other tests (according to EN 12976 and including performance test) shall be performed on the “medium” sub system. Detailed testing requirements are given in Annex D.

Performance indicators for the system configurations which are not performance tested can be determined based on the performance test result on the “medium” system configuration according to the procedures described in Annex D.

#### **4.3.2 System families (EN 12977 - Custom built systems - including unique large systems)**

The systems defined in one assortment file according to EN 12977-1 section 6.8.2 “Assortment file for small systems” are considered being the same subtype (within the same system “family”).

The following components in a custom built system shall (as a general rule<sup>5</sup>) be Keymarked:

- Solar collectors (EN 12975)
- Solar water heater stores (EN 12977-3)

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<sup>5</sup> If a large systems is tested according to EN 12977-2 Annex C (method C4), only the collectors shall be Keymarked.

- Solar combistores (EN 12977-4)
- Control equipment (EN 12977-5)

For large custom built systems performance testing and test results may be given in accordance to EN 12977-2 Annex C. For such large custom-built solar thermal systems tested according to Annex C, the concept of “system family” is not applicable and the certification is valid only for the specific configuration.

#### **4.4 Store families**

##### **4.4.1 Solar water heater stores**

A series of solar water heater stores fulfilling the requirements in EN 12977-3 Annex E is considered as one store family - and same subtype.

##### **4.4.2 Solar combi stores**

Combi stores shall be certified individually. So far no family concept defined for stores related to EN 12977-4.

#### **4.5 Controller families**

Controllers with exactly the same control functions, sensors and actuators are considered as one controller family - and same subtype.

#### **4.6 Submission**

The inspector either takes with him the test samples and delivers them to the testing laboratory, or he marks them with a permanent mark (alternatively seals their packing) and instructs the manufacturer to deliver them to the testing laboratory.

#### **4.7 Changes in products – re-testing**

The Keymark licence is not valid if a keymarked product is changed/modified. However, depending on the modifications, it might not be necessary to carry out a complete new initial type test. In order to keep the license, the manufacturer shall supply the certification body with a revised “manufacturers application file” noting that the product is a modification of an already keymarked product (specifying exactly which one) and specifying exactly which modification(s) will be made. The certification body will then assess the necessity of re-tests/supplementary tests on the basis of table C.1 in Annex C of EN 12975-1 (collectors) and table A.3 in Annex A of EN 12976-1 (factory made systems) and taking into account decisions made at Solar Keymark Network meetings<sup>6</sup>. Depending on the degree of changes in the production process, the certification body will evaluate if a new initial inspection of the production line is needed. If the certification body approves the new tests (and inspection), the manufacturer may mark the modified product.

Note: The fees for the modified product are the same as for a new product, but some expenses for testing and inspection might be saved. The manufacturer may keep the license for the original product.

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<sup>6</sup> An updated list of decisions from the Solar Keymark Network meetings is available from the [www.solarkeymark.org](http://www.solarkeymark.org). Included here are decisions made on those specific collector and system sub-components which can be interchanged without retesting.

Note: If the changes are only changes in sub-components/materials a new initial inspection should not be necessary.

#### **4.7.1 Equivalent collector absorbers**

##### **4.7.1.1 Exchangeability of absorbers in flat plate collectors except absorber coating**

Flat plate collectors with modified absorbers can be generally considered as the same subtype (same collector family) just if 4, 5, 6, 7 and 8 of Table 1 (see below) are modified and if:

- 
- The power curves (for  $G = 1000 \text{ W/m}^2$ ) determined by an accredited test lab for the two collectors with different absorbers shall not differ by more than 2% of the peak power at a temperature difference of 0 K and not more than 2% of the peak power at a temperature difference of 50 K. Peak power is the module power at temperature difference at 0 K. The principle is illustrated in figure 1.
- In the case of a modification of header pipes (clause 7 in Table 1) the exception described in remark 1 shall be taken into account.
- In the case of a modification of the nominal distance between absorber pipes (clause 8 in Table 1) the exception described in remark 2 shall be taken into account.

Collectors with equal absorbers according to the requirements above can just be sold as the same subtype for 1 year.

If the requirement above is not fulfilled or if the collectors with unequal absorbers should be sold in parallel for more than 1 year, separate certificates shall be issued.

It is recommended to do the performance measurement as a comparative measurement of a collector as originally certified and a collector with the modified absorber.

In the case of existing collector families (e.g. different length and height) the smallest and biggest size need to be taken into account. If the requirement above is not fulfilled for every tested size, separate certificates shall be issued.

If there are different interpretations possible within a certification procedure, the certification bodies have to ensure a harmonized certification decision according to the Solar KEYMARK Network Internal Regulations, clause 5.

**Rules for testing**

	Shall be tested according to 12975-2 on “new” absorber design							
	6. Thermal performance	Determination of the effective thermal capacity and time constant	5.2 Internal pressure tests for absorbers	5.3 High-temperature resistance test	5.4 Exposure test	5.6 Internal thermal shock test	5.7 Rain penetration test	5.11 Final inspection
1. Material of absorber sheet	X	X		X	X	X		X
2. Material of pipes	X	X	X	X	X	X		X
3. Design of absorber plate								
a. Absorber fins to full plate absorber	X	X		X	X	X		X
b. Full plate absorber to absorber fins	X	X		X	X	X		X
4. Nominal thickness of absorber sheet	X	X				X		X
5. Type of connection of absorber sheet and absorber pipes	X		X	X	X	X		X
6. Absorber pipes (nominal diameters, nominal thickness)	X	X	X	X	X	X		X
7. Header pipes (nominal diameters, nominal thickness)	X <sup>1</sup>	X	X	X	X	X	X	X
8. Nominal distance between absorber pipes	X <sup>2</sup>	X <sup>2</sup>	X <sup>2</sup>					

**Table 1: List of changes on absorbers of flat plate collector except coating**

- 1 If diameter is changed for “one step” no additional performance test is necessary. “One step” means changes from one listed outer diameter to the next listed larger or smaller outer diameter. The listed diameters are:

12 mm	15 mm	18 mm	22 mm	28 mm	32 mm
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- 2 Retesting is required if the nominal spacing between adjacent absorber pipes is changed by more than  $\pm 5\%$ .

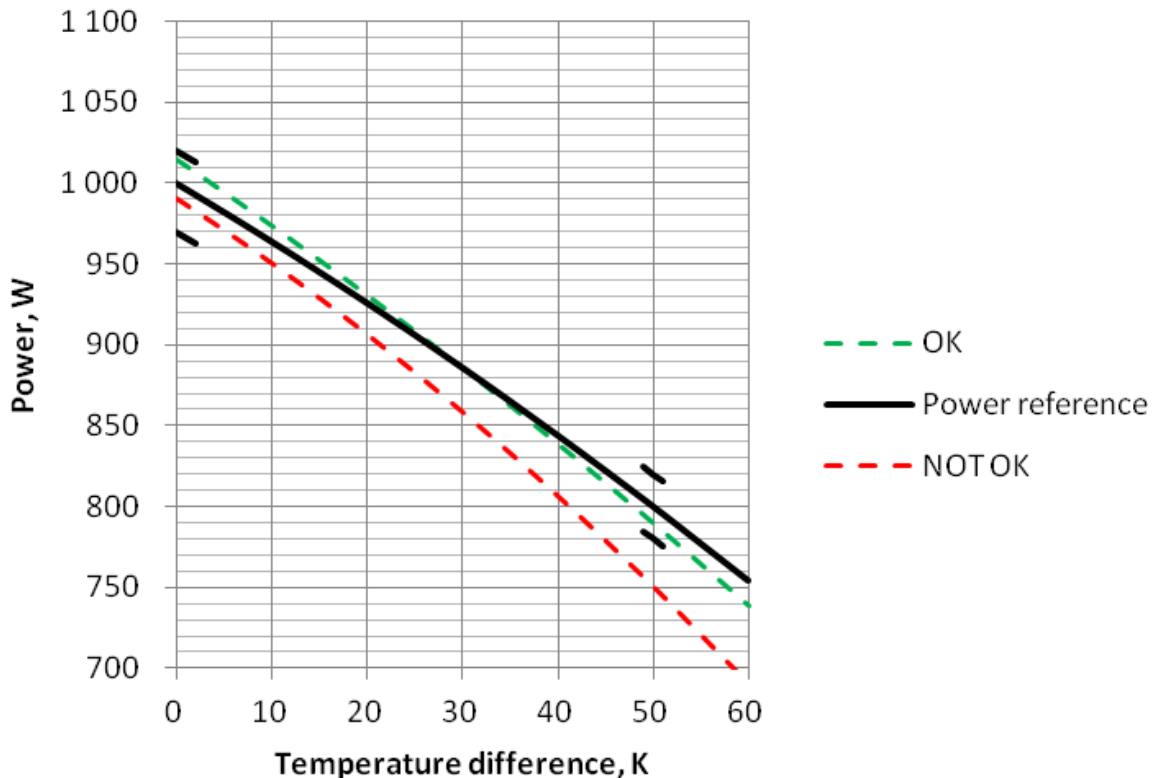
**Limitations and remarks**

- Just absorbers made of copper or aluminium are covered.
- The certification of upright and horizontal format is not covered.
- The proposal shows possible modifications where an agreement was found, other possible modifications are not covered.
- Each not listed modification need to be checked with test labs and certification bodies.
- Flat plate collectors with absorbers with different flow schemes (U-harp, Z-harp and meander) cannot be considered in one collector family. Testing shall be done according EN 12975-1 Annex C.
- If more than one modification is intended (after some time or at new certification process) always the combination of listed tests according to Table 1 is needed.
- The measurement of pressure drop is not included, because of informative status in EN 12975:2006
- The measurement of the IAM needs not to be done.
- All tests need to be done successfully by a Solar KEYMARK recognized test lab and reported in test reports.
- For custom built collectors it is essential to use different sizes of header pipes within a collector (clause 7 of Table 1). For this kind of collector this clause is not relevant.

The measurement of the stagnation temperature is necessary in combination with the High-temperature resistance test.



## Power curve and error band



*Fig.1. Illustration of the principle given in point 3: The power curve for the collector with the coating in question shall be within the 2 % peak MAX and MIN marks indicated at 0 and 50 K. In the case shown here with a module peak power of 1 000 W, the MAX (MIN) points are 20 W bigger (smaller) than the corresponding reference power curve (black curve). The green dotted curve illustrate a power curve fulfilling the requirement; the red dotted curve illustrates a power curve NOT fulfilling the requirement (because of a too low value at 50 K).*

### 4.7.1.2 Procedure for considering selective absorber coatings as equivalent

Different coatings are considered as equivalent provided that

1. They are applied on the same substrate (e.g. copper, aluminium)
- and
2. The specific test procedures described below have been passed successfully
- and
3. The equality is accepted by the Solar Keymark Network

#### Procedure

If a coating is to be considered equivalent to other coatings then the following tests shall be passed and requirements shall be fulfilled:

1. Two identical collectors (apart from the absorber coating) are compared to verify the equality of the two coatings. The absorbers of the two collectors must be made of the same material and must have the same thickness. One of the collectors is coated with one of the reference coatings fulfilling the following requirements:  $\alpha \geq$  mean value of  $\alpha$  values in the group - 1 % point;  $\epsilon \leq$  mean value of  $\epsilon$  values in the group + 1 % point. The mean value shall be given and updated each time a new member is included. The other collector is coated with the new coating.
2. The durability and reliability tests according to EN 12975-2 (being relevant with regard to the absorber, thus 5.3 High Temperature Resistance, 5.4 Exposure and 5.6 Internal Shock) for the collector with the new coating performed by an EN12975 accredited test lab are successfully passed.
3. The power curves (for  $G = 1000 \text{ W/m}^2$ ) determined by an accredited test lab for the two collectors with different coatings shall not differ by more than 2% of the peak power at a temperature difference of 0 K and not more than 2% of the peak power at a temperature difference of 50 K. Peak power is the module power at temperature difference at 0 K. The principle is illustrated in figure 1 in previous section.
4. The absorptance and emittance of the different coatings under question shall have - according to the specifications of the manufacturer - equivalent optical properties ( $\alpha_1 = \alpha_2 \pm 1\%$  point at most,  $\epsilon_1 = \epsilon_2 \pm 1\%$  point at most) and the same range of the production variability, e.g.  $0.95 \pm 2\%$  points.
5. For selective absorber coatings on metal, a IEA SHC Task X test shall be performed successfully
6. The interchange ability is accepted by the Solar Keymark Network

The equivalency of the absorber coating can be challenged anytime. In this case the absorber has to be sampled by an accredited third party or by the test lab. The costs for the whole procedure are fully carried by the challenger. Upon presentation of tests that suggest none-equivalency of an absorber coating, the SKN is obliged to request the re-evaluation of a absorber coating the latest until the forthcoming SKN meeting. The absorber has to be sampled by a third party.

**NB.** Updated rules and procedures for exchanges of absorber coatings and updated list of absorber coatings which can be exchanged are found in latest version of SKN\_N0137, public available from [www.solarkeymark.org](http://www.solarkeymark.org).  
*SKN resolution R1.M13.*

#### **4.7.2 Equivalent collector glazing**

Note: This procedure applies for thermally toughened safety flat glass only. For all other types of glass, no equivalences can be defined at present, due to a lack of experience

Collector glazing can be considered as equivalent if the following requirements are fulfilled:

1. If material, texture, surface treatment and thickness of the glass remain unchanged,
  - a. the solar transmittance (AM 1.5) shall be measured and documented for both types of glazing. The solar transmittance (AM 1.5) shall not differ by more than  $\pm 1$

percentage point from the one of the glass used for the initial Solar Keymark collector test. These measurements shall be not older than 2 years and shall be made by one of the Solar Keymark test labs or by labs accredited for transmittance measurements;

and

- b. if the impact resistance test according to EN12975-2, chapter 5.9 was performed during the initial test, the impact resistance test shall be passed successfully with equal or better result than in the initial test. The tests shall be carried out by a Solar Keymark test lab or at the manufacturing site by a test engineer from a Solar Keymark test lab.
2. If the glass is not identical like described in point 1 above the following additional test has to be done:
- a. If the thickness of glass is changed, mechanical load and rain penetration has to be tested.
  - b. If the thickness of glass is changed by less than 1 mm no transmittance measurement needs to be done, if no other characteristic of the glazing was changed and if the glass is of the same type and from the same glass manufacturer (e.g. Securit Albarino T from Saint Gobain).
  - c. If texture or surface treatment is changed, the collector performance test incl. IAM has to be done.

Remark: The new test results from collector testing (not glass only testing) have to be documented in an updated test report from accredited test lab according to EN 12975.

*SKN decision D2.M11.*

### **4.7.3 Collectors**

A collector in a Solar Keymark certified system can be changed under the following conditions:

- The original test report of the tested system configuration remains the reference for all kinds of modifications, even if a modification was accepted without retest. The procedure for an advice of amendment follows the four topics:
- The manufacturer informs the Certification Body about the planned change of collector type.
- The manufacturer delivers the test reports and Solar Keymark data sheets of both collectors and the system to the Certification Body.
- Both the Certification Body and the test lab which has issued the system test report have to approve the system modification.

A negative decision can also be based on technical consideration out of the following few requirements.

Minimum requirements on the collector:

- The alternative collector is Solar Keymark certified.

- The original collector must be performance tested according to EN 12975
- The test reports of both collectors and the system are available to the Certification Body
- The change of the collector does not cause a change of the system configuration e.g. piping, inlet connections, controller, pump etc.
- Both collectors have to be “technical identical”

Definition of “technical identical” Collector” (Data based on test report)

- Tolerance of gross area  $\pm 10 \%$
- IAM ( $50^\circ$ )  $\pm 3 \%$
- The pressure drop shall not differ by more than  $\pm 10 \%$  for the nominal flow rate as stated by the manufacture
- Total performance of the collector at  $1000 \text{ W/m}^2$ :
- Integral from 0 to  $100 \text{ }^\circ\text{C}$ , tolerance of 0 to  $10 \%$  (new collector being better than original)
- $W_{\text{peak}} \pm 10 \%$ , (Peak Power [ $G = 1000 \text{ W/m}^2$ ] per collector unit)

No modifications allowed at:

- Hydraulic flow type
- Maximal operating pressure
- Permitted heat transfer fluid

Reporting

- The original test report of the tested system remains the reference for all kinds of modifications – cascading modifications are excluded. The original test report remains unchanged and valid. The use of alternative collectors is briefly reported as an addendum to the original test report.

*SKN decision D6.M7.*

## **5 Factory production control and initial inspection of manufacturing site**

With the initial inspection it is checked whether the manufacturing site fulfils the requirements stated in 4.1.3 in [1]:

“The manufacturer shall operate a quality system covering the production line of the product for which the licence to use the Keymark is granted and which should be based on the quality standards which are at least of the level of the EN ISO 9000 series of standards.

In granting the licence, the empowered certification body shall take into account the existence of any quality system certificate issued by a certification body that is accredited by a member of the European co-operation for Accreditation (EA).”

The quality management system shall cover the production line according to inspector's criteria. In the case of collectors the requirements are specified in Annex E.

The inspection procedure and checklist given in Annex A1 shall be used.

In case the manufacturer is ISO 9001 certified by a certifier accredited by a national accreditation body being a member of IAF (International Accreditation Forum) ([www.iaf.nu](http://www.iaf.nu)) a Solar Keymark factory inspection is only required every second year provided the ISO 9001 report is made available to the certifier.

Based on conclusions of previous audits, interim inspections can be requested by the certifier.

*SKN decision D12.M8 & R2.M13.*

## **6 Surveillance**

The general surveillance procedures are given in 4.1.4 of [1]:

“Periodic surveillance by the empowered certification body including testing of samples from the production line or from the market and surveillance of the manufacturer's quality system.”

and A.1.6.3 of [4]:

*“The factory inspections/assessments shall include the checking of the documentation of the related FPC at least once a year, as well as selecting samples for tests at least every second year ...”*

### **6.1 Complete re-testing**

A complete re-testing of solar thermal products is required if the initial date of Solar Keymark certification or the last complete re-testing was more than 10 years ago.

*Resolution R4.M15.*

### **6.2 Surveillance test**

The surveillance test is a detailed physical inspection of the product and a comparison with the specifications of the original type tested sample. The procedure for the detailed physical inspection given in Annex A2 shall be used. The surveillance test shall be done at least every second year. The test samples for surveillance testing are taken out of the current production or from the stock of the manufacturer. The inspector points out the test samples and records their serial numbers. See also section 4.1.

*SKN resolution R3.M13.*

### **6.3 Special test**

Complaints concerning the conformity of a certified product are handled according to [1] section 10.5 (Complaints) and section 7.4 (Appeal procedures).

In this connection a special test can be ordered through the certification body by anyone, if the fulfilment of the requirements of the certification program or the registered values of a certified product is doubted.

The special test is normally to be made as a type test and in agreement with the manufacturer by a second approved testing laboratory listed in paragraph 8. If only one or a few points of the certification program are challenged, the certification body decides after consulting the testing laboratory if the special test can be made as a partial or supplementary test.

If the tested product does not fulfil the requirements and/or does not comply with the registered values (see section 6.2.1), the legal person holding the Keymark licence of the product in question has to carry the costs of the special test.

If the tested product fulfils the requirements and complies with the registered values, the costs have to be carried by the party which questioned the fulfilment of the requirements or registered values and ordered the test through the certification body.

If the special test shows that the failure of the product to conform to the requirements and/or registered values is due to random manufacturing error or transport damage, the testing laboratory has to take a second sample. The result of this test is the obliging result for the special test.

The legal person holding the Keymark licence or a person authorised by the legal person holding the Keymark licence must have the opportunity to take part during the whole procedure of the special test. He must be informed of the results of the test without delay to have the chance to react directly.

If the special test states deviations from the requirements and/or the registered values, the certification body requires the legal person holding the Keymark licence to rectify the faults within a certain limited time which should not exceed one month, depending on the extent and manner of the fabrication. Thereafter the testing laboratory performs a new special test, the extent and manner being determined by the certification body consulting the testing laboratory.

### **6.3.1 Compliance with registered values**

- Collectors (EN 12975):
  - The integral of the measured instantaneous efficiency at the special test shall be more than 90% of the already registered integral in the interval of the reduced temperature from 0 – 0,1 K/(W/m<sup>2</sup>). The reduced temperature is defined in EN 12975-2, paragraph 6.1.4.8.3, and the instantaneous efficiency in 6.1.4.8.4.2.
- Systems (EN 12976):
  - Solar-plus-supplementary systems: The calculated  $Q_{aux,net}$  based on the special test shall be less than 110% of the originally calculated  $Q_{aux,net}$ .  $Q_{aux,net}$  is defined in EN 12976-2, paragraph 5.9.3.2. The calculations to be compared shall be based on the Würzburg climate data and the design load already given by the manufacturer (see: EN 12976-2, Annex B, table B.1).
  - Solar-only and solar preheat systems: The calculated  $f_{sol}$  based on the special test shall be more than 90% of the originally calculated  $f_{sol}$ .  $f_{sol}$  is defined in EN 12976-2, paragraph 5.9.3.3. The calculations to be compared shall be based on the Würzburg climate data and the design load already given by the manufacturer (see EN 12976-2 Annex B, table B.1).
- Systems (EN 12977-2):

- Solar-plus-supplementary systems: The calculated  $Q_{aux,net}$  based on the special test shall be less than 110% of the originally calculated  $Q_{aux,net}$ .  $Q_{aux,net}$  is defined in EN 12977-2, paragraph 7.7.4. The calculations to be compared shall be based on the Würzburg climate data and the design load already given by the manufacturer (see: EN 12977-2, Annex A, table A.1).
- Solar-only and solar preheat systems: The calculated  $f_{sol}$  based on the special test shall be more than 90% of the originally calculated  $f_{sol}$ .  $f_{sol}$  is defined in EN 12977-2, paragraph 7.7.5. The calculations to be compared shall be based on the Würzburg climate data and the design load already given by the manufacturer (see EN 12977-2 Annex A, table A.1).
- Large unique systems: The predicted yearly system gain according to EN 12977-2 Annex C §C.4.8 based on the special test shall be more than 85% of the originally calculated yearly system gain for the same reference conditions.
- Solar water heater stores (EN 12977-3):
  - Solar water heater stores (EN 12977-3):
    - Values of heat loss shall be within  $\pm 10\%$  of the original values.
    - Effective volume shall be within  $\pm 5\%$  of the original values.
    - Heat capacity shall be within  $\pm 5\%$  of the original values.
- Solar combistores (EN 12977-4):
  - Solar combistores (EN 12977-3):
    - Values of heat loss shall be within  $\pm 10\%$  of the original values.
    - Effective volume shall be within  $\pm 5\%$  of the original values.
    - Heat capacity shall be within  $\pm 5\%$  of the original values.
- Solar controllers (EN 12977-5):
  - Control equipment (EN 12977-5): The special test shall show no principle deviations in the functions of the controller and the accuracy of the sensors shall be within the required maximum deviation as specified in EN 12977-5, §7.

## 7 Supervised manufacturers testing

Procedures such as "supervised manufacturers' type testing" and/or "type testing at manufacturers' premises" are not included in these scheme rules.

Note: At the moment no manufacturer is doing the type testing itself. In the future it might be taken into consideration to specify the rules for such an option

## 8 List of bodies for the implementation of the scheme.

An updated list of empowered certification bodies and approved inspection bodies and testing laboratories is available at the Solar Keymark web site: [www.solarkeymark.org](http://www.solarkeymark.org).

## 9 Fees

By applying for the licence to use the Keymark, the manufacturer also agrees to meet:

1. the costs specified in [1]

2. the fees for the Solar Keymark Network specified in ANNEX C. These fees are not set and regulated by CEN but by the Solar Keymark network.

## 10 Additional requirements for obtaining the license

Some large solar collectors have to be CE-marked, further information at:

<http://www.solarkeymark.org>

## 11 Changing certification body

Procedures for changing the certification body

- It is possible for a manufacturer to move with an original certificate to another certification body without re-testing and re-inspection
- The certification body that issued the original certificate has to be informed by the certificate holder about the cancellation of the certificate
- A copy of the notification of cancellation by the former certification body has to be provided to the “new” certification body before issuing the new certificate
- The test report(s) and the inspection report(s) have to be provided to the “new” certification body
- The testing laboratory that issued the test reports has to be accepted by the “new” certification body before issuing the new certificate
- At least a new data sheet shall be issued stating the “new” certification body and registration number.
- Change of certification body and issuance of new certificate should be done within 3 months after the request.
- Original certificate shall be withdrawn when new one is issued
- These procedures apply to all OBL certificates linked to the original certificate

*SKN decision D1.M3.*

## 12 Solar Keymark certification of a system with a collector certified by another certification body

It is no required that a system and the components in the system are Keymark certified by the same certification body. In general a certifier has to perform Solar Keymark system certification based on collector Solar Keymark certificates issued by another certification body.

The manufacturer is obliged to inform the certification body certifying his system about any changes related to the certification of the collector used in the system - including if the collector certificate is cancelled<sup>7</sup>.

*SKN decision D4.M8.*

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<sup>7</sup> According to the existing rules the manufacturer is required to inform, in addition to the certifier of the collector, also the certifier of the system about any changes related to the collector. In order to be sure that the manufacturer informs the certifier of the system about a withdrawal of the certificate for the collector, it is recommended to state the obligation clearly in the contract between the certifier of the system and the manufacturer.



## 13 Clarifications on specific testing and certification issues

### 13.1 Solar Keymark certification of ICS systems

Solar Keymark certification of ICS systems is possible.  
*SKN decision D5.M3.*

### 13.2 Negative pressure test of the collector

“Negative pressure test of the collector” according to 5.9.2 EN 12975-2:2006 does not have to be performed on tubular collectors due to the following reason: The negative pressure test is intended to assess the extent to which the fixings between the collector cover and collector box are able to resist uplift forces caused by the wind. This is not relevant for tubular collectors.

There shall be a remark on the Solar Keymark certificate in case the negative pressure test was not performed as long as the pressure test is still mandatory according to the standard.  
*SKN decision D6.M3.*

### 13.3 Nominal store volume

The nominal store volume stated on the system identification label shall not differ by more than 10 % from the effective store volume determined from the measured thermal capacity. The calculation of the percentage of the difference between the two volumes is based on the value of the effective volume. The effective store volume shall be mentioned in the test report.

*SKN decision D2.M5.*

### 13.4 Hot water tapping times

#### Hot water tapping times

Following tapping times should be used for the performance prediction:

Table 1: Data of reference locations and adjusted tapping time.

Reference locations	Longitude <sup>1</sup>	Time zone	Adjustment of standard time	Tapping time (CET <sup>2</sup> )
Stockholm	18.07°	1	-0.20	17.80
Würzburg	9.90°	1	0.34	18.34
Davos	9.82°	1	0.35	18.35
Athens	23.70°	2	0.42	18.42

Note: Time given in Table 1 are decimal figures.

*SKN decision D5.M8.*

### 13.5 Pre-ageing of solar collector test samples

Before performing a rain penetration test the solar thermal product should be pre-aged to at least the following extent by using either possibility 1 or possibility 2:

- Possibility 1:
  - Expose the product at least for 15 valid days (according to the validity criteria of EN 12975, 5.4).
- Possibility 2:
  - Two stagnation tests using a solar simulator providing at least 850 W/m<sup>2</sup> and 10°C ambient temperature with a duration of irradiance of at least 4h. In between this two stagnation tests the collector has to reach approximately ambient temperature.

- Exposure to outdoor conditions for at least 15 days, not requiring any boundary conditions to be fulfilled.
- Two stagnation tests using a solar simulator providing at least 850 W/m<sup>2</sup> and 10°C ambient temperature with a duration of irradiance of at least 4h. In between this two stagnation tests the collector has to reach approximately ambient temperature.

*SKN Decision D8.M10.*

### **13.6 Solar Keymark Certification of PVT collectors**

Requirements for certification of PVT collectors are given in Annex J - Specific requirements for PVT collector Certification.

Note: PVT collectors are Photo Voltaic / Thermal collectors. PVT collectors (named hybrid collectors in ISO 9806) can generate heat and electric power at the same time.

*SKN Resolution R3.M19 Adding Annex J about PVT certification to the SK specific scheme rules*

### **13.7 Calculation of “Collector Annual Output” (CAO)**

The calculation of the “Collector Annual Output” (CAO) shall be done by latest version of the SCEnOCalc software (SCEnOCalc is available from the Solar Keymark website). Results shall be presented as shown in Annex B1 of the Solar Keymark Scheme rules (collector data sheet).

*SKN resolution R4.M14*

For the calculation of thermal power output for solar air heating collectors (SAHC) it is essential to choose a specific mass flow rate, as the performance indicators vary strongly with it. To compare different SAHCs based on the results presented in the SKN Data Sheet, such an "evaluation point" has to be found in a fair and defined manner.

For that purpose the excel tool AirCow has to be used in order to choose this specific mass flow rate or evaluation point from the test results generated according to EN ISO 9806.

Note: The tool cannot find this point for open-to-ambient SAHC, as they cannot be handled with an efficiency curve yet

*SKN Resolution M19.R2*

### **13.8 Procedures for ScenoCalc revision**

Each new version of ScenoCalc shall be approved by the SKN before it becomes official. As a basis for this approval a document describing the major changes compared to previous approved versions as well as the validation performed with the latest version shall be provided.

*SKN resolution M16.R1*

### **13.9 Determination of gross area for roof integrated collectors**

For the determination of the gross area of roof integrated collectors the part of the roof covered by the roof mounting kit surrounding the collector to prevent the ingress of water into the roof (cladding) shall not be taken into account.

*SKN resolution M17.R2*

### **13.10 All original test reports must be submitted to certification body**

All original test reports contributing to a certain certificate must be submitted to the certification body for certification

*SKN resolution M19.R10*

## **14 Labels and logo**

### **14.1 Display of Solar Keymark licence number on collector**

#### **Display of Solar Keymark licence number on collector**

For new Solar Keymark certificates issued from 01. May 2010 on-wards it is only allowed to display the Solar Keymark logo on the collector together with the Solar Keymark licence number.

For Solar Keymark certificates issued before 01. May 2010 it is required to display the Solar Keymark licence number together with the Solar Keymark logo (in case the logo is displayed) from 01.May 2011 onwards on the collectors.

*SKN decision D7.M8.*

### **14.2 Labelling of systems**

The requirement stated in EN 12976-1:2006, clause 4.7 “Every system shall have the following information durably marked on a plate or label to be visible at installation” can be considered as fulfilled if:

- the label is included in the documentation supplied with the system
- and
- in the documentation it is stated that the label (or corresponding page of the documentation with the label) has to be placed at the systems or the site where the system is installed
- and
- an appropriate way for providing a durable fixing and display of the label is provided

The requirement mentioned above is relevant for the system label required according to EN 12976-1:2006, clause 4.7 and for the Solar Keymark system label.

*SKN decision D3.M9.*

## **15 Others**

### **15.1 Mandatory identification of the manufacture**

For collectors as the name of the manufacturer also the name of the supplier of the collector can be mentioned.

*SKN decision D10.M7.*

### **15.2 Translation of Solar Keymark documents**

Certification bodies or test institutes can translate documents such as e.g. factory inspection reports or data sheets in other languages provided that always the original English text remain in the document.

This means that the preparation of a document using any language and English is possible. In case of doubts, contradictions etc. the English text is the relevant one.

*SKN decision D11.M7.*

## 16 Updating Solar Keymark scheme rules

The Solar Keymark scheme rules should be updated once every year taking into account the decisions made in the meantime. Since the decisions are already agreed on by the Solar Keymark Network, no extra voting on the accordingly updated Solar Keymark scheme rules is required.

*SKN decision D1.M9.*

## 17 Updating Solar Keymark database

The certification bodies shall inform the Solar Keymark manager every two weeks about the Solar Keymark certificates issued and withdrawn for updating the Solar Keymark database every two weeks.

*SKN decision D4.M9.*

## 18 References

- [1] CEN/CENELEC INTERNAL REGULATIONS – Part 4: Certification – 2014
- [2] EN ISO/IEC 17025, General requirements for the competence of testing and calibration laboratories
- [3] EN 45011, General criteria for certification bodies operating product certification

*How to get the references:*

*[1] is available from CEN:*

<http://boss.cen.eu/reference%20material/RefDocs/Pages/default.aspx>

*[2] and [3] and the referenced standards (see section 1.2) are available from the national standardisation bodies.*

## 19 List of Annexes

*Annexes to the Solar Keymark Specific Scheme Rules are available from:*

[www.solarkeymark.org](http://www.solarkeymark.org)

Unless otherwise specified, the annexes are normative.

**Annex A1:** Harmonised factory inspection procedure & check list

**Annex A1b:** Alternative inspection report

**Annex A2:** Solar Keymark surveillance test

**Annex A3:** Parts list, drawings and specifications, Solar Keymark Collectors

**Annex A4:** Parts list, drawings and specifications, Solar Keymark Systems

**Annex B1:** Example of collector data sheet

**Annex B2:** Example of system datasheet

**Annex C:** Solar Keymark Fees

**Annex D:** System families - requirements and extrapolation procedures

**Annex E:** Factory production control

**Annex F:** Requirements for freeze resistance test of evacuated tube collectors with heat pipes following EN 12975:2006

**Annex G:** Solar KEYMARK certificates and sub-licenses for other brands, product names, and sellers

**Annex H:** Transition from EN 12975-2 to EN ISO 9806 (testing) (from 2014-01-10)

**Annex I:** Complaints - Related to Solar KEYMARK Testing Laboratories and Inspectors

**Annex J:** Specific requirements for PVT collector Certification