

ANNEX WP1.A: Minutes concerning WP1.A Solar Collectors

The 4th Solar Keymark meeting in Rome, October 24-26, 2002

Minutes taken by Åsa Wahlström SP (AAW).

Implementation of test procedures and update of time schedule

To label solar collectors with the Solar Keymark test must have been performed according to EN12975-1, paragraph 5.2 *Required tests a)-j*).

- Five laboratories are accredited for all tests
- Six laboratories are planning to get accreditation during the project time or by the end of 2003.
- CSTB will be accredited only for test h) *Thermal performance* and TNO for several selected tests. Additional tests must be performed at another laboratory.
- Four laboratories will exclude test i) *Freeze resistance* test. This test is, however, only for collectors that are claiming to be freeze-resistant. The laboratories therefore can offer complete tests for Solar Keymark for all other collectors while collectors that are claiming that they are freeze resistant must do test i) at another laboratory.
- All laboratories have already implemented the planned test except TNO and INTA. They will start to implement the tests in beginning of 2003.
- Laboratories are allowed to perform tests for Keymark labelling as soon as the tests are implemented (according to the Scheme rules) until end of 2003. After that they must be accredited.

The implementation and accreditation plans are shown in Table WP1.A.1 and Figure WP1.A.1.

Table WP1.A.1 Implementation and accreditation of test procedure. EN12975-1, 2 Solar Collectors

Laboratory	Accreditation	Tests planning for accreditation stated in EN 12975-1 § 5.2 a) – j)
Arsenal (Austria)	Ready	All
CSTB (France)	2003-03-01	h) Thermal performance
Demokritos (Greece)	Ready	Excluded test: i) Freeze resistance
DTI (Denmark)	2002-12-31	Excluded tests: i) Freeze resistance
ENEA (Italy)	2003-03-01	All
INETI (Portugal)	2003-03-01	Excluded test: i) Freeze resistance
INTA (Spain)	Implementation ready: 2003-05-01 Accreditation 2003-12-31	All
ITW (Germany)	2002-12-31	All
ITC (Spain)	Thermal performance accreditation ready. Reliability tests accreditation 2003-03-01	Excluded tests: i) Freeze resistance
IZES (Germany)	Ready	All
SP (Sweden)	Ready	All
SPF (Switzerland)	Ready	All
TNO (The Netherlands)	Implementation ready: 2003-03-01 Accreditation 2003-12-31	b), c), d), e), f), g) and j)

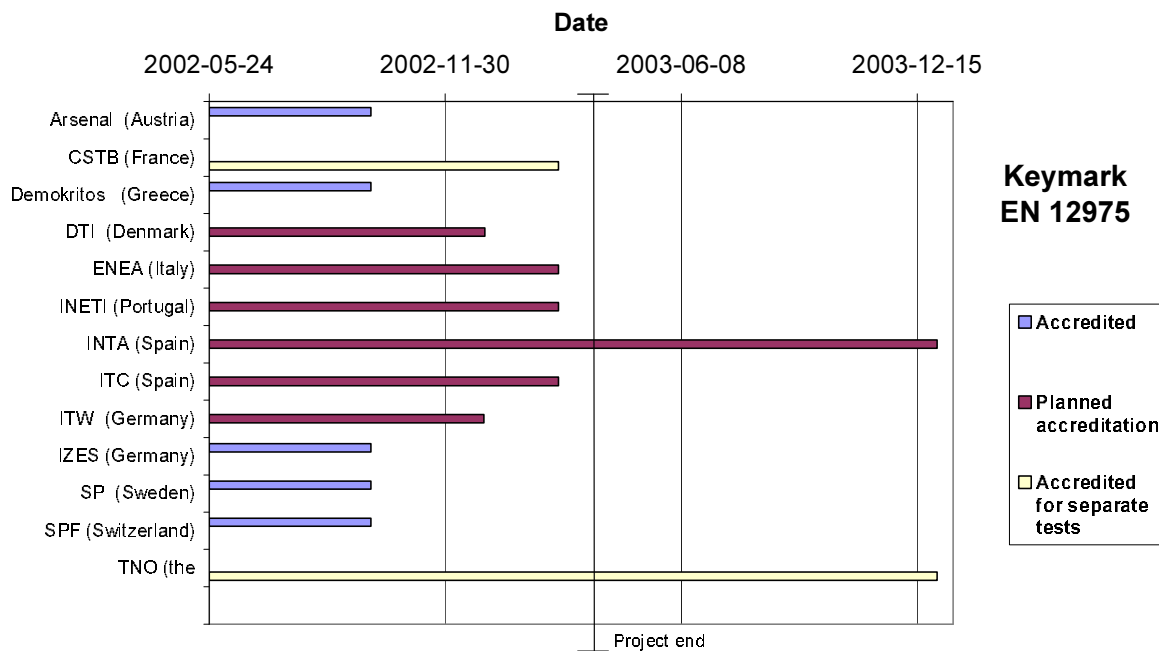


Figure WP1.A.1 Accreditation of test procedure according to EN12975-1, Solar Collectors

Inter-comparison of test results

Benchmark test for parameter identification for QDT

Peter Kovacs presented the updated version of the inter-comparison of parameter identification from a set of measurement data. The purpose with the benchmark is to compare if measurement values collected during a QDT test will be evaluated in the same way at different laboratories. In total seven laboratories took part in the comparison.

It was discussed that the results are not really satisfying since the efficiency curve will not be the same for all laboratories. One conclusion is that odd measurement points will not be excluded if there is no explanation of why they have appeared. Another is that it is very difficult to follow the standard

Action: **Peter Kovacs** will investigate this further by more questions to the participants and come up with a suggestion on how to structure the standard better, in order to give guidance of how to make a better selection of data points. The final version of the report will be ready at February 15, 2003. He will also write an article about the investigation for the ISES conference in Gothenburg 2003.

Round Robin

Pierre Richard pointed out that there are requirements that a properly round robin should be performed.

Harald Drueck informed that it will be a German Round Robin on glazed collectors. The Round Robin will be running during 2003 between 3-4 Germany laboratories. After that it will probably be possible for laboratories in other countries to also participate. They will be invited to participate in 2004. Only thermal performance test will be performed, either SS or QDT.

Peter Kovacs informed that SP and DTI have made a NordTest application for a Round Robin. Seven laboratories have already declared their interest in participating. The aim is that SP will start to test one vacuum collector and DTI an ordinary collector.

A discussion started if it is possible to combine these Round Robins but it was concluded that this is not possible due to the financial premises.

Comparison of SS with QDT

SP will do some comparison between SS and QDT and AAW informed that the measurements are ready but not the evaluation. Hopefully it will be ready for the Portugal meeting. Hubert Fechner informed that the situation for the Arsenal comparison is the same.

Lessons learned and Comments on the EN12975-1&2

The follow up of the Vienna comments together with some new comments and the Solar Keymark input to WG1 were discussed. Below are the comments that were brought up for discussion with decisions for actions:

Follow up on discussions of the Vienna meeting

Calibrating pyranometers

AAW informed that SP is accredited to calibrate pyranometers and SP states the uncertainty in the calibration certificate. A discussion started that several other laboratories are also accredited for calibrating pyranometers and gives uncertainty calculations e.g. Davos.

Mechanical load test

Problem 1: Is the maximum pressure level too low?

Problem 2: The information about required maximum load pressure is confusing within the different standards EN 12975-1 (5.3.8) and EN 12975-2 (5.9.1.3; 5.9.2.3; 5.9.3.3). Is the maximum load pressure decided to be at least 1000 Pa or can it be lower/higher due to specifications by manufacturers, to suit particular climate conditions or to individual country's safety requirements?

Pierre Richard presented some calculations about how high the pressure should be in the mechanical load test according to French regulations and the "Eurocode". His notes is added in Annex WP1.A.A

- "Notes: Mechanical load and French regulations" by Pierre Richard

Based on Pierre's examples a discussion started if required maximum load pressure should be increased. It was agreed that, if the solar collector should be exposed for particular conditions (e.g. high wind pressure or snow load conditions), it could need testing at higher load pressures. However, this is possible within the standards due to that the manufacturer may specify the load pressure and national requirements are prevailing.

Action 1: It was decided that it should be recommended in the "Solar Keymark input to WG1" that the WG1 work group should investigate if it is possible to harmonize the standard with the "Eurocode" or to further specify when a higher maximum load pressure is needed. In the meanwhile 1000 Pa is kept.

Action 2: It was decided that it should be recommended in the "Solar Keymark input to WG1" that the standard should be clarified: the maximum load pressure shall be at least 1000 Pa for all mechanical load tests and that the text should be equal in all paragraphs 5.9.1.3, 5.9.2.3 and 5.9.3.3 and in consentience with 5.3.8. It should clearly be stated that the manufacturer or national requirements might increase the load pressure above 1000 Pa due to e.g. particular climate conditions.

Uncertainty of test results

Problem: A procedure of deciding the uncertainty of the end result of the testing is missing in the standard.

Discussion: Kostas Voropoulos and Emmanouil Mathioulakis informed that NCSR and ITR in Greece are using a procedure for calculating the uncertainty.

Stephan Fischer informed that he and Ueli Frei have made some internal exchange of data and uncertainty calculations that could be passed around.

Sharma Vinood and Giacobbe Braccio informed that there is a new published paper about uncertainty calculations. The paper is supplied and attached in Annex WP1A.B

- “Efficiency test of solar collectors: uncertainty in the estimation of regression parameters and sensitivity analysis” by V. Sabatelli, D. Marano, G. Braccio and V.K. Sharma, *Energy Conversion & Management*, Vol 43, pp 2287-2295, 2002.

Action: **Kostas Voropoulos** and **Emmanouil Mathioulakis** will write a proposal for a procedure of how to calculate the uncertainty until the Portugal meeting. The proposal will be based on the two incoming papers of uncertainty calculation that can be found in Annex WP1.A.D of the Vienna notes and the new paper in Annex WP1A.B.

The procedure can be included as an informal Annex either be include it directly in the Scheme rules or by a suggestion to WG1 for revising the standard. Maybe it can be helped with a common excel spreadsheet.

Clause 6.3.5.2

Hubert Fechner will work on that until the Portugal meeting.

Clause 6.1.5.2

The problems were postponed since Christian Müller-Schöll is no longer working at SPF.

Inconsistence between 12975-1 and 12975-2

Problem: Inconsistence between 12975-1 and 12975-2. Some requirements are subjective since description of test methods are missing. For example the requirement of “no sharp edges” has no test method.

AAW informed that “no sharp edges” is the only requirement that she can find that has no test method. She also informed that Hoang Liauw has checked with TC if it is a formal problem that the EN 12975-1 has requirements that have no method for testing in EN 12975-2. His answer is: “ There is no rule that a requirement in an European Standard should always refer to a test method in another accompanying European standard. It may well refer to an ISO or other reference document.”

Action: It was concluded that is not difficult to identify “ sharp edges” and the problem need no further actions.

New Additional Comments

Comment: Annex A and D in 12975-1

Problem and discussion: Annex A is informative information on conformity assessment. However, these things will be dealt with in the Solar Keymark Scheme Rules and will be confusing here. Better to refer to the Solar Keymark Scheme Rules. Annex D is informative information about tests to be repeated in collector design modification. The recommendation seems to be very weak since the Annex is both informative and test repetition is recommended to be considered.

Action: It was decided that it should be recommended in the “Solar Keymark input to WG1” that Annex A is deleted in the standard and Annex D is kept as informative with change of reference to Annex A.4. Change also in Table that (+) means, “Test should be repeated” and (–) means, “Test need not be repeated”.

Comment: 5.10 Impact resistance test

Problem: The impact test includes a non-realistic test. Although it is an optional test, this does give confusion on the market in practice. Also, in practice there was never reason to doubt the impact resistance of collectors.

Discussion: It would be better to delete this clause in the standard.

Action: It was decided that it should be recommended in the “Solar Keymark input to WG1” that the 5.10 clause should be deleted in the standard

Comment: Exposure test

Problem: It would be favourable to have a complete indoor version of the exposure test or to let it be possible to run this test in parallel.

Discussion: It was agreed that it really would be favourable if it were possible to run the exposure test indoors. However, a procedure of how to perform the method must be worked out. This cost both time and money. Amelie Veenstra said that she would like to develop the test procedure but she has no economical possibilities to do that. It was pointed out that an indoor test would decrease the costs for testing and it would therefore be beneficial for the manufacturers in all countries if such a method were developed.

Action: **AV** will do a preliminary investigation on procedures for an indoor exposure test. **AAW** will write to ESTIF (done 7/1 2003) to inform them about the issue and that it might be necessary to find some support in order to get a fully developed procedure that can be used in practice.

Comment: Editorial of Formulas and texts on page 37

Action: It was decided that it should be recommended in the “Solar Keymark input to WG1” that

- the sentence in 6.1.4.8.2 immediately before Equation 4 should be changed to “The solar energy intercepted is AG where the area is A_A when referred to the absorber area of the collector and A_a when referred to the aperture area of the collector, and the collector efficiency is”
- the Equations (8) and (10) should be deleted since they are repetitions of Equations (4) and (6).
- the last sentence in 6.1.4.8.4.1 should be moved to Clause 6.1.4.3 (“Where diffuse solar irradiance is less than 30 %, its influence may be neglected. The collector shall not be tested at diffuse irradiance level of greater than 30 %.”).

Comment: Editorial of Formulas and texts on page 68

Action: It was decided that it should be recommended in the “Solar Keymark input to WG1” that the following sentence should be added directly after Equation (34) in Clause 6.3.4.8.2

- “where the area is A_A when referred to the absorber area of the collector and A_a when referred to the aperture area of the collector (see Annex M)”

Comment: Editorial of text in Clause 6.3.4.3

Action: It was decided that it should be recommended in the “Solar Keymark input to WG1” that the sentence in the middle of the page is changed to

-“ The average value of the surrounding air speed, taking into account spatial variations over the collector and temporal variations during the test period, shall be greater than 1 m/s and less than 4 m/s ($1 < \text{Average surrounding air speed} < 4$).”

Comment: Tilt angel of the collector

Problem: The tilt angel of the collector should be mounted in 45° according to clause 6.1.1.3. This will make comparison of measurements at different laboratories difficult since the incident angel will vary with the latitude.

Action: It was decided that it should be recommended in the “Solar Keymark input to WG1” that the same specifications as in Clause 6.1.4.3 should be added in the beginning of 6.1.1.3. The first two sentences on page 35: “ The angel of incidence of direct solar radiation at the collector aperture shall be in the range in which the incident angle modifier for the collector varies by no more than 2 % from its value at normal incidence. For single glazed flat plate collectors, this condition will usually be satisfied if the angle of incident of direct solar radiation at the collector aperture is less than 20° .” Thereafter, should the word “shall” be changed to “should” in the first sentence in 6.1.1.3. (“the collector should be mounted such ...”)

Comments to the “Solar Keymark input to WG1”

Comment 3: Specify properties of coating

Action: Add that also the brand name of the coating should be specified.

Comment 11: Maximum T_m^* values

Action: Recommend that this issue should be further discussed in WG1.

Comment 18: Rain penetration test, -measuring of condensation level

Action: AAW will clarify in the suggestion that

- the drying of the collector before the rain penetration test must continue until the collector is dry and can be far more than 30 minutes
- the inspection of the condensation level should be done after a short time (not immediately) in case of that the collector has good ventilation qualifications that will prevent accumulation of humidity inside the collector. However, the collector should not have time to make any temperature changes before inspection.

ANNEX WP1A.A:

Notes: Mechanical load and French regulations

ANNEX WP1.A.B:

Efficiency test of solar collectors: uncertainty in the estimation of regression parameters and sensitivity analysis