Annex P1 Collectors EN 12975 General

SKN_0863R0 / Edition 2025-12-10

solarkeymark.eu

Table of Contents

1. Abbreviations

The definitions in the Solar Keymark Scheme Rules apply.

2. Specific sampling requirements

2.1 From serial production

A series production is assumed 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.

2.2 From stock

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.

2.3 Prototype testing

If for any reason the described standard sampling procedures are not applicable and prototypes must be submitted for testing, the CB has to decide on appropriate sampling procedures. In this case a factory inspection is required after the sampling and within 6 months after the issue of the certificate to verify the conformity of the sampled product with the planned serial production.

3. Compliance criteria for performance

3.1 General

To compare the thermal performance of two collectors in the framework of the Solar Keymark the principles and figures given in this chapter shall be used.

3.2 Thermal performance

Thermal performance parameters shall be compared based on Σ which corresponds to the area under the measured power curve per m² gross area, i.e. for a collector A:

$$\Sigma_A\left(\Delta\vartheta_{m,\max}\right)=\frac{1}{A_{G_A}}\int_0^{\Delta\vartheta_{m,\max}}\left[\dot{Q}_{BlueSky,SRC,A}\left(\Delta\vartheta_{\mathrm{m}}\right)\right]_{pos}d\Delta\vartheta_{\mathrm{m}}$$

Where $\dot{Q}_{BlueSky,SRC,A}(\Delta\vartheta_m)$ is the thermal performance under Blue Sky Standard reporting conditions for collector A. The subscript “pos” indicates that only positive values shall be taken into account. Negative values shall be coerced to 0.

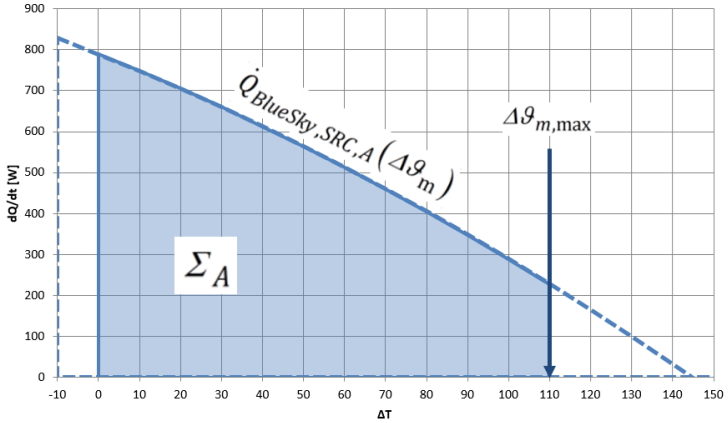

Figure 1: Definition of Σ corresponding to the area under the measured power curve per m² gross area

The thermal performance curve of two collectors shall be compared using $\sum_A(\Delta\vartheta_{m,max})$ and $\sum_B(\Delta\vartheta_{m,max})$. Care must be taken to select properly the maximum temperature difference $\Delta\vartheta_{m,max}$. Per definition all thermal performance parameters are valid up to the maximum temperature difference where measured data points are available plus 30°K (see clause 23.3 of

ISO 9806:2025). Comparisons of two collector is therefore only possible up to $\Delta\vartheta_{m,max}$ that is valid for both collectors, i.e. $\Delta\vartheta_{m,max} = min(\Delta\vartheta_{m,max}(ColA), \Delta\vartheta_{m,max}(ColB))$.

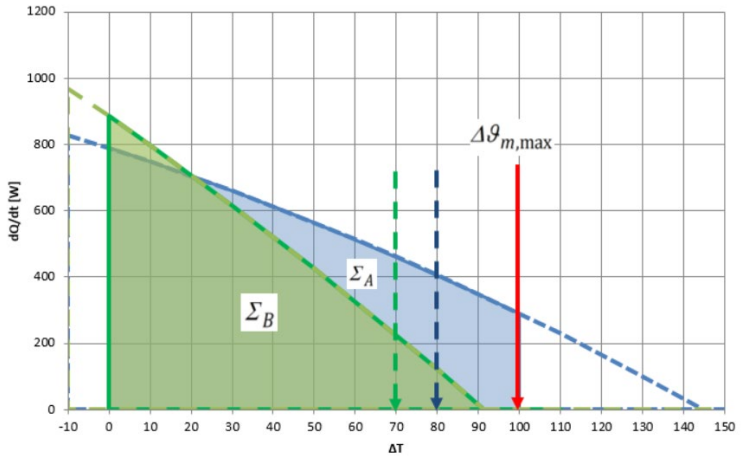

Figure 2: Comparison of thermal performance of two collectors

In the example of Figure 2, Collector A (blue) was measured up to a $\Delta\vartheta_m(ColA) = 80K$ which would allow to extrapolate up to 110 K. Collector B (green) was measured only up to $\Delta\vartheta_m(ColA) = 70K$ allowing the extrapolation up to 100K. The comparison of the two collectors is therefore only allowed up to $\Delta\vartheta_{m,max} = 100K$ and of course a certificate including the two collectors can be valid only up to 100K only.

In addition, the power output $\dot{Q}$ of the two collectors under Blue Sky SRC shall not differ by more than 2% of the peak power and not more than 2% of power at a temperature difference of $\Delta\vartheta_{m,max}/2$ and not more than 5% at $\Delta\vartheta_{m,max}$.

If not defined differently, the thermal performance of a collector B is then considered the same if

$$\left|\frac{\Sigma_A\left(\Delta\vartheta_{m,\max}\right) - \Sigma_B\left(\Delta\vartheta_{m,\max}\right)}{\Sigma_A\left(\Delta\vartheta_{m,\max}\right)}\right| \leq 0.1$$

3.3 Incidence angle modifier

The incidence angle modifier is compared based on the tabulated values indicated in the test report (ISO 9806, Annex A) and on the deviation parameter δ: Collector B is considered the same as Collector A with respect to IAM, if for all angles (L and T) from 10° to 80° the IAM of Collector B is within the limits of Collector A defined by formula

$$IAM\left(ColB(\theta)\right) \in IAM\left(ColA(\theta)\right) \pm \frac{\delta}{(90-\theta)} \quad \text{for the standard value } \delta = 0.8$$

A deviation parameter $\delta = 0.8$ results in a “tolerance” of ±2% at $\theta = 50°$

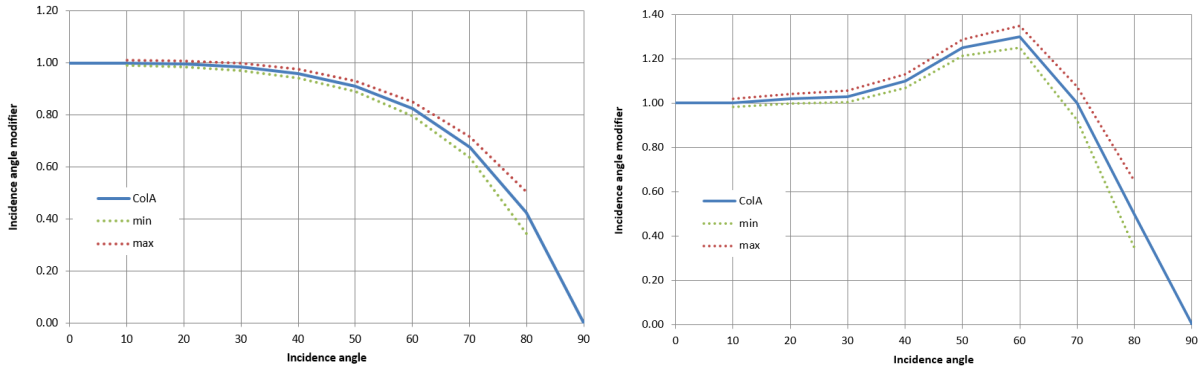

Figure 3: Example of incidence angle modifier variations of $\delta = 0.8$ (left side) and $\delta = 1.5$ (right side)

3.4 Annual energy output

To compare the annual thermal output of collector A and collector B, the annual output data from the ScenoCalc (Collector data sheet) shall be used. The annual energy output is considered as equal if the results computed for all 4 locations at 25° are within less than ±2.5% and at 50° within less than ±5.0% and at 75° within less than ±7.5%.

	Athens			Davos			Stockholm			Würzburg		
	25°C	**50°C**	**75°C**	**25°C**	**50°C**	**75°C**	**25°C**	**50°C**	**75°C**	**25°C**	**50°C**	**75°C**
ColA	2'975	2'078	1'342	2'234	1'522	953	1'640	1'053	632	1'794	1'142	675
ColB	3’035	2’203	1’221	2'237	1'533	961	1'639	1'060	638	1'783	1'141	677
%	2.02	6.02	9.02	0.13	0.72	0.84	-0.06	0.66	0.95	-0.61	-0.09	0.30
	OK	X	X	OK	OK	OK	OK	OK	OK	OK	OK	OK

In this case the annual output criteria not fulfilled A and B can’t be considered as equivalent if equivalency of the annual energy output is required.

4. Product families

4.1 General

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.

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 as required for the certified family.

In this case, reference to all relevant test reports has to be made on each data sheet, even if a product is not mentioned in the family. With regard to the fees, the different collectors are treated as different subtypes.

4.2 Collector size families

As an exception to EN 12975:2022, 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.

The 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.

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.

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 parameters 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.

5. Tolerances and Equivalences

5.1 Varying absorber materials in same collectors

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 Σ as defined in 3.2, for other combinations of materials only the relevant collector has to be measured again to define the applicable performance figures of this family.

5.2 Custom built collectors

For custom built collectors (built in, roof integrated collectors that do not comprise factory made modules and are assembled directly on the place of installation) a representative collector with the same structure is tested. The collector gross area in the case of custom-built collectors shall be at least 2 m².

The manufacturer has to explain the conformity of the test collector with the normal production and must provide a detailed description of the components. Very large collector modules may be treated as a custom-built collector, if testing of the full-size module is not possible. The regulation of clause 4.2 apply.

5.3 Exchangeability of absorbers in flat plate collectors

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

- The thermal performance of the modified collector is the same as defined in 3.2.
- In the case of a modification of header pipes, EN 12975 C.2.4 is fulfilled.
- In the case of a modification of the nominal distance between absorber pipes, EN 12975 C.2.3 is fulfilled.

If the absorber coating is changed, the rules in 5.4 apply.

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

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

Rules for testing

	Shall be tested according to ISO 9806:2025 on the “new” absorber design						
	22 – 23 Thermal performance	24. Effective thermal capacity and time constant	6 Internal pressure	9 Exposure test test	11 Internal thermal shock test	12 Rain penetration test	17 Final inspection
1. Material of absorber sheet	X	X		X	X		X
2. Material of pipes	X	X	X	X	X		X

3. Design of absorber plate							
a. Absorber fins to full plate absorber	X	X		X	X		X
b. Full plate absorber to absorber fins	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
6. Absorber pipes (nominal diameters, nominal thickness)	X	X	X	X	X		X
7. Header pipes (nominal diameters, nominal thickness)	X	X	X	X	X	X	X

Limitations and remarks

- Modifications not listed here, shall be treated by the involved test labs and the certification bodies in a way that is in line (and not conflicting) with the principles of the EN 12975 and the Solar Keymark Scheme rules. The SKN shall be informed when specific regulations have to be applied, so that such specific regulations can be integrated in this Annex.
- Flat plate collectors with absorbers with different flow schemes (U-harp, Z-harp and meander) are considered as different collectors and cannot be considered as members of the same collector family.
- 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.
- Only in the context of this clause, retesting the thermal performance can be done without the measurement of the IAM.
- 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.

5.4 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 ≥ mean value of alpha values in the group – 1 % point; epsilon ≤ 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 ISO 9806 being relevant with regard to the absorber, thus 10 Exposure and 12 Internal thermal shock for the collector with the new coating are successfully passed under climate class A conditions.
3. The thermal performance of the modified collector is considered the same as defined in 3.2.
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, $\varepsilon_1 = \varepsilon_2 \pm 1\%$ point at most) and the same range of the production variability, e.g. 0.95 ± 2% points.

5. For selective absorber coatings on metal, an ISO 22975-3 (IEA SHC Task X) test shall be performed successfully by one of the Solar Keymark recognised testing laboratories.

6. The interchangeability is approved 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 the absorber coating the latest until the next SKN meeting. The absorber has to be sampled by a third party.

An updated list of absorber coatings which can be exchanged is found in Annex P5.8 of the Solar Keymark Scheme rules.

5.5 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 ± 1 percentage point from the glass which was 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 ISO 9806 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 glass types "clear" and "mat" as shown in Figure 4, are considered as the same texture. A strongly structured surface like prismatic will still be seen as different texture and Clause 5.6. Point 2. shall apply.

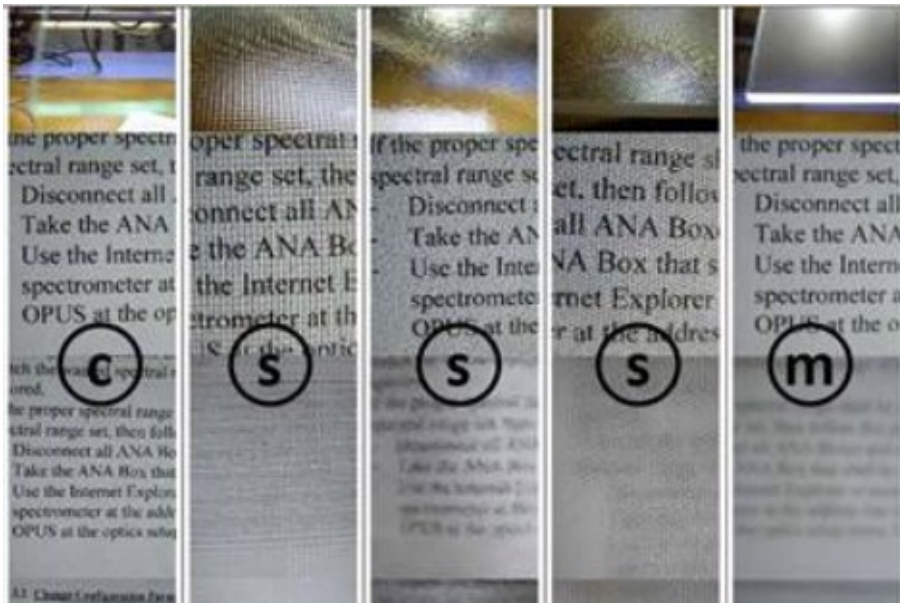

Figure 4 Glasses of type: c: clear, s: structured, m:matt

The product (collector) with clear and with matt glass must have a different name because the optical appearance is quite different. However, they may be presented in the same certificate.

2. If the glass is not identical as 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.

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.

5.6 Tolerances of the outer collector dimensions and the collector gross area

A change of the outer collector dimensions resulting in a change of the gross collector area by less than 2%, and no change for the aperture area, does not require retesting. The dimension of the areas shall be determined based on a check of the technical drawings and documented in the change report. The values stated in the test report and the SKN data sheet shall not be changed in this case.

5.7 Procedure for exchanging absorber coatings in already certified collectors with absorber coatings resulting in a lower standard stagnation temperature

For the use of an absorber coating in a collector which is already certified with another absorber coating, the following tests are required once:

- ISO 22975-3 (IEA SHC Task X).
- One-time exposure and internal thermal shock test for at least climate class A on a collector equipped with the new coating. If in the final inspection (ISO 9086 clause 17) no finding is rated as "2 - Major failure", the new absorber layer is permitted for the use in collectors with a standard stagnation temperature that is a maximum of 20 K above the stagnation temperature determined in the exposure test.
- The test report must be made available to the Solar Keymark Network. The tests must be performed by a testing laboratory of the SKN. Upon approval by the SKN, the coating can be registered together with the measured standard stagnation temperature.

The following tests are required for each collector in which this absorber coating is used:

- Testing of the thermal performance (incl. determination of the stagnation temperature, but without Incidence angle modifier and time constant) of the collector; in the case of a collector family, the collector whose performance characteristics are documented on the Solar Keymark data sheet is tested. The newly determined stagnation temperature is the basis for the standard stagnation temperature of the collector with the new coating.
- The results of the reliability and durability test of the collector with the original absorber coating remain valid if the stagnation temperature of the collector with the new absorber coating does not exceed that of the collector with the original absorber coating.

Note: It is not possible to have the original collector and the collector with the new coating in the same certificate.

6. Miscellaneous

6.1 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 considered.

6.2 Calculation of thermal power output for solar air heating collectors (SAHC)

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 ISO 9806.
Note: The tool cannot find this point for open-to-ambient SAHC, as they cannot be handled with an efficiency curve yet

6.3 Not continuously differentiable performance curve

For solar thermal collectors operating not continuously differentiable performance curve with an efficiency depending on the absolute temperature (e.g. integrated high temperature cut off), ScenoCalc may be calculated with two split curves. A clear switching point between the different curves shall be given in the test report and on the data sheet. The parameters describing the thermal performance below the switching point are η_0, a_1, a_2, as usual, the parameters describing the thermal performance above the switching point shall be named with different letters, for example above s_0, s_1, s_2 (or η_0^*, a_1^*, a_2^*). The mathematical model for the description of the thermal performance shall be given in the test reports and in the remarks field of the data sheet. It has to be considered that the switching point is usually depending on the absolute temperature and not on the relative temperature difference.

6.4 Thermodynamic Collectors

Solar collectors directly integrated in the solar collector loop as part of a solar thermal system with a heat pump (thermodynamic system) are in the scope of EN 12975 and ISO 9806 and can apply for Solar Keymark certification.

To avoid any confusion that the complete thermodynamic system is certified, on the certificate, data sheet and in product flyers and website of the certificate holder the following remark needs to be added (e.g. via a foot note):

The product was tested and certified as a solar collector. The product is not certified for any use as evaporator of a thermal system with a heat pump.

In cases of collectors designed for the evaporation of the heat transfer fluid, the factory inspection also has to include the aspect of gas tightness (e.g. leakage tests are normally carried out with gas) and the documentation / communication only as a collector).

Explanation: According to accreditation requirements, the testing laboratories and the certification bodies are obliged to test and certify all products, which are in the scope of ISO 9806 and EN 12975. The Solar Keymark certificate confirms the conformity with the respective product standard (only the test results as a solar thermal collector) and the Solar Keymark data sheet the technical information of the collector. This is also the case for all other existing Solar Keymark certified collectors.

The certificate shows and confirms not the application within a heat pump system. Any statement concerning so-called thermodynamic systems is not allowed.

Solar Keymark certification for “thermodynamic systems”, which are intended to work as a heap pump, with an evaporator as a solar collector

This is currently not possible and allowed, because a standardized performance test for the certification of the complete system with the real use is missing.

6.5 Determination of the data required for CDR (EU) No 812/2013

The parameters required for CDR (EU) No 812/2013 as indicated on page 2 of the solar Keymark datasheet shall be determined as follows:

CDR (EU) No 812/2013		ISO 9086 notation
Area	A_{Sol}	$A_{Sol} = A_G$
Zero-loss efficiency	η_0	$\eta_0 = P_{Peak}/(1000 \cdot A_G)$
First-order coefficient	a_1	$a_1 = a_1$
Second-order coefficient	a_2	$a_2 = a_2$
Incidence angle modifier	IAM (50°)	$IAM(50) = 0.85\big(K(0, \theta_L) \cdot K(\theta_T, 0)\big) + 0.15 \cdot K_d$

6.6 Determination of the data required for CDR (EU) No 811/2013

The collector efficiency as required for CDR (EU) No 811/2013 and as indicated on page 2 of the solar Keymark datasheet shall be determined as follows:

$$\eta_{Col} = \frac{\dot{Q}\left(\vartheta_m - \vartheta_a = 40K; G_b = 850\frac{W}{m^2}; G_d = 150\frac{W}{m^2}; E_L = -100\frac{W}{m^2}; \mathrm{u} = 1.3\frac{m}{s}\right)}{A_G \cdot 1000\frac{W}{m^2}}$$