

ANNEX WP1.A.B: Rain Penetration Test

Comments and suggestions concerning the rain penetration test defined in 5.7 of EN 12975-2: Weighting the Collector

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Point 1:

The Standard EN 12975-2 suggests three alternative methods of measuring the penetration of water into the collector, after the rain penetration test (5.7.2.2):

- weighting the collector
- humidity measurement
- measuring the condensation level

However, only for the first method it specifies the procedure and the measuring device together with its uncertainty. It says nothing about the other two methods, i.e. the procedure to be followed, instruments, accuracies, e.t.c.

The measurement of humidity inside the collector is a method which introduces many uncertainties due to its nature and it is not mentioned when, how and at which point of the collector this measurement is conducted.

The procedure for the measurement of the condensation level in the inside part of the cover is not also specified. Measuring the area of the condensate is very unreliable since this area does not have regular shapes and is not evenly distributed in the cover.

Our opinion is that the whole procedures for both humidity and condensation level measurements should be mentioned clearly in the test of paragraph 5.7 of EN 12975-2.

Point 2:

In 5.7.2.2 of EN 12975-2, it is stated that the minimum accuracy of scale must be ± 1 gr for the measurement of the collector weight.

Since there are collectors that their weight can reach over 50 kg, it is obvious that the measurement of such a collector with the accuracy of ± 1 gr presents many uncertainties related to other environmental parameters and requires very expensive balances. It is proposed that the measurement should be conducted with an accuracy of 5 gr/m² collector area.

Point 3:

In the Standard there is no specific mention about the several types of collectors that can be tested in rain penetration, concerning their construction materials. However, there are collectors which have wood on their backs.

Our proposal is that an extra paragraph should be included in 5.7 of the Standard, stating clearly that in cases of collectors having wood in the backs (or other special cases), the laboratory must take all necessary measures so that the final result will not be influenced or altered by the special construction of the collector during the conduction of the test.

Comments and suggestions concerning the pass criteria of the rain penetration test defined in 5.3.7 of EN 12975-1

In this paragraph it is stated that the pass criterion for the collector concerning the rain penetration test, and in the case that the weighting method has been used, is that the determined water quantity shall be less than 5 gr/m².

According to our opinion, this figure is too small, since in praxis the majority of the collectors present such water penetration. It should also not be forgotten that actually this the only test in which a quantitative pass criterion is set, whereas in all other tests it is the "no major failure". This may cause the unhappy situation that a collector with medium efficiency can pass the rain penetration test due to its "heavy sealing", thus being certified and another collector with very high efficiency can be excluded because it did not meet the 5 gr/m² rain penetration criterion.

It is therefore proposed that the acceptance criterion of the rain penetration test for the collector should be 30 gr/m².

Suggestion of the method 5.7.2.2.b: Humidity measurements

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As far as I see my job, we are looking for something quantitative, which is still not very easily done, and might need some more experience and also input from other labs, but I will try something that is on the safe side:

For flat plate collectors, an "absolute humidity sensor" has to be placed in the air gap between the absorber and the glazing. Care shall be taken that the sensor does neither touch the glazing nor the absorber. This type of sensor usually consists of two elements, a relative humidity sensor and a temperature sensor. Absolute humidity is assessed by calculation. The collector and the sensor shall be connected to the hot fluid loop for at least five hours before the rain is switched on in order to stabilize. When testing outdoors, in order to minimize disturbances of the measurement, the collector shall be shaded during the whole test.

The humidity shall be monitored from five hours before the raining till at least five hours after the raining.

Results

Any visible droplets in the inside of the collector or a humidity that exceeds 20 g/kg at any time during the periods described above, or a humidity that doubles from the value measured after stabilization during the periods described above, shall yield "major failure" (a mark of "2").

NOTE: Ingress of water might also be detected at a later stage, during the test "Final inspection", Clause 5.11.

Remarks from the author:

We might also need to add a chapter about humidity sensors, calibrations, uncertainties etc. in the appropriate section.

Numerical figures in the text proposed above are subject to discussion.

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Suggestions on how to clearer define the Rain penetration test in EN 12975-2: Measuring of condensation level

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The Standard EN 12975-2 suggests three alternative methods of measuring the penetration of water into the collector, after the rain penetration test (5.7.2.2):

- weighting the collector
- humidity measurement
- measuring the condensation level

This document gives a suggestion on how to clearer define how the test should be performed when using the *measuring of condensation level* for detection of ingress of water.

Improvements of test method

5.7.2.2

The collector shall be mounted and sprayed as explained above while the absorber in the collector should be kept warm (minimum 50 °C). The heating of the collector shall be started at least 30 minutes before the spraying of water to ensure that the collector box is dry before testing. This shall be done by circulating hot water (or other transfer fluid) above 50 °C through the absorber before but also during the complete test. The option of keeping the absorber warm by exposing the collector to solar radiation are, therefore, not suitable for detection of ingress of water by *measuring the condensation level*.

For the entire time that the test is in progress the absorber is kept warm and this will evaporate the water that finds its way into the collector. The water will thereafter condense on the inside of the glazing, which is being cooled by cold water on the outside. To ensure that no water has penetrated the collector box without forming condensation on the glazing, the collector shall be tipped on all four sides in turn after the test is terminated.

The penetration of water into the collector shall be determined by measuring the condensation level on the cover glass and by measuring the water that come out of the collector when tipping it.

5.7.3

The collector should be sprayed with water at a temperature between 10-25 °C and with a flow rate of approximately 0,05 kg/s per square meter of sprayed area. The duration of the spraying shall be 4 hours.

After 2 hours an intermediate inspection of condensation of the cover glass shall be done in order to facilitate the reporting of the places where water penetrates. After finishing the spraying the inspection of condensation of the cover glass should be done immediately, before the collector will make any temperatures changes. The collector shall not be exposed by solar radiation. The condensation area on the glazing shall be measured.

On completion of the measuring the condensation level, dry the collector carefully on all sides. Tip it on to all four sides in turn, standing it on a clean base on which any water that runs out can be collected and/or approximated quantified.

5.7.4

The collector should be inspected for water penetration by the presence of any condensation and the approximate quantity of water that leaked out. The results of the inspection i.e. the extension of water penetration and the places where water penetrated shall be reported.

EN 12975-1

5.3.7

c) the measured condensation level shall be less than 5 % of the transparent cover and the collected water shall be less than 20 gr/m².