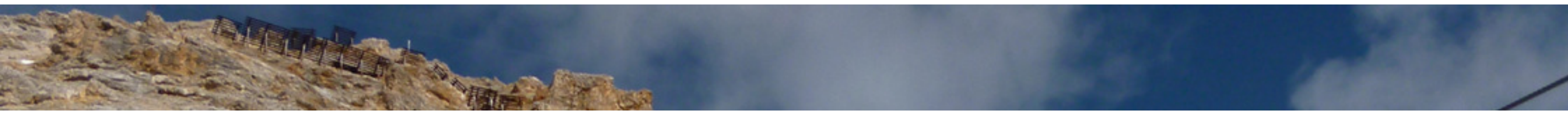
Absorber Surface Durability Standard Testing: ISO 22975-3 vs. Measured Thermal Stress at Extreme Test Site

INFO SHEET No. 03



Description	Absorber surface durability standard testing ISO 22975-3 vs. measured thermal stress at extreme test site in the projects *Speed*Coll (2011-2015) and *Speed*Coll2 (2016-ongoing)
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Project partners	Fraunhofer ISE (Coordinator), ITW TZS University Stuttgart, Alanod, Almeco Tinox, Arcelor Mittal, Bosch, Dow Corning, DSM, First Solar, Interfloat, Kömmerling, Lorenz, Otto Chemie, Vaillant, Viessmann
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Download & further information	www.speedcoll2.de

*Speed*Coll and Solar Absorbers

The objectives of the *Speed*Coll projects are: The exposition of collectors and components in extreme climatic conditions, the analysis of ageing processes under these climatic conditions and finally the further development of accelerated ageing tests for solar thermal collectors and their components.

Ageing effects occurring in flat plate solar collectors are mainly determined by the temperature level and the humidity in the collector. Lately, the trend towards systems with higher solar fractions leads to an increase in stagnation times and temperatures.

Solar absorbers, as a key component in solar thermal collectors, are in the focus of this Info Sheet. A well-established durability testing method for the solar absorber is the testing procedure described in ISO 22975-3. This standard testing procedure is applicable to a typical solar domestic hot water system.

ISO Standard vs. Measurement

Depending on their location and prevalent climatic conditions, the components of solar thermal collectors have to bear high climatic and mechanical stresses. Besides high temperatures, UV-light, wind, snow, humidity or saline and corrosive atmospheres can cause a rapid degradation of materials and components.

Different samples of solar absorbers on aluminium and copper substrates were characterized before, during and after the tests. Various methods, including FT-IR spectroscopy and surface sensitive technologies like AFM microscopy were employed to measure the degradation on different scales and to identify the processes taking place.

Samples of different absorber types were exposed to outdoor weathering within a concerted commercial solar thermal collector at five test sites with different climatic conditions and continuous monitoring of the climatic conditions.

The highest measured absorber temperature within a solar thermal collector in stagnation mode was measured at the alpine exposition site (Figure 1).

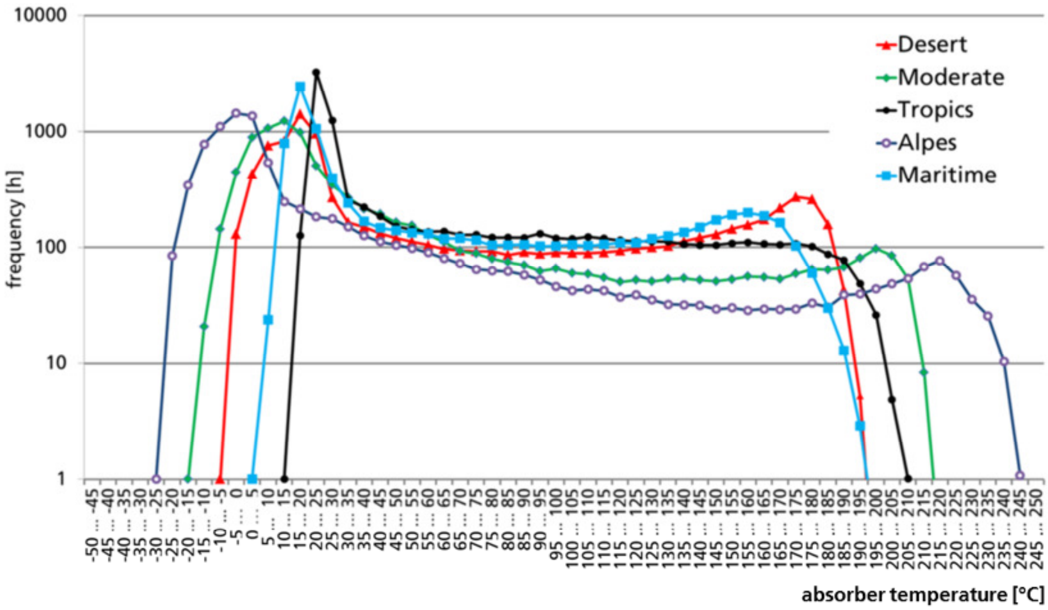

Figure 1: Histogram of the absorber temperature [°C] at different exposition sites, measured period from 12/2013 to 11/2014, Negev desert (arid) in Israel; Freiburg (moderate) in Germany; Kochi (tropical) in India; Zugspitze (alpine) in the German Alps and Gran Canaria (maritime) in Spain

These measured thermal loads were then transformed in laboratory test conditions according to ISO 22975-3. In figure 2, the calculated effective mean temperatures for the different exposition sites are shown. The alpine test site derived the maximum value.

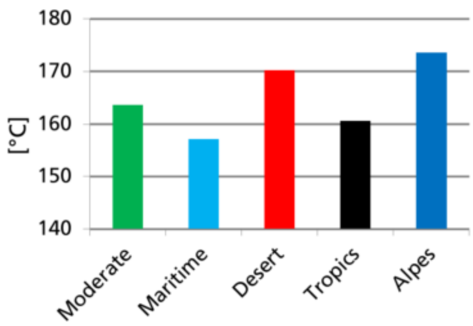

Figure 2: Effective mean absorber temperature [°C] at different exposition sites, measured period from 12/2013 to 11/2014, Freiburg (moderate) in Germany; Gran Canaria (maritime) in Spain; Negev desert (arid) in Israel; Kochi (tropical) in India and Zugspitze (alpine) in the German Alps

It showed that the corresponding testing time of the procedure for the high temperature test for the alpine test site is less than the procedure described in the standard ISO 22975-3. Therefore, the standard testing procedure assumes even higher thermal loads than shown at the extreme alpine test site with high absorber temperature in constant stagnation mode.

Thus, the standard testing procedure ISO 22975-3 fully covers the ageing behaviour of absorbers in terms of high temperature loads even at the condition measured at the extreme alpine test site, where the highest absorber temperatures within the *Speed*Coll projects were measured.