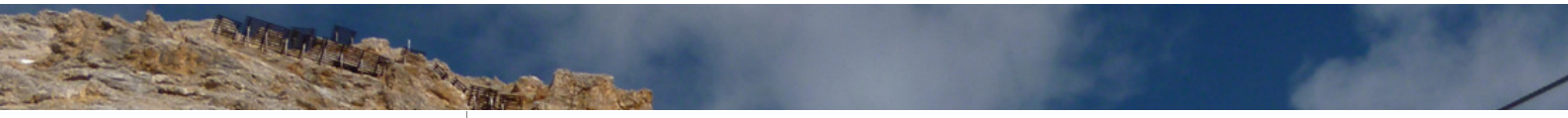
Possible Damages and Weak Points of Solar Thermal Collectors

INFO SHEET No. 04



Description	Overview of the catalogue of possible damages and weak points of solar thermal collectors elaborated in the projects *Speed*Coll (2011-2015) and *Speed*Coll2 (2016 – ongoing)
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Project partners	Fraunhofer ISE (Coordinator), ITW/TZS University of 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

The Catalogue of Possible Damages and Weak Points

As part of the projects *Speed*Coll and *Speed*Coll2, manufacturers and test institutes have bundled their many years of experience in the field of degradation of individual materials and components of solar thermal collectors. In each of the two projects, the consortium carried out a failure mode and effects analysis (FMEA), in which potential damages were assessed on the basis of the three categories probability of occurrence, severity and probability of detection. Ratings in these categories were made on a scale of 1 to 10. The product of the three scores gives the Risk Priority Number (RPN), which can take values from 1 to 1000.

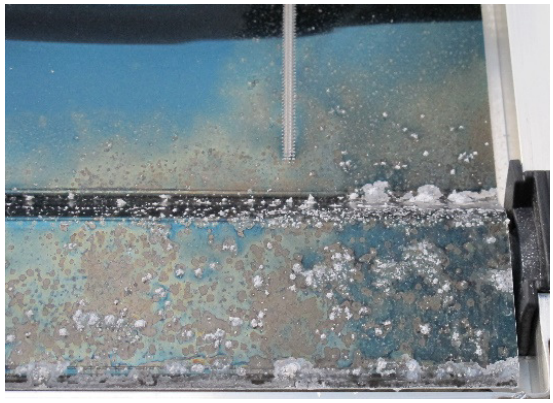

Figure 1: Salt deposition and corrosive degradation of the absorber layer near a pipe

Figure 2: Degradation of the bond between glass cover and collector frame

The results were merged into a catalogue of possible damages and weak points related to climatic impact and the specific loads pollution of dirt, wind, noxious gas and corrosive atmosphere. The catalogue is going to be used in the future development of standards to ensure the quality of solar thermal collectors.

The participating manufacturers of collectors and components already take into account the documented findings in order to prevent corresponding damages. The catalogue of possible

damages and weak points does therefore not state, that a solar thermal collector generally has all the possible weak points documented in the catalogue. Rather, it serves as a "checklist", which helps to consider these possible degradation effects and weak points during development and manufacture of a solar thermal collector and its components. The catalogue has a hierarchical structure, which is based on the structure of common flat plate collectors:

	Damage mechanism	Combinations of damage mechanisms climatic conditions and specific loads	Max. RPN
Collector and mounting kit	1	2	720
Whole collector	1	1	294
Casing	5	10	700
Casing (parts) of plastic	7	20	800
External surfaces of the casing	1	2	504
Corners	1	4	280
Tray of plastic	1	2	800
Pipe penetrations made of plastic	2	8	240
Ventilation holes	1	4	400
Cover	12	36	576
Cover made of plastic	2	8	392
Cover made of glass	4	10	800
Absorber	11	48	640
Connection absorber plate and absorber pipes	3	10	40
Absorber pipes	4	14	400
Absorber layer	8	28	448
Screw connection	1	2	400
Thermal insulation	9	20	567
Adhesives and sealing materials	5	10	500
Sealing/adhesive between glass and frame	8	24	900
Sealing/adhesive between back wall and frame	3	8	315
Seal of the pipe penetration	3	8	315
Hydraulic sealing	3	3	560
Connection between cover and casing	2	8	TBD
Connections of different metals	1	2	1000
Heat pipe	1	4	147

The following list shows the main damage mechanisms with a RPN over 700:

- Mechanical impairment of metallic components by galvanic coupling of different metals, especially under salt load.
- Reduction of stability, deformation or breakage of the collector casing or the mounting kit due to strong wind and snow loads
- Reduction of the stability of plastic components due to very low temperatures, very high temperatures or UV radiation
- Loss of effect of adhesives or sealants at very low temperatures, very high temperatures or condensation of water and / or formation of microorganisms or algae on adhesives and sealants (see Fig. 2)
- Breakage of the cover due to hail, thermal cycling or heavy wind and snow loads

Figure 3: Collector with caked-on dirt on the cover and dirt entry through a pipe penetration