

DIN EN ISO 9806:2014-03 (E)

Solar energy - Solar thermal collectors - Test methods (ISO 9806:2013)

Contents	Page
Foreword	5
Introduction	6
1 Scope	7
2 Normative references	7
3 Terms and definitions	7
4 Symbols and abbreviated terms	9
5 General	14
5.1 Test overview - Sequence of the tests	14
5.2 Particular aspects of collectors using external power sources and active or passive measures for normal operation and self-protection	15
6 Internal pressure tests for fluid channels	16
6.1 Inorganic fluid channels	16
6.2 Fluid channels made of organic materials (plastics or elastomers)	16
6.3 Apparatus and procedure	16
6.4 Results	17
7 Leakage test (closed loop air heating collectors only)	17
7.1 Objective	17
7.2 Apparatus and procedure	17
7.3 Test conditions	18
7.4 Results	18
8 Rupture or collapse test (air heating collectors only)	18
8.1 Objective	18
8.2 Apparatus and Procedure	19
8.3 Test conditions	20
8.4 Results and reporting	20
9 High-temperature resistance test	20
9.1 Objective	20
9.2 Apparatus and procedure	20
9.3 Test conditions	21
9.4 Results	21
10 Standard stagnation temperature of liquid heating collectors	22
10.1 General	22
10.2 Measurement and extrapolation of standard stagnation temperature	22
10.3 Determining standard stagnation temperature using efficiency parameters	23
10.4 Results	23
11 Exposure and pre-exposure test	24
11.1 Objective	24
11.2 Apparatus and procedure	24
11.3 Test conditions	24
11.4 Results	25

12	External thermal shock test	25
12.1	Objective	25
12.2	Apparatus and procedure	25
12.3	Test conditions	26
12.4	Results	26
13	Internal thermal shock test	26
13.1	Objective	26
13.2	Apparatus and procedure	26
13.3	Test conditions	27
13.4	Results	27
14	Rain penetration test	27
14.1	Objective	27
14.2	Apparatus and procedure	27
14.3	Test conditions	28
14.4	Results	30
15	Freeze resistance test	30
15.1	Objective	30
15.2	Apparatus and procedure	30
15.3	Test conditions	31
15.4	Results	31
16	Mechanical load test with positive or negative pressure	31
16.1	Objectives	31
16.2	Apparatus and procedure	31
16.3	Test conditions	32
16.4	Results	32
17	Impact resistance test	32
17.1	Objective	32
17.2	Test procedure	33
17.3	Impact location	33
17.4	Method 1: Impact resistance test using ice balls	33
17.5	Method 2: Impact resistance test using steel balls	34
17.6	Results	34
18	Final inspection (related to Clauses 5 to 17)	35
19	Test report (related to Clauses 5 to 18)	35
20	Performance testing of fluid heating collectors	35
20.1	General	35
20.2	Steady-state efficiency test using a solar irradiance simulator	36
21	Collector mounting and location	37
21.1	General	37
21.2	Collector frame	37
21.3	Tilt angle	38
21.4	Collector orientation outdoors	38
21.5	Shading from direct solar irradiance	38
21.6	Diffuse and reflected solar irradiance	39
21.7	Thermal irradiance	39
21.8	Surrounding air speed	39
22	Instrumentation	40
22.1	Solar radiation measurement	40
22.2	Thermal radiation measurement	41
22.3	Temperature measurements	43
22.4	Flow rate measurement	45

22.5	Surrounding air speed measurement	46
22.6	Elapsed time measurement	47
22.7	Pressure measurement	47
22.8	Humidity measurement	48
22.9	Collector gross area	48
22.10	Collector fluid capacity	48
23	Test installation	48
23.1	Liquid heating collectors	48
23.2	Air heating collectors	52
24	Performance test procedures	54
24.1	General	54
24.2	Test installation	55
24.3	Preconditioning of the collector	55
24.4	Test conditions	55
24.5	Test procedure	57
24.6	Measurements	58
24.7	Test period	60
24.8	Presentation of results	65
25	Computation of the collector parameters	65
25.1	Liquid heating collectors	65
25.2	Steady-state air heating collectors	69
26	Determination of the effective thermal capacity and the time constant of a collector	70
26.1	Measurement of the effective thermal capacity (separate measurement)	70
26.2	Measurement of the effective thermal capacity (quasi dynamic method)	72
26.3	Calculation method	72
26.4	Determination of collector time constant (optional)	73
27	Determination of incident angle modifier	75
27.1	Modelling	75
27.2	Test procedures	79
27.3	Calculation of collector incidence angle modifier	80
28	Determination of the pressure drop across a collector (Liquid) (optional)	81
28.1	General	81
28.2	Test installation	81
28.3	Preconditioning of the collector	81
28.4	Test procedure	81
28.5	Measurements	82
28.6	Pressure drop caused by fittings	82
28.7	Test conditions	82
28.8	Calculation and presentation of results	83
28.9	Pressure drop for air collectors	83
Annex A (normative) Test reports		85
Annex B (informative) Mathematical models for liquid heating collectors		110
Annex C (normative) Properties of water		114
Annex D (informative) General guidelines for the assessment of uncertainty in solar collector efficiency testing		117
Annex E (informative) Measurement of the velocity weighted mean temperature		121
Bibliography		123