

TEST REPORT NON-LOADBEARING WALL

Name of sponsor:	Nordic Build A/S		
Product name:	Non-loadbearing facade element		
File no.:	PGA11339A	Revision no.:	0
Test date:	10-12-2018	Date:	29-01-2019
Pages:	10	Encl.:	41
Ref:	RBI / ADR		

Client information

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Date of test

The test was conducted on 10-12-2018.

Purpose of test

Examination of the fire-resistance of a Non-loadbearing facade element.

The test specimen has been subjected to a standard fire test in accordance with the following standards:

DS/EN 1363-1:2012 Fire resistance tests – General requirements

in conjunction with

EN 1364-1:2015 Fire resistance for non-loadbearing elements Part 1: Walls

Test specimen

The trade name and sponsors identification mark is stated below:

Trade name:	Non-loadbearing facade element
Identification mark:	None

The components for the test specimen were sampled, delivered and mounted by the sponsor.

Drawings and description

Details of the construction are shown in the enclosed documentation as stated below:

Type	Drawing No.	Dated	Subject
Drawing	1	26.11.2018	Ikke bærende facadeelement - vandret snit
Drawing	2	26.11.2018	Ikke bærende facadeelement - opstalt front
Drawing	3	26.11.2018	Ikke bærende facadeelement - opstalt bagside
Drawing	4	26.11.2018	Ikke bærende facadeelement - perspektiv
Drawing	5	26.11.2018	Ikke bærende facadeelement - perspektiv
Drawing	6	26.11.2018	Ikke bærende facadeelement - opstalt front
Drawing	7	26.11.2018	Ikke bærende facadeelement - opstalt
Drawing	8	26.11.2018	Ikke bærende facadeelement - detalje
Drawing	9	26.11.2018	Ikke bærende facadeelement - detalje
Drawing	10	02.12.2018	Ikke bærende facadeelement - vandret snit
Drawing	11	02.12.2018	Ikke bærende facadeelement - lodret snit
Data sheet			M4 composite board (2 pages)
Data sheet			Stone wool (2 pages)
Data sheet			Adhesive
Data sheet			Steel (2 pages)

The documentation is supplied by the sponsor and it is stamped by DBI - Danish Institute of Fire and Security Technology

Description

The test specimen consisted of the components described in the following. DBI inspected the components during mounting, the test and after the test.

The sponsor carried out the mounting of the test specimen.

Test specimen

External measures:	Height: 2985 mm	Width: 2950 mm	Thickness: 352 mm
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The test specimen was a non-loadbearing wall construction made of facade elements of steel, M4 composite boards and stone wool. The test specimen consisted of 12 elements – further documentation see drawing 1.

The test specimen was build of individual elements with a width of 250 mm – further documentation see drawing 10. The element at free edge had a width of 200 mm.

Each individual element consisted of two 0.9 mm profiled flanges of steel. The two flanges of steel were connected through a M4 composite board – the M4 composite boards were glued with 140 g/m² to the flanges of steel. Stone wool was installed between the two flanges of steel – there was no glue used to bond the stone wool to the flanges of steel. Each individual element formed an insulated beam. The individual elements were connected in an airtight tongue and groove lock – further documentation see drawing 10.

The test specimen was symmetrical.

Components

Boards	15 mm M4 composite boards designated Cantona M4 komposit with a nominal density of 1.100 kg/m ³ . The M4 composite boards had a width of 350 mm and was installed in full height of the test specimen – 2985 mm.
Insulation	300 mm stone wool insulation designated Rockwool Flexibatts 34 with a measured density of 38 kg/m ³ . The nominal density is not indicated. The stone wool was installed in full height of the test specimen – 2985 mm – with a plural number of joints.
Adhesive	A two component adhesive designated PKI ProFect 41176 +91102 with a nominal density of 1.6 kg/L + 1.2 kg/L.
Steel	Exterior side of the test specimen was formed with steel plates designated Aluzinc with a bulk density of 3750 kg/m ³ .

Measured by DBI

Product		Flexibatts 34	M4 composite board	M4 composite board
Density	kg/m ³	38	1041	1041
Thickness	mm		15	15
Moisture content	%	0.36	16.39	23.63
Organic content	%	2.27		
Sampling method		Extra material	Extra material	Extra material
Drying temperature		105°C	55°C	105°C

Test conditions

Conditioning

Two identical specimens were delivered on the 10-12-2018 to the DBI laboratory and stored under room temperature. On the day of the fire testing one specimen was selected for testing the other for material verification. The condition of the test specimen was similar with respect to its moisture content as the test specimen would be in normal service.

Mounting

The test specimen was mounted in a concrete lined test frame with a clear opening of 3000 x 3000 mm.

The test specimen was delivered to the DBI laboratory as one unit. The mounting in the concrete lined test frame was as describes in the following:

Exposed side

Fixed edge	A 50 x 50 x 4 mm steel profile was mounted into the test frame. The steel profile was partitioned into 3 smaller parts with the following lengths – 960/1010/900 mm – as seen from top to bottom. The steel profile was placed 20 mm from exterior side of the test frame and fastened with 100xHUS3-C 6x40/5 screws. The test specimen was fastened to the steel profile in the following positions – 130/1130/2130 mm – as seen from top to bottom measured from internal side of the test frame. The test specimen was fastened with M8x60 SW13 screws.
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Upper side of the test specimen	<p>A 50 x 50 x 4 mm steel profile was mounted into the test frame. The steel profile was partitioned into 3 smaller parts with the following lengths – 650/1245/1035 mm – as seen from left to right on exposed side.</p> <p>The steel profile was placed 20 mm from exterior side of the test frame and fastened with 100xHUS3-C 6x40/5 screws.</p> <p>The test specimen was fastened to the steel profile in the following positions – blind rivet no. 1-4 as seen from left to right on exposed side. The test specimen was fastened with M8x60 SW13 screws – further documentation see drawing 3.</p>
Lower side of the test specimen	<p>The test specimen was placed directly on the test frame. The test specimen was fastened to the test frame in the following positions – 510/1130/1740/2740 mm as seen from left to right on exposed side measured from internal side of the test frame. The test specimen was fastened with 100xHUS3-C 6x40/5 screws.</p>
Unexposed side	
Fixed edge	<p>No mounting was established on unexposed side.</p> <p>Any gaps between the test specimen and the test frame were packed with stone wool.</p>
Upper side of the test specimen	<p>Upper side of the test specimen was packed with stone wool in between the test specimen and the test frame. Free standing upper side of the test specimen was covered with non-combustible boards.</p> <p>4 pieces of 4 mm Z-profiles were fastened to the test frame and to the test specimen. The Z-profiles were fastened with FS-H 7.5x52 screws into the test frame and with M8x60 SW13 screws into the test specimen. The Z-profiles were placed as shown on drawing 6.</p>
Lower side of the test specimen	<p>4 pieces of 4 mm Z-profiles were fastened to the test frame and to the test specimen. The Z-profiles were fastened with 100xHUS3-C 6x40/5 screws into the test frame and with M8x60 SW13 screws into the test specimen. The Z-profiles were placed as shown on drawing 6.</p>

A free edge was established along the right vertical edge of the test specimen as seen from the unexposed side. The free edge was made by 2 x 25 mm stone wool with alu-foil.

Fire test

Observations were made during the test on the general behavior of the test specimen.

Temperature observations were taken continually during the entire testing time.

The surface temperatures were measured on the unexposed surface of the test specimen as indicated on DBI drawing No. 1.0.

The furnace temperature was determined by means of plate thermocouples uniformly distributed at a distance of approximately 100 mm from the exposed side of the test specimen. The furnace temperature was continuously controlled so as to follow the standard time temperature curve within the accuracy specified in EN 1363-1:2012.

The thermocouples were constructed according to the description in EN 1363-1:2012.

The furnace pressure was controlled at a level of 20 Pa at the top of the test specimen during the test, which corresponds to a furnace pressure at a level of 5.6 Pa measured 1.16 m above notional floor level.

Test results

Duration of the test was 92 minutes.

Measurements

The enclosed graphs and tables show:

Enclosures 2.0 and 2.1	Furnace temperatures The actual minimum-, average- and maximum furnace temperature in relation to the standard temperature. The table also shows the area under the actual time-temperature curve as well as the area under the standard time-temperature curve
Enclosures 3.0 and 3.1	Average temperature rise Measured with 5 thermocouples
Enclosures 4.0 and 4.1	Maximum temperature rise Maximum temperature rise on the unexposed side
Enclosures 5.0 and 5.1	Deformation Negative values indicates movement towards the furnace
Enclosures 6.0 and 6.1	Vertical furnace pressure The differential pressure in the furnace during the test, measured 1,16 m above notional floor level
Enclosures 7.0 and 7.1	Ambient temperature The ambient temperature in the laboratory during the test

Visual observations:

Time / Minutes	Visual observations:	U = Unexposed side E = Exposed side
0	Test commences	
1	Thermocouple no. 1.5 lost connection	U
10	Faint smoke development vertical along the upper half of the specimen, fixed edge	U
12	Nothing to observe on exposed side	E
18	Continuing faint smoke, fixed edge	U
19	Faint smoke development at upper corner, free edge	U
19	Faint smoke development along the top of the specimen	U
21	Water dripping down from the top of the specimen	U
25	Increased smoke development along fixed edge	U
39	Nothing new to observe	U
46	Significant amount of water dripping from lower corner of specimen, free edge	U
48	Edge profile at lower edge of the specimen filled with water, dripping at free edge	U
55	Significant amount of water dripping from lower corner of specimen, fixed edge	U

57	Discoloration along vertical joint no. 4 seen from fixed edge	U
59	No cotton pad test was performed as the occasion of failure of integrity was not relevant	U
60	Gap between non-combustible boards and steel profiles	E
65	Continuing water released from specimen	U
72	Nothing new to observe	U
89	No cotton pad test was performed as the occasion of failure of integrity was not relevant	U
92	Test stopped	

The photographs on the attached photo sheets show the test specimen during the mounting, testing and after the test. See the description at each photo.

Conclusion

Fire resistance testing according to EN 1364-1:2015 of the construction described in this test report showed that failure according to the performance criteria stated in the test method occurred at the following time:

Integrity (E): **92 minutes**

- Sustained flaming did not occur during the test
- The cotton pad was not ignited during the test
- No through-going openings in the test specimen were created during the test

Insulation (I): **92 minutes**

- Failure of insulation did not occur during the test
- The average temperature rise on the unexposed surface of the test specimen did not exceed 140 °C during the test
- The maximum temperature rise on the unexposed surface of the test specimen did not exceed 180 °C during the test

Remarks

The field of direct application of the test results appears from EN 1364-1:2015, clause 13.

This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outlined in EN 1363-1, and where appropriate EN 1363-2. Any significant deviation with respect to size, constructional details, loads, stresses, edge or end conditions other than those allowed under the field of direct application in the test method is not covered by this report.

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

This report has only been printed in a pdf-version. DBI has not issued a hard copy version.

All values mentioned in this report are nominal values, production tolerances are not considered.

Danish Institute of Fire and Security Technology



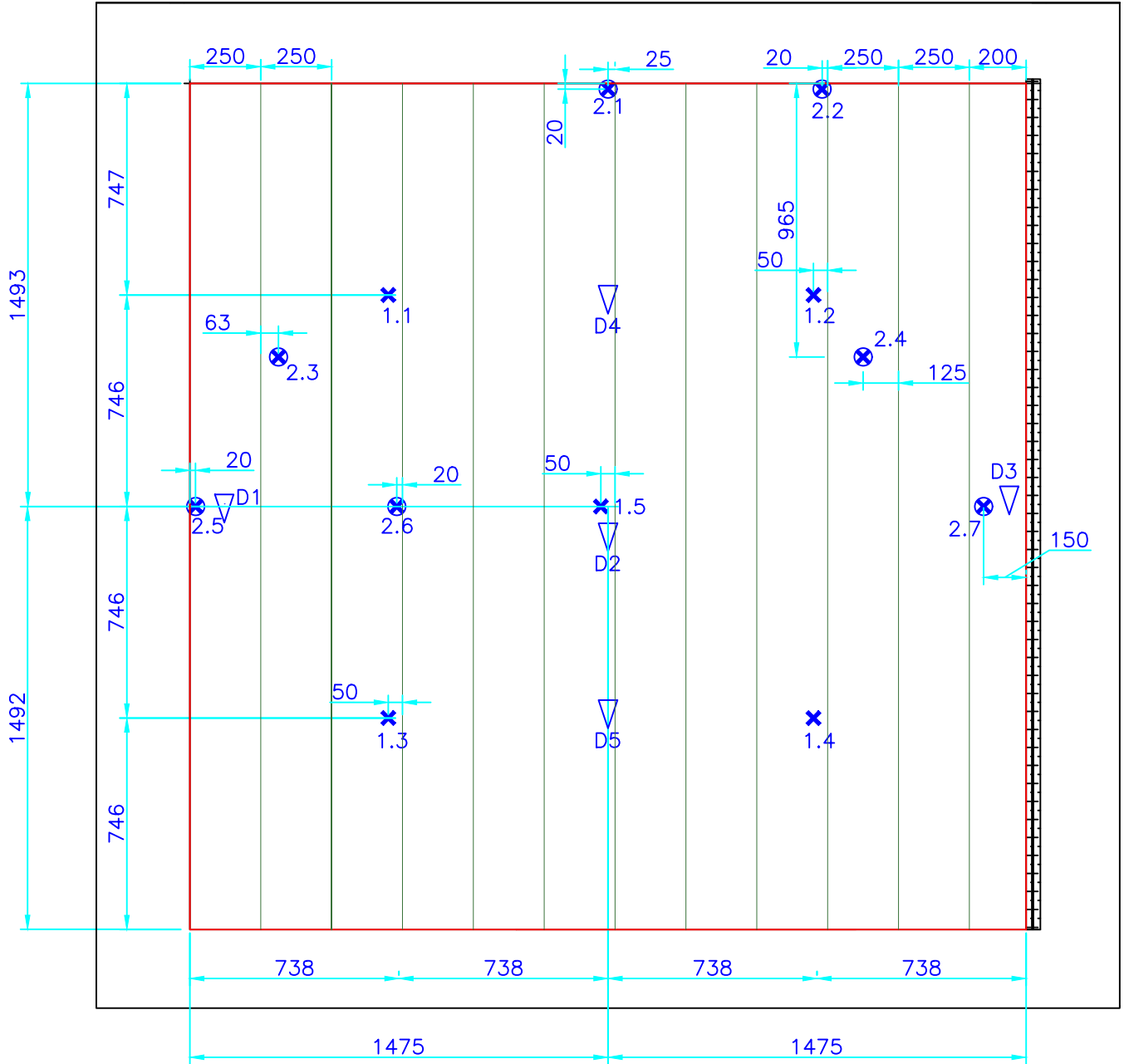
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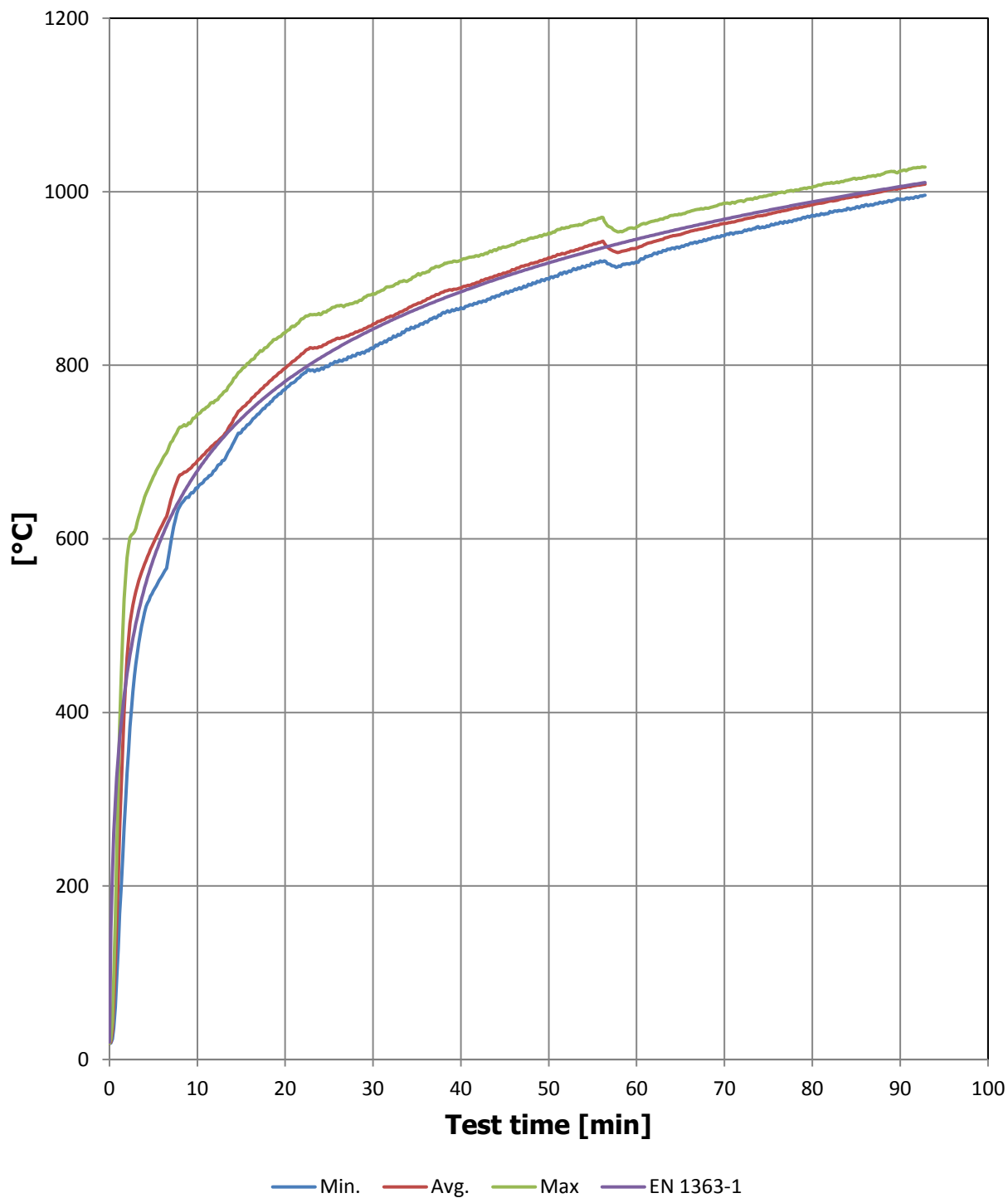
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Enclosures:	41
DBI drawings:	1
DBI graphs and tables:	12
Photo sheets:	10
Sponsors drawings:	18



- ✘ Thermocouple placed on the unexposed surface (average)
- ⊗ Thermocouple placed on the unexposed surface (maximum)
- ▽ Deflection measuring point

Furnace temperature



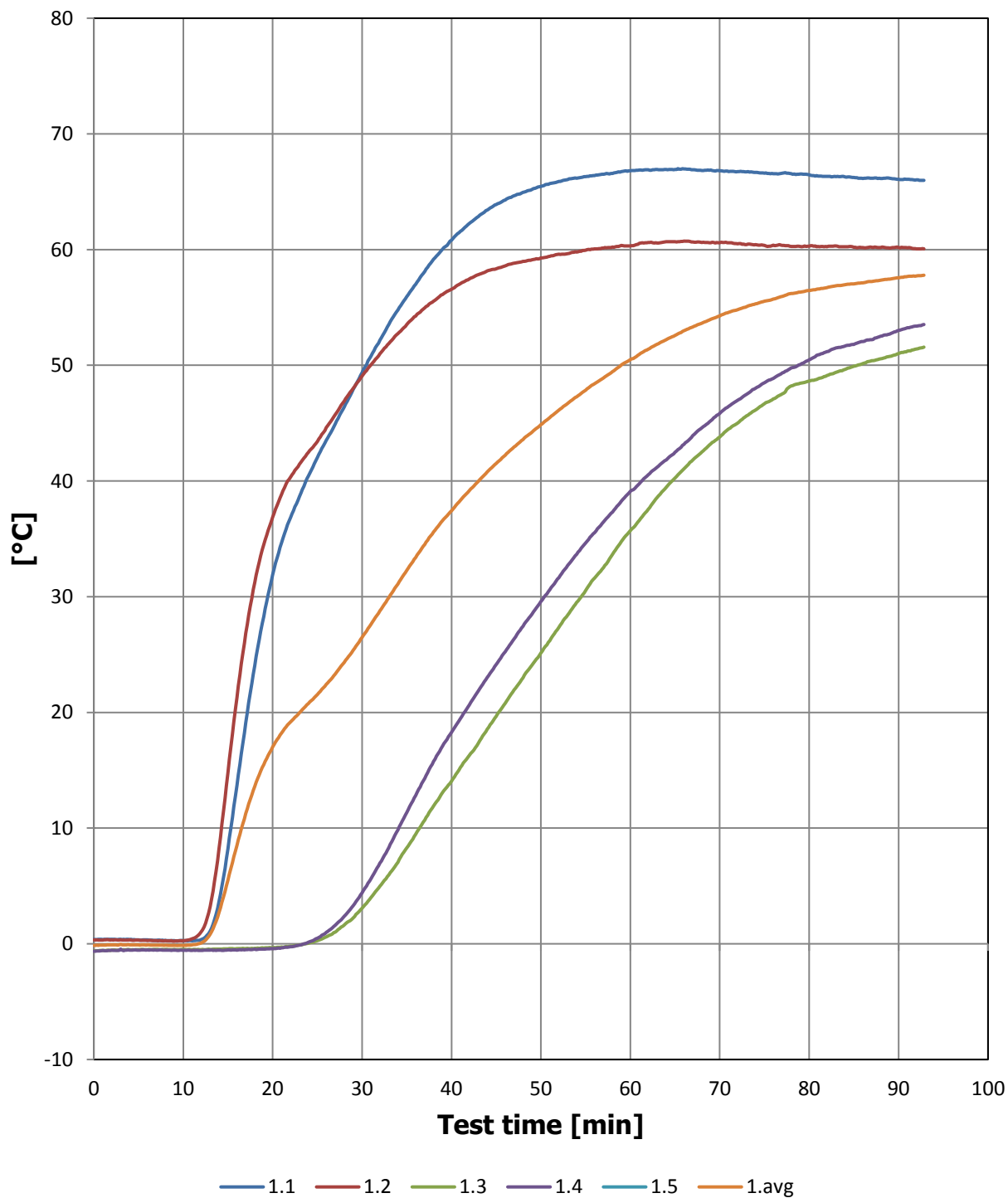


Furnace temperature

Time Minutes	Measured			Norm EN 1363-1	Area under curve		Dev. [%]	Limit [%]
	Minimum	Average	Maximum		Measured	EN 1363-1		
0	19	19	19	20	0	0	0,0	
3	456	539	612	502	944	1115	-15,3	
6	558	616	691	603	2690	2790	-3,6	15
9	648	680	734	663	4655	4695	-0,9	15
12	679	710	759	705	6739	6750	-0,2	14
15	723	750	794	739	8923	8918	0,1	13
18	755	779	822	766	11217	11176	0,4	11
21	780	805	845	789	13595	13508	0,6	10
24	796	821	858	809	16042	15904	0,9	8
27	807	834	870	826	18527	18357	0,9	7
30	819	848	883	842	21047	20859	0,9	5
33	835	861	896	856	23609	23406	0,9	5
36	850	875	907	869	26214	25994	0,8	5
39	864	887	919	881	28860	28619	0,8	4
42	873	895	926	892	31533	31279	0,8	4
45	884	906	936	902	34237	33971	0,8	4
48	893	918	947	912	36973	36692	0,8	4
51	902	928	957	921	39739	39442	0,8	3
54	913	936	964	930	42533	42218	0,7	3
57	916	934	959	938	45350	45019	0,7	3
60	919	935	959	945	48147	47844	0,6	3
63	933	945	968	953	50969	50691	0,5	3
66	940	954	977	960	53819	53559	0,5	3
69	947	961	984	966	56692	56448	0,4	3
72	953	968	990	973	59585	59356	0,4	3
75	960	974	996	979	62498	62283	0,3	3
78	967	981	1002	985	65431	65228	0,3	3
81	975	987	1008	990	68383	68190	0,3	3
84	981	993	1013	996	71353	71169	0,3	3
87	985	998	1019	1001	74340	74164	0,2	3
90	991	1004	1024	1006	77344	77175	0,2	3
92	993	1008	1028	1009	79356	79190	0,2	3

Average temperature rise

Measured with 5 thermocouples





Average temperature rise

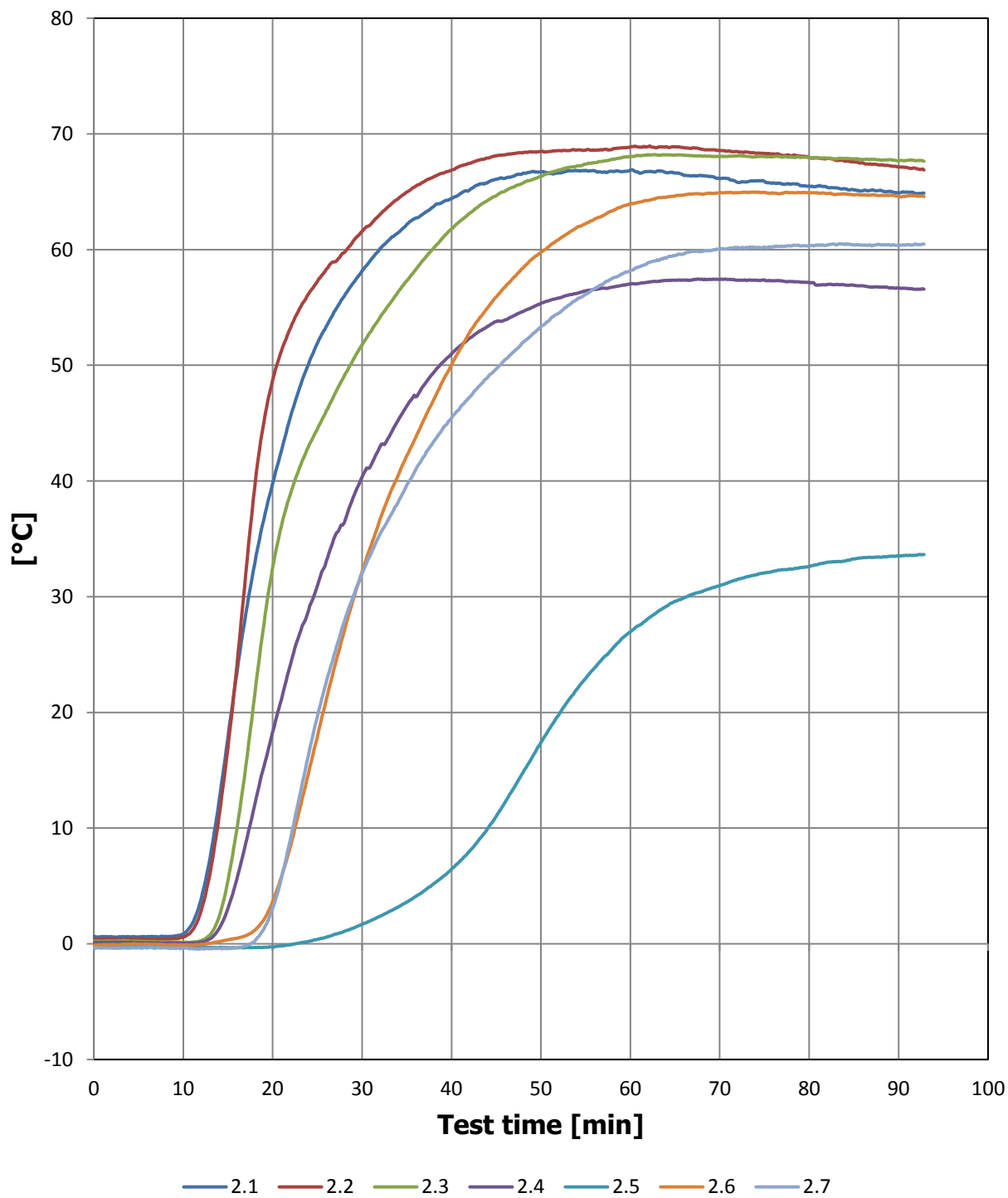
Measured with 5 thermocouples

Min. / °C	1.1	1.2	1.3	1.4	1.5	1.Avg	1.Max
0	0	0	-1	-1	0	0	0
3	0	0	0	0	0	0	0
6	0	0	0	-1	0	0	0
9	0	0	0	-1	0	0	0
12	0	1	-1	-1	0	0	1
15	8	15	0	-1	0	6	15
18	24	31	0	0	0	14	31
21	35	39	0	0	0	18	39
24	40	42	0	0	0	21	42
27	45	46	1	2	0	23	46
30	49	49	3	4	0	26	49
33	54	52	6	8	0	30	54
36	57	54	9	13	0	33	57
39	60	56	13	17	0	37	60
42	62	57	16	21	0	39	62
45	64	58	20	24	0	42	64
48	65	59	23	27	0	44	65
51	66	59	26	31	0	45	66
54	66	60	30	34	0	47	66
57	67	60	33	36	0	49	67
60	67	60	36	39	0	50	67
63	67	61	39	41	0	52	67
66	67	61	41	43	0	53	67
69	67	61	43	45	0	54	67
72	67	60	45	47	0	55	67
75	67	60	47	48	0	56	67
78	67	60	48	50	0	56	67
81	66	60	49	51	0	57	66
84	66	60	50	52	0	57	66
87	66	60	50	52	0	57	66
90	66	60	51	53	0	58	66
92	66	60	51	53	0	58	66

Failure [min]	-	-	-	-	-	-	-
Failure °C	180	180	180	180	180	140	180

Maximum temperature rise

Maximum temperature rise on the unexposed side





Maximum temperature rise

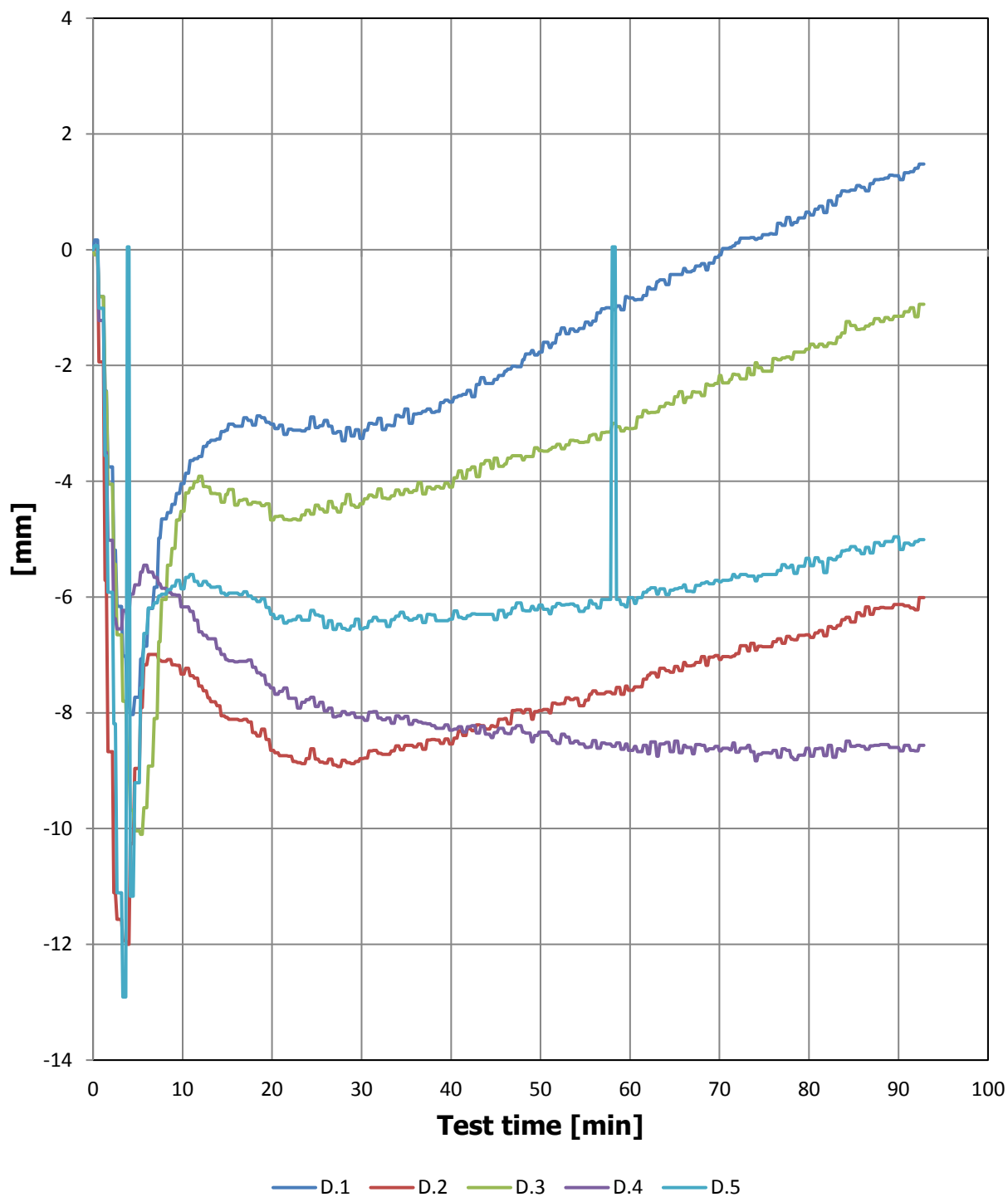
Maximum temperature rise on the unexposed side

Min. / °C	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.Max
0	1	0	0	0	0	0	0	1
3	1	0	0	0	0	0	0	1
6	1	0	0	0	0	0	0	1
9	1	0	0	0	0	0	0	1
12	4	3	0	0	0	0	0	4
15	18	17	5	3	0	0	0	18
18	33	39	22	12	0	1	0	39
21	43	51	36	21	0	6	6	51
24	50	56	43	29	0	15	16	56
27	55	59	48	35	1	24	25	59
30	58	62	52	40	2	32	32	62
33	61	64	55	44	3	39	37	64
36	63	65	58	47	4	44	41	65
39	64	67	61	50	6	49	44	67
42	65	67	63	52	8	53	47	67
45	66	68	65	54	11	56	50	68
48	67	68	66	55	15	58	52	68
51	67	68	67	56	19	60	54	68
54	67	69	67	56	22	62	56	69
57	67	69	68	57	25	63	57	69
60	67	69	68	57	27	64	58	69
63	67	69	68	57	29	64	59	69
66	66	69	68	57	30	65	60	69
69	66	69	68	57	31	65	60	69
72	66	68	68	57	32	65	60	68
75	66	68	68	57	32	65	60	68
78	66	68	68	57	32	65	60	68
81	65	68	68	57	33	65	60	68
84	65	68	68	57	33	65	60	68
87	65	67	68	57	33	65	60	68
90	65	67	68	57	34	65	60	68
92	65	67	68	57	34	65	60	68

Failure [min]	-	-	-	-	-	-	-	-
Failure °C	180	180	180	180	180	180	180	180

Deformation

Negative values indicates movement towards the furnace





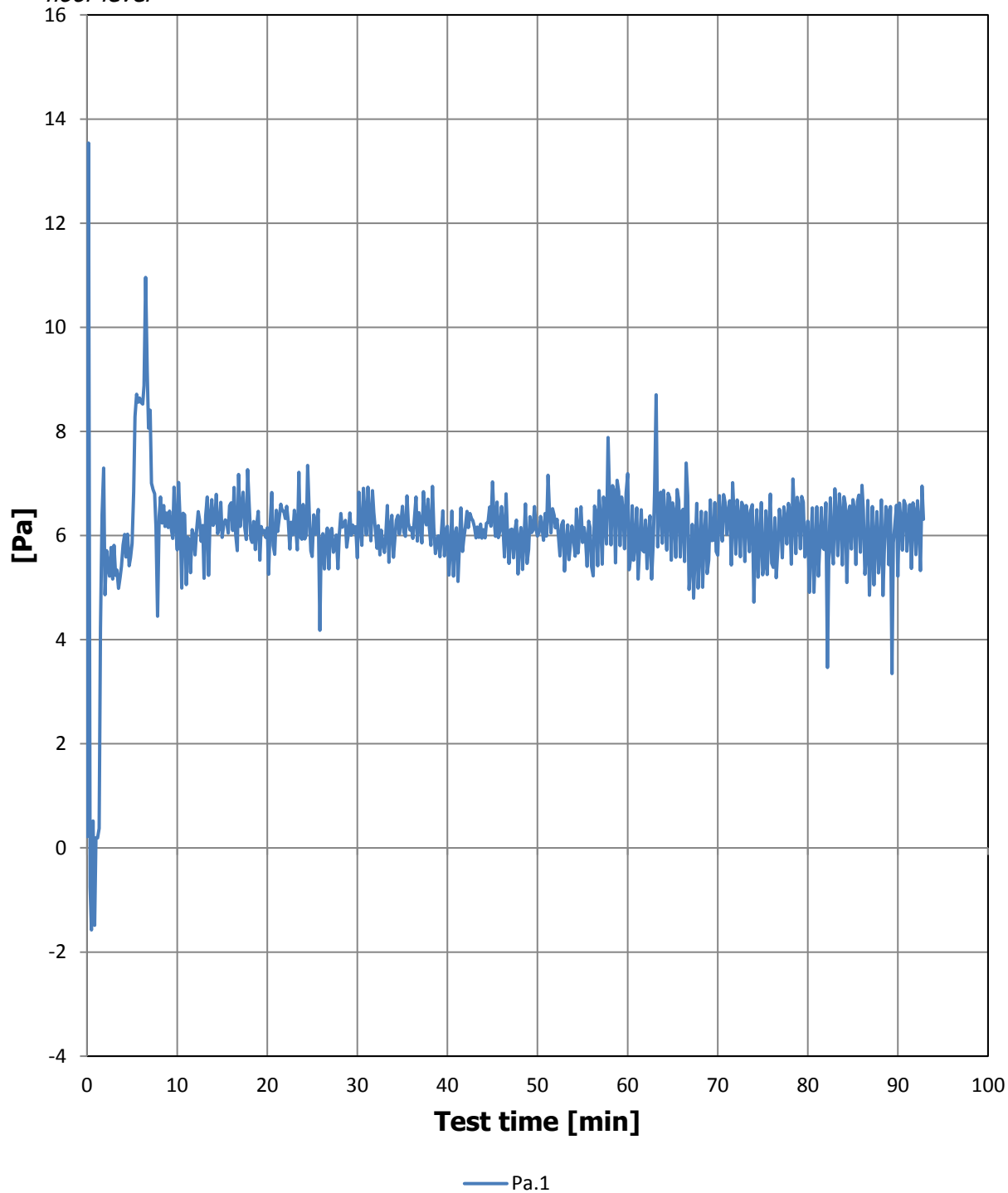
Deformation

Negative values indicates movement towards the furnace

Min. / mm	D.1	D.2	D.3	D.4	D.5
0	0,0	0,0	0,0	0,0	0,0
3	-6,2	-11,6	-6,7	-6,6	-11,1
6	-6,9	-7,2	-9,6	-5,5	-6,6
9	-4,4	-7,2	-5,2	-6,0	-5,8
12	-3,6	-7,5	-3,9	-6,6	-5,8
15	-3,1	-8,1	-4,2	-7,1	-6,0
18	-3,0	-8,3	-4,4	-7,2	-6,0
21	-3,0	-8,7	-4,6	-7,6	-6,3
24	-3,1	-8,8	-4,5	-7,8	-6,4
27	-3,2	-8,9	-4,5	-8,1	-6,6
30	-3,3	-8,8	-4,4	-8,1	-6,6
33	-3,0	-8,7	-4,3	-8,1	-6,5
36	-2,8	-8,6	-4,2	-8,1	-6,4
39	-2,6	-8,5	-4,1	-8,3	-6,4
42	-2,4	-8,3	-3,8	-8,2	-6,3
45	-2,2	-8,2	-3,6	-8,3	-6,4
48	-1,9	-8,0	-3,6	-8,3	-6,2
51	-1,7	-8,0	-3,5	-8,4	-6,3
54	-1,4	-7,8	-3,3	-8,5	-6,2
57	-1,0	-7,7	-3,2	-8,5	-6,0
60	-0,8	-7,6	-3,1	-8,7	-6,0
63	-0,6	-7,4	-2,8	-8,8	-6,0
66	-0,3	-7,1	-2,6	-8,6	-5,8
69	-0,2	-7,0	-2,3	-8,6	-5,8
72	0,1	-7,0	-2,2	-8,7	-5,7
75	0,3	-6,9	-2,1	-8,7	-5,6
78	0,4	-6,7	-1,9	-8,8	-5,5
81	0,7	-6,6	-1,7	-8,6	-5,3
84	1,0	-6,4	-1,4	-8,7	-5,2
87	1,1	-6,3	-1,3	-8,6	-5,2
90	1,3	-6,1	-1,2	-8,6	-5,0
92	1,4	-6,2	-1,2	-8,7	-5,0

Vertical furnace pressure

The differential pressure in the furnace during the test, measured 1,16 m above notional floor level





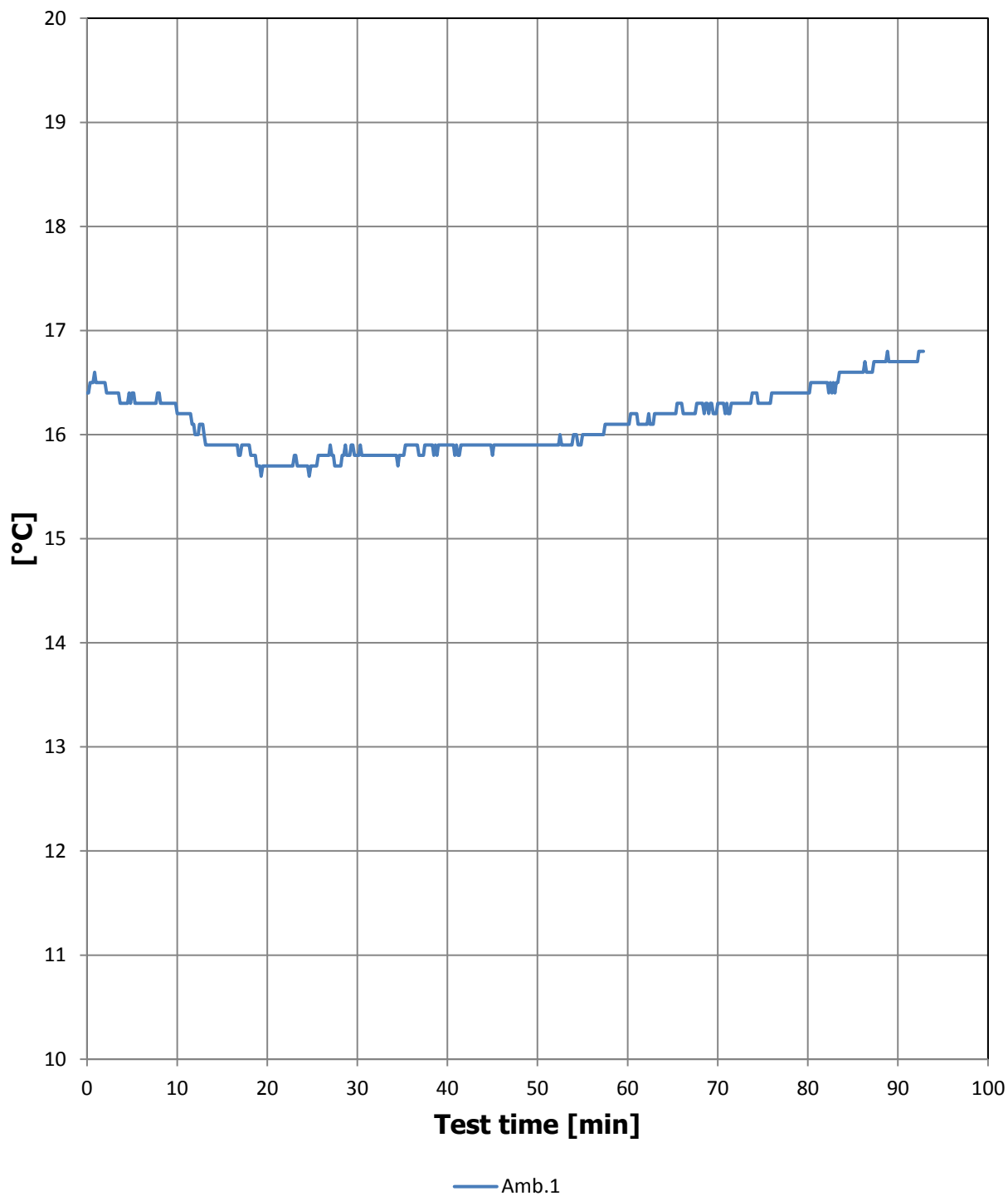
Vertical furnace pressure

The differential pressure in the furnace during the test, measured 1,16 m above notional floor level

Min. / Pa	Pa.1
0	0,2
3	5,8
6	8,6
9	6,2
12	5,6
15	6,0
18	6,6
21	6,5
24	6,6
27	6,1
30	5,6
33	5,7
36	6,1
39	6,0
42	6,2
45	7,0
48	5,9
51	6,0
54	5,9
57	6,3
60	7,2
63	6,8
66	6,5
69	5,5
72	5,6
75	5,2
78	6,5
81	6,6
84	6,7
87	5,6
90	5,2
92	5,6

Ambient temperature

The ambient temperature in the laboratory during the test



Ambient temperature

The ambient temperature in the laboratory during the test

Min. / °C	Amb.1
0	16,4
3	16,4
6	16,3
9	16,3
12	16,0
15	15,9
18	15,9
21	15,7
24	15,7
27	15,9
30	15,8
33	15,8
36	15,9
39	15,9
42	15,9
45	15,8
48	15,9
51	15,9
54	16,0
57	16,0
60	16,1
63	16,2
66	16,3
69	16,2
72	16,3
75	16,3
78	16,4
81	16,5
84	16,6
87	16,6
90	16,7
92	16,7

Photo No. 1 The test specimen before mounting

Photo No. 2 Upper edge of test specimen showing profile of galvanized steel at free edge

