

TEST REPORT

LOADBEARING WALL

Name of sponsor:	Wood:UpHigh		
Product name:	Loadbearing wall		
File no.:	PGA12247A	Revision no.:	0
Test date:	08/03/2023	Date:	14-07-2023
Pages:	11	Encl.:	55
Ref:	MRD / JBK		

Client information

Client: Wood:UpHigh
Address: Jernholmen 12
2650 Hvidovre
Denmark

The test is part of the project Wood:UpHigh. The project is partly sponsored by Uddannelses- og Forskningsstyrelsen through DBI's performance contract, Realdania and Grundejernes Investeringsfond. The project is headed by DBI, except for the construction of test specimens for the fire tests, which is headed by LOGIK&CO.

The results relate only to the items tested. The report should only be reproduced in extenso - in extracts only with a written agreement with this institute.

Content

	Client information	2
	Content	3
1	Date of test	4
2	Purpose of test.....	4
3	Test specimen	4
4	Drawings and description.....	5
	Description.....	5
	Measured by DBI.....	6
5	Test conditions.....	7
	Conditioning	7
	Mounting	7
	Loading	7
	Fire test.....	7
6	Test results.....	8
	Measurements.....	8
	Visual observations:.....	9
7	Conclusion	10
8	Remarks	11

1 Date of test

The test was conducted on 2023-03-08.

2 Purpose of test

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

DS/EN 1363-1:2020 Fire resistance tests – General requirements

in conjunction with

EN 1365-1:2012 Fire resistance tests for loadbearing elements Part 1: Walls

3 Test specimen

The trade name and sponsors identification mark is stated below:

Trade name: None

Identification mark: None.

The components for the test specimen were delivered and mounted by LOGIK&CO.

4 Drawings and description

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

Type	Drawing No.	Dated	Subject
Drawing	1.1	08-03-2023	Loadbearing wall - outer layer of clay boards - unexposed side
Drawing	1.2	08-03-2023	Loadbearing wall - inner layer of clay boards - unexposed side
Drawing	1.3	08-03-2023	Loadbearing wall – timber construction - unexposed side
Drawing	1.4	08-03-2023	Loadbearing wall – timber construction - exposed side
Drawing	1.5	08-03-2023	Loadbearing wall - inner layer of clay boards - exposed side
Drawing	1.6	08-03-2023	Loadbearing wall - outer layer of clay boards - exposed side

The documentation is supplied 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.

LOGIK&CO carried out the selection of the products for the test specimen as well as the mounting.

Test specimen

External measures:	Height: 3000 mm	Width: 2930 mm	Thickness: 263 mm
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The test specimen was a loadbearing timber construction with two layers of clay boards with seaweed wool insulation.

The test specimen was symmetrical.

Studs:

A total of 13 studs were used in the wall construction, all 2910 mm tall. The studs are 45 x 95 mm dry graded C24 construction spruce wood with a nominal density of 450 kg/m³. The studs were spaced c/c 500 mm.


Two timber frames were constructed with 250 mm staggered studs. The airgap between the two timber frames were 40 mm.

The loadbearing timber frame front side (exposed side) is made with six timbre frames, with a loadbearing stud placed 215 mm form the free edges.

The loadbearing timber frame back side (unexposed side) is made with seven timbre frames, with a loadbearing stud placed up against the free edges.

See drawing no. 1.3 and 1.4 and photo no. 1.

Top and bottom timber beams:

The top and bottom beams are 45 x 95 mm dry graded C24 construction spruce wood with a nominal density of 450 kg/m³. The top and bottom beams are fixed to the studs using two  5,0 x 100 mm screws in each end of the studs.

Insulation: The insulation material used was a seaweed wool designated [REDACTED] the insulation was used in two layers in each frame, which gives a total of 4 layers throughout the construction.

The insulation had a nominal thickness of 65 mm and a nominal density of 80 kg/m³.

The tested slab size was 455 x 1000 mm (width x length).

See photo no. 2.

Boards: Two different boards were used for both the exposed and unexposed side of the test specimen.

1st layer (inner layer)

Inner clay boards designated [REDACTED] with the nominal dimensions of 22 x 1250 x 1000 mm with a nominal density of 750 kg/m³ was mounted on the exposed side to the loadbearing studs with 3,9 x 35 mm gypsum screws. Seven screws were used in three rows against the loadbearing studs, with 15 mm to the board edge.

See photo no. 4a and 5a.

2nd layer (outer layer)

Outer layer clay boards designated [REDACTED] with the nominal dimensions of 10 x 1250 x 1000 mm with a nominal density of 750 kg/m³. This layer was fixed with 3.9 x 45 mm screws with a Ø35 mm washer. The washer had a thickness of 0.7 mm. A total of 21 screws were used for a full board with 7 in each row.

See photo no. 4b and 5b.

Mesh A mesh was positioned over the joints of the boards. The mesh was designated [REDACTED] with a 5 x 5 mm mesh size. The width of the mesh was 250 mm and a surface weight of 45 g/m². The mesh was stapled to the clay boards.

Plaster: The clay plaster designated [REDACTED] was used on both the exposed and unexposed side of the test specimen. The plaster was mixed according to the producers mixing instructions. The plaster was applied with approximately 3 mm layer.

See photo no. 5b.

Measured by DBI

Product		Clayboard 1	Clayboard 2	Clay plaster
Density	kg/m ³	597	783	2291
Thickness	mm	23.1	9.6	-
Moisture content	%	3.85	3.02	25.33
Sampling method		Extra material	Extra material	Extra material
Drying temperature	°C	105	105	105

5 Test conditions

Conditioning

The test specimen was delivered on the 24-02-2023 to the DBI laboratory and stored under room temperature. On the day of the fire testing 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 simple supported in a test frame suitable for loaded tests with a clear opening of 3000 x 3000 mm.

Free edge was established along both vertical edges of the test specimen (2 x 25 mm stone wool with alu-foil in each side) to allow for unrestrained deformation of the test specimen.

The timber frame with 7 studs were towards the unexposed side, and the timber frame with 6 loadbearing studs were towards the fire side.

Loading

The test specimen was loaded with a total applied load of 37,54 kN/m during the test, corresponding to a total load of 11208 kg or 110,0 kN.

The load was applied centrally on the horizontal top beam, e.g. there was no eccentricity in the loading conditions.

The loading conditions correspond to example d) in figure 1 in EN 1365-1:2012. The figure describes the load transfer system at head with loading from above. The wall was simple supported at the bottom.

The load was applied in 10 steps prior to the fire test. The fire test was commenced approx. 30 minutes after reaching the final load on the test specimen.

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 1363-1:2020.

The thermocouples were constructed according to the description in EN 1363-1:2020.

The pressure was controlled to maintain 20 Pa at the top of the test specimen.

The deformation data malfunctioned during the first 10 minutes of the test. The measurements have been zeroed with the last measurement after the loading phase was completed and the start of the fire test.

6 Test results

Duration of the test was 67 minutes.

Measurements

The enclosed graphs and tables show:

Enclosures 2.0 and 2.1	<p>Furnace temperatures</p> <p>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</p>
Enclosures 3.0 and 3.1	<p>Vertical furnace pressure</p> <p>The differential pressure in the furnace during the test, measured 1,16 m above notional floor level</p>
Enclosures 4.0 and 4.1	<p>Ambient temperature</p> <p>The ambient temperature in the laboratory during the test</p>
Enclosures 5.0 and 5.1	<p>Average temperature rise</p> <p>Measured with 5 thermocouples on the unexposed side</p>
Enclosures 6.0 and 6.1	<p>Maximum temperature rise</p> <p>Maximum temperatures on the unexposed side</p>
Enclosures 7.0 and 7.1	<p>Load per cylinder</p> <p>Load per cylinder during test</p>
Enclosures 8.0 and 8.1	<p>Internal temperature - between clay boards</p> <p>Placed on center board 250 mm from the edge at each side at mid height</p>
Enclosures 9.0 and 9.1	<p>Additional thermocouples - Internal temperature - between studs and clay boards mid height, 4.1 and 4.2 is placed on stud 2 and 3 from the left, and 4.3 is placed on insulation between stud 3 and 4.</p>
Enclosures 10.0 and 10.1	<p>Internal temperature - on studs</p> <p>Placed on the back side of the unexposed wooden studs at stud 3 and 4 from the left.</p>
Enclosures 11.0 and 11.1	<p>Additional thermocouples - Internal temperature - between studs and clay board exposed side</p> <p>6.1 and 6.2 is placed 750 mm from top on insulation between 2 and 3, and 3 and 4 respectively. 6.3 and 6.4 is placed mid height on studs 2 and 3 from the left. 6.5 is placed 750 mm from bottom on insulation between stud 3 and 4.</p>

Enclosures 12.0 and 12.1	Additional thermocouples - Internal temperature - between clay boards exposed side Placed on the left side full board 250 mm from the edge at each side at mid height of construction
Enclosures 13.0 and 13.1	Maximum temperature in the construction layers
Enclosures 14.0 and 14.1	Deformation horizontal Positive values indicate movement away from the furnace
Enclosures 15.0 and 15.1	Horizontal deformation Negative values indicate movement towards the furnace The deformation data malfunctions the first 10 min of the test.
Enclosures 16.0 and 16.1	Vertical deformation Negative values indicate downwards movement The deformation data malfunctions the first 10 min of the test.
Enclosures 17.0 and 17.1	Vertical deformation rate The deformation data malfunctions the first 10 min of the test.
Enclosures 18.0 and 18.1	Horizontal deformation during loading Negative values indicate movement towards the furnace
Enclosures 19.0 and 19.1	Vertical deformation during loading Negative values indicate downwards movement
Enclosures 20.0 and 20.1	Load per cylinder during loading Load per cylinder

Visual observations:

Time / Minutes	Visual observations:	U = Unexposed side E = Exposed side
0	Test commences	
14	No change	U+E
20	No change	U
21	Smoke from the top of frame	U
23	Small area of plaster has fallen down	E
25	Large cracks in boards/plaster	E
29	Flames coming out of crack	E
31	No change	U
35	The size of the crack has increased	E
37	Smoke from right free edge	U
42	No change	U+E
48	Crack at top of wall	U
49	Increase in smoke from frame	U

52	More flames from the right side	E
58	No critical place for cotton pad test	U
59	Horizontal crack right side	E
60	Faint smoke from bottom of construction + some faint discoloration	U
61	Horizontal crack extend to left side of construction	E
65	More cracks on exposed side	E
67	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.

7 Conclusion

Fire resistance testing according to EN 1365-1:2012 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:

Load-bearing capacity (R): 66 minutes

- The load on the test specimen was maintained for 66 minutes.
- The measured vertical deflection did not exceed the criteria of $C = h/100 = 29$ mm during the test.
- The measured rate of vertical deflection did not exceed the criteria of $dC/dt = 3h/1000 = 9$ mm/min during the test.

Integrity (E): 66 minutes

- Failure of integrity occurred after 66 minutes of testing due to failure of load-bearing capacity.
- 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): 66 minutes

- Failure of insulation occurred after 66 minutes of testing due to failure of load-bearing capacity.
- 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.

8 Remarks

The field of direct application of the test results appears from EN 1365-1:2012, 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 1363-1:2020, and where appropriate EN 1363-2:1999. 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.

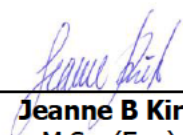
This report has only been printed in a pdf-version. DBI has not issued a hard copy version.

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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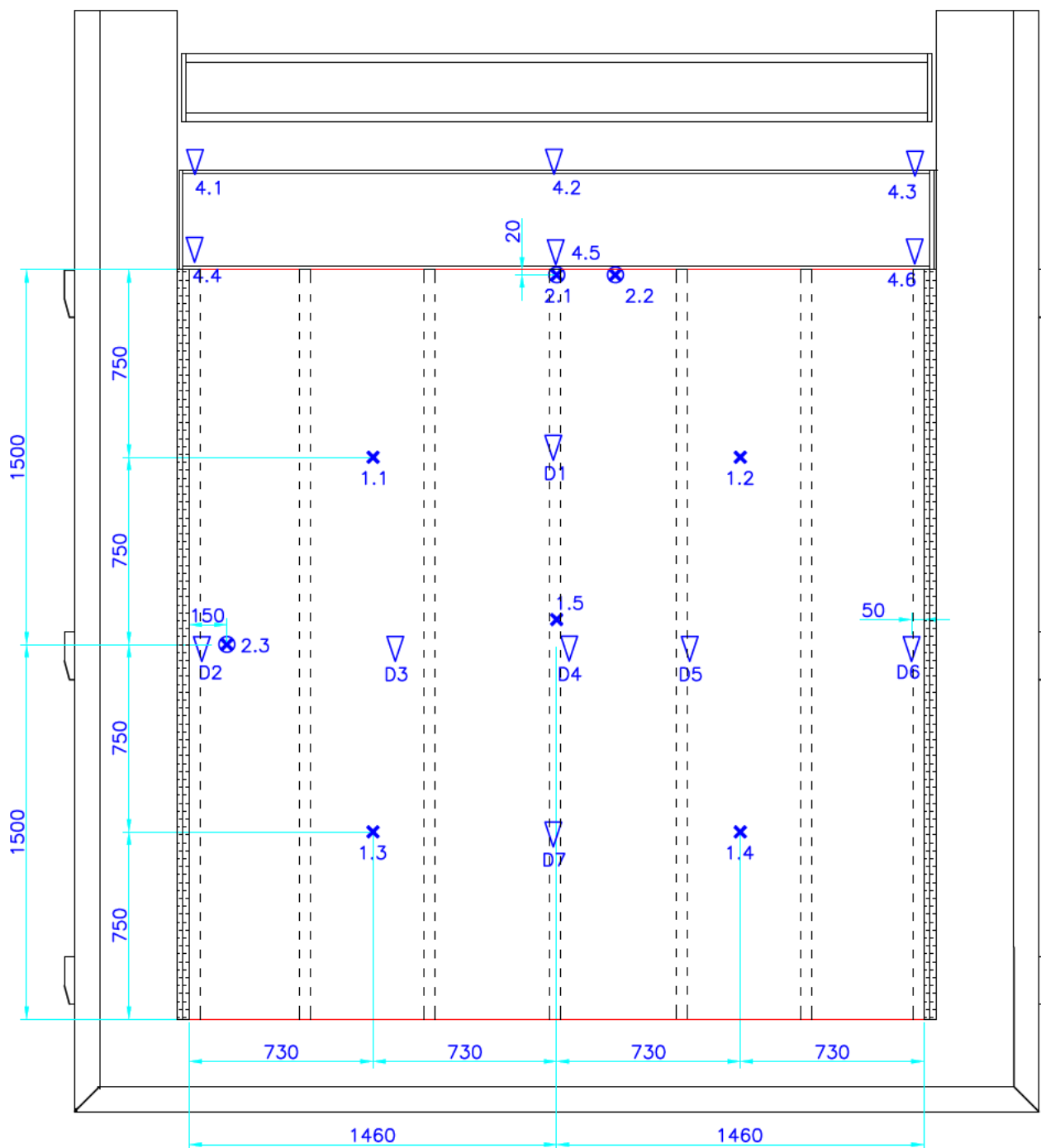
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Enclosures:

DBI drawings:	7
DBI graphs and tables:	36
Photo sheets:	12
Sponsors drawings:	0

55



- ✕ Thermocouple placed on the unexposed surface (average)
- ⊗ Thermocouple placed on the unexposed surface (maximum)
- ∇ Deflection measuring point

All measurements are in mm

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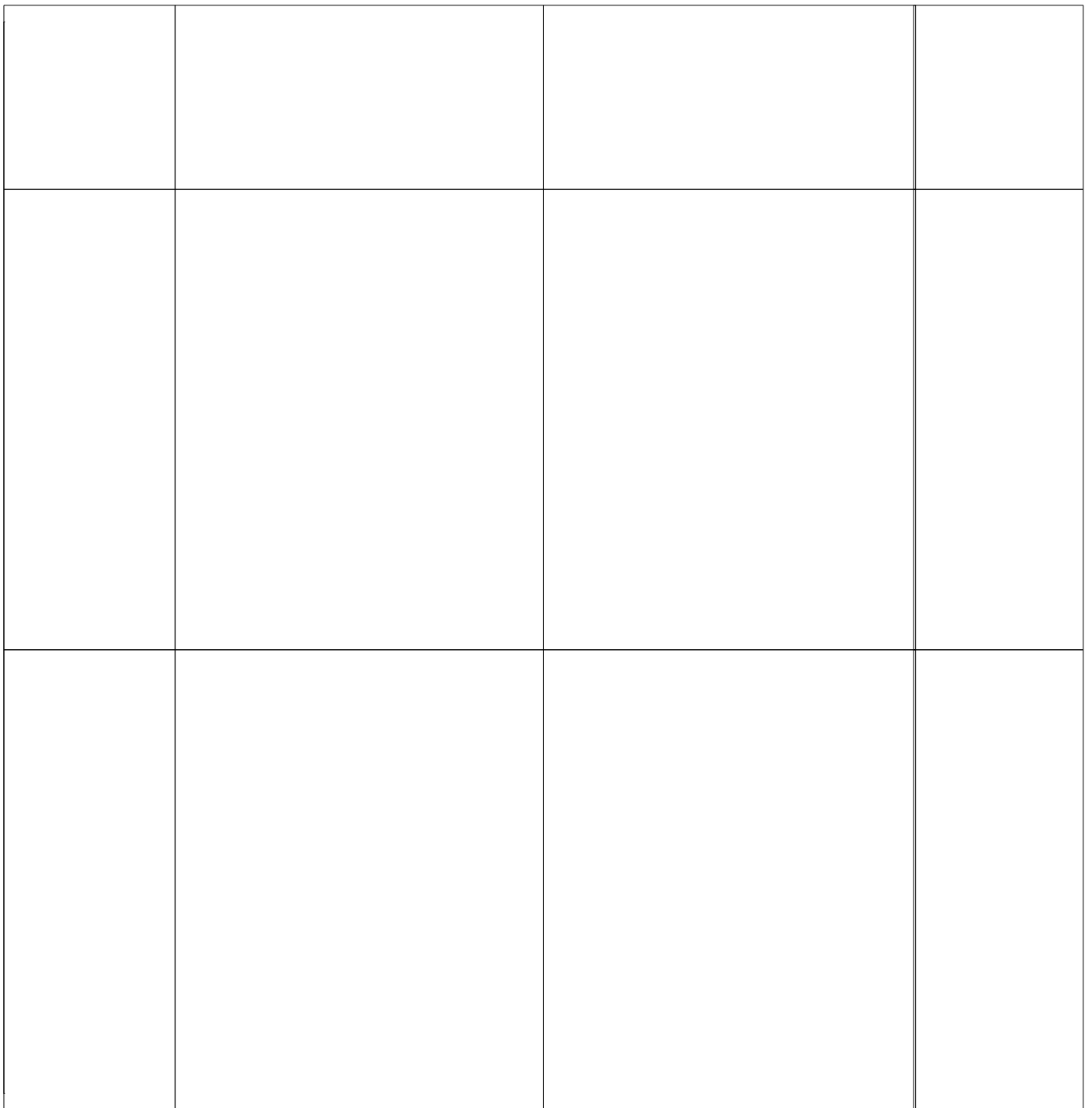
Sponsor: DBI

Subject: Loadbearing wall

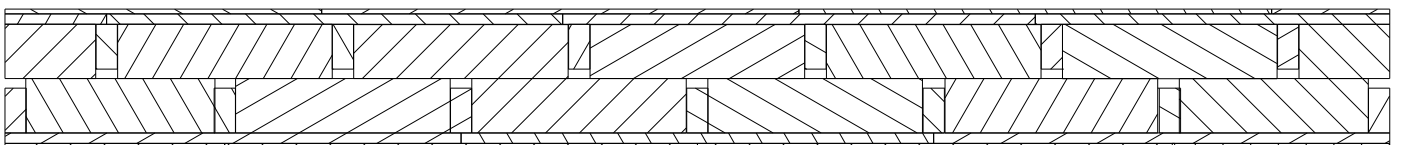
File No.: PGA12247A

Test date: 2023-03-08

Enclosure: 1.0



A-A (1:16)



All measurements are in mm



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Sponsor: Wood:UpHigh

Subject: Loadbearing wall - outer layer of clay boards - unexposed side

File No.: PGA12247A

Test date: 08-03-2023

Enclosure: 1.1

	<p style="text-align: center;">⊕</p> <p style="text-align: center;">3.1</p>	<p style="text-align: center;">⊕</p> <p style="text-align: center;">3.2</p>

All measurements are in mm



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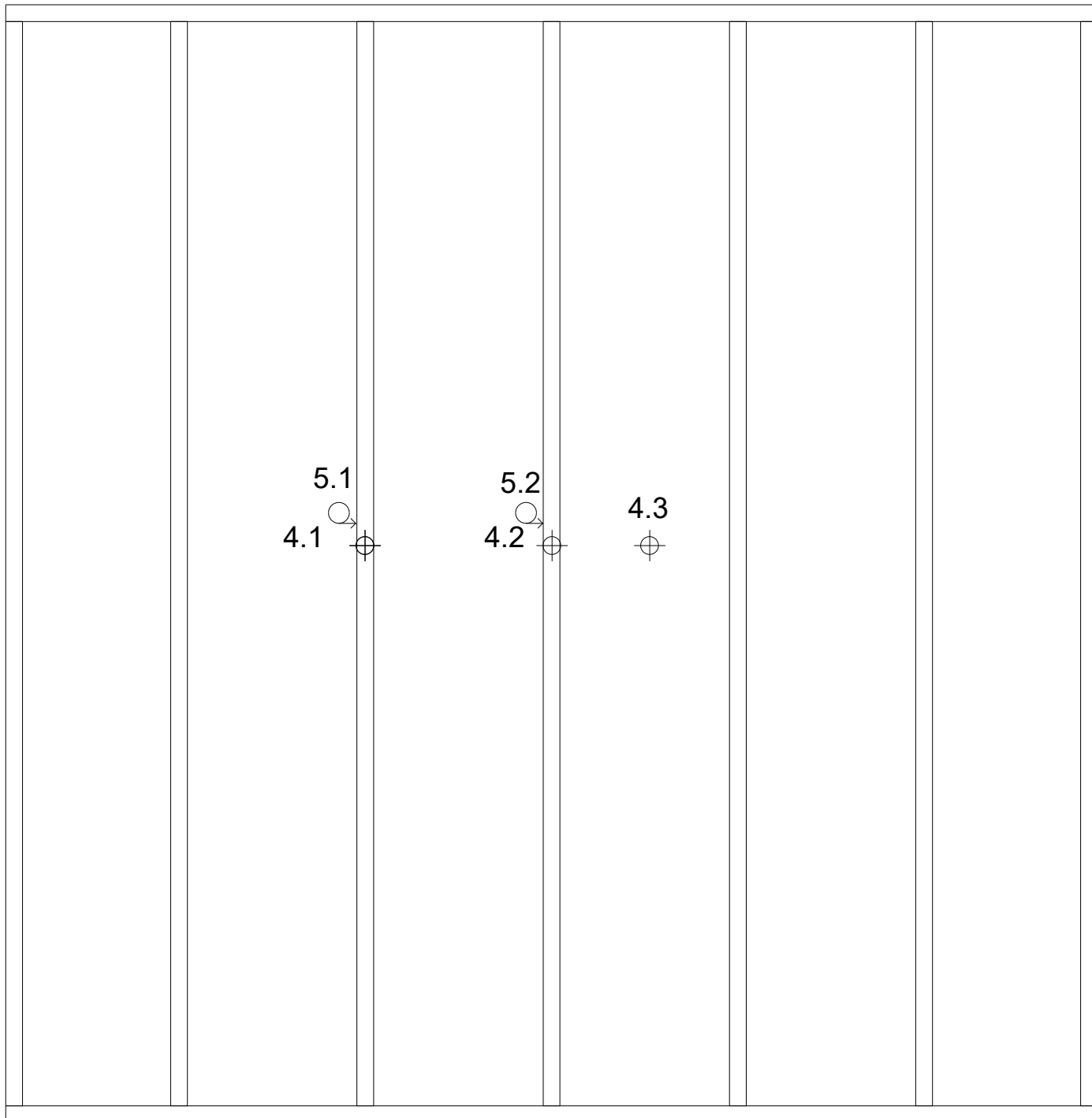
Sponsor: Wood:UpHigh


Subject: Loadbearing wall - inner layer of clay boards - unexposed side


File No.: PGA12247A

Test date: 08-03-2023

Enclosure: 1.2

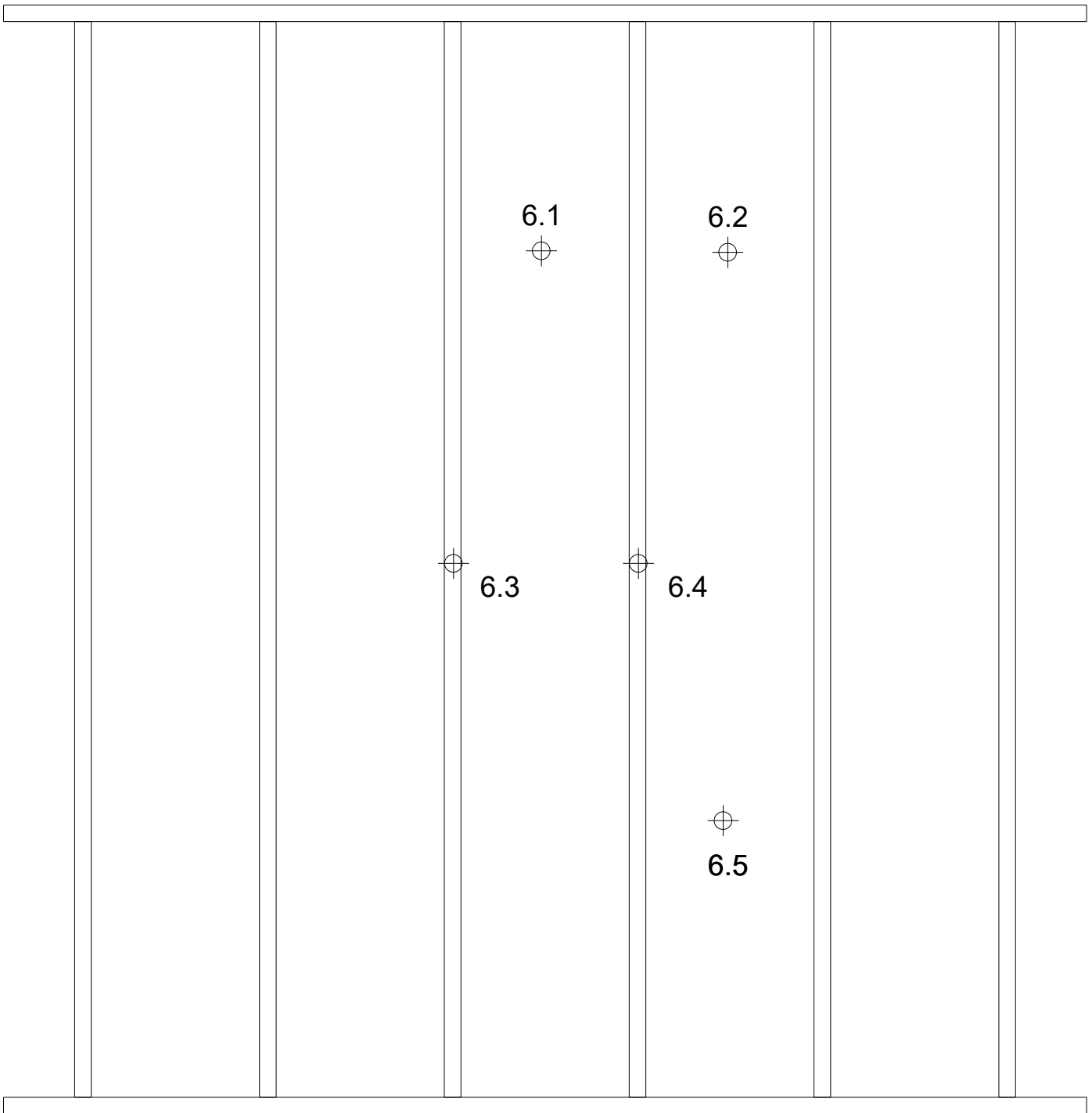


 Placed on the back side of the stud

 internal temperature on the surface of the stud



All measurements are in mm





All measurements are in mm



	<p style="text-align: center;">  7.1 </p> <p style="text-align: center;">  7.2 </p>		

All measurements are in mm



All measurements are in mm



Danish Institute of Fire and Security Technology

Sponsor: Wood:UpHigh

Subject: Loadbearing wall - outer layer of clay boards - exposed side

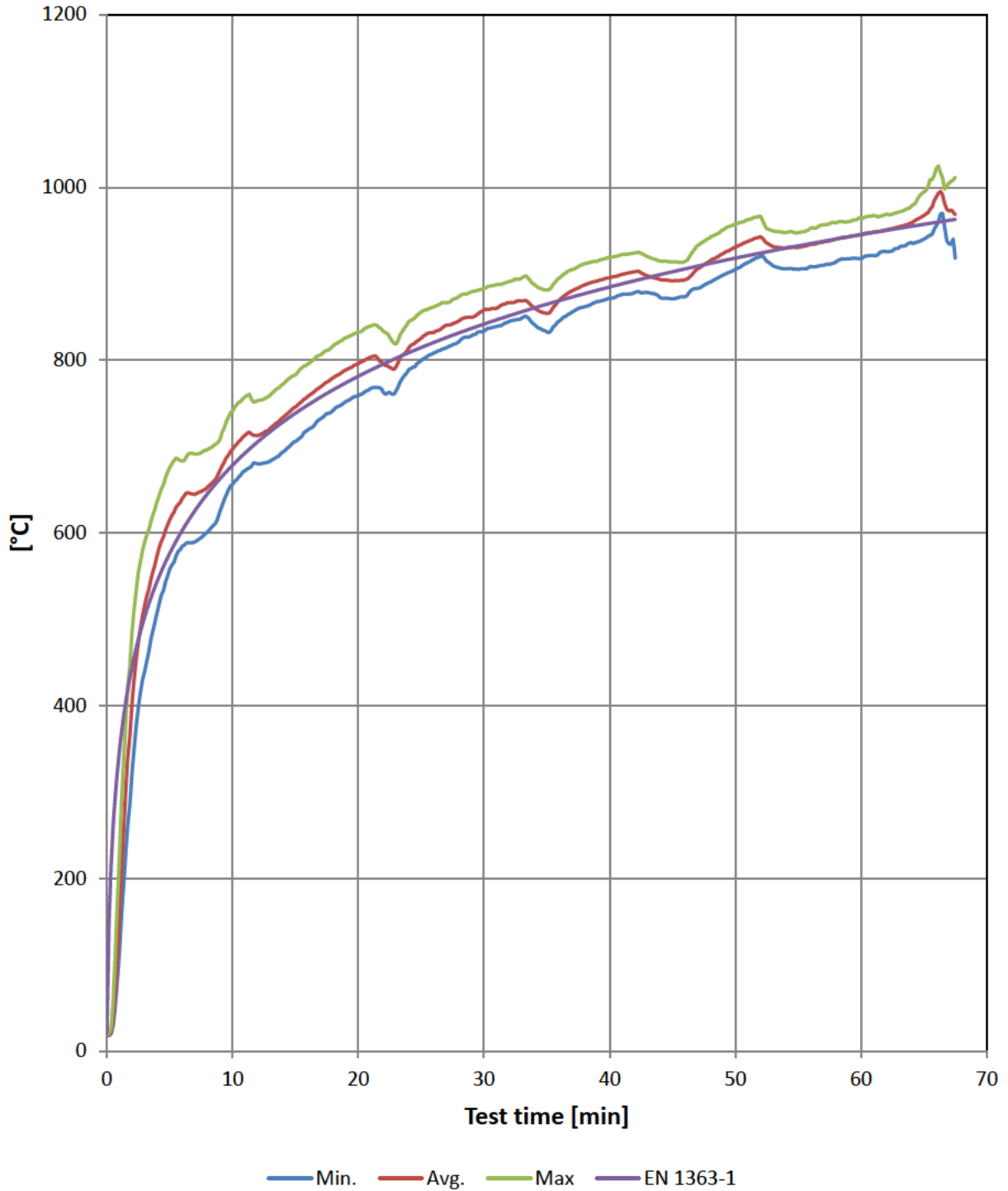
File No.: PGA12247A

Test date: 08-03-2023

Enclosure: 1.6

Furnace temperature

Furnace temperature



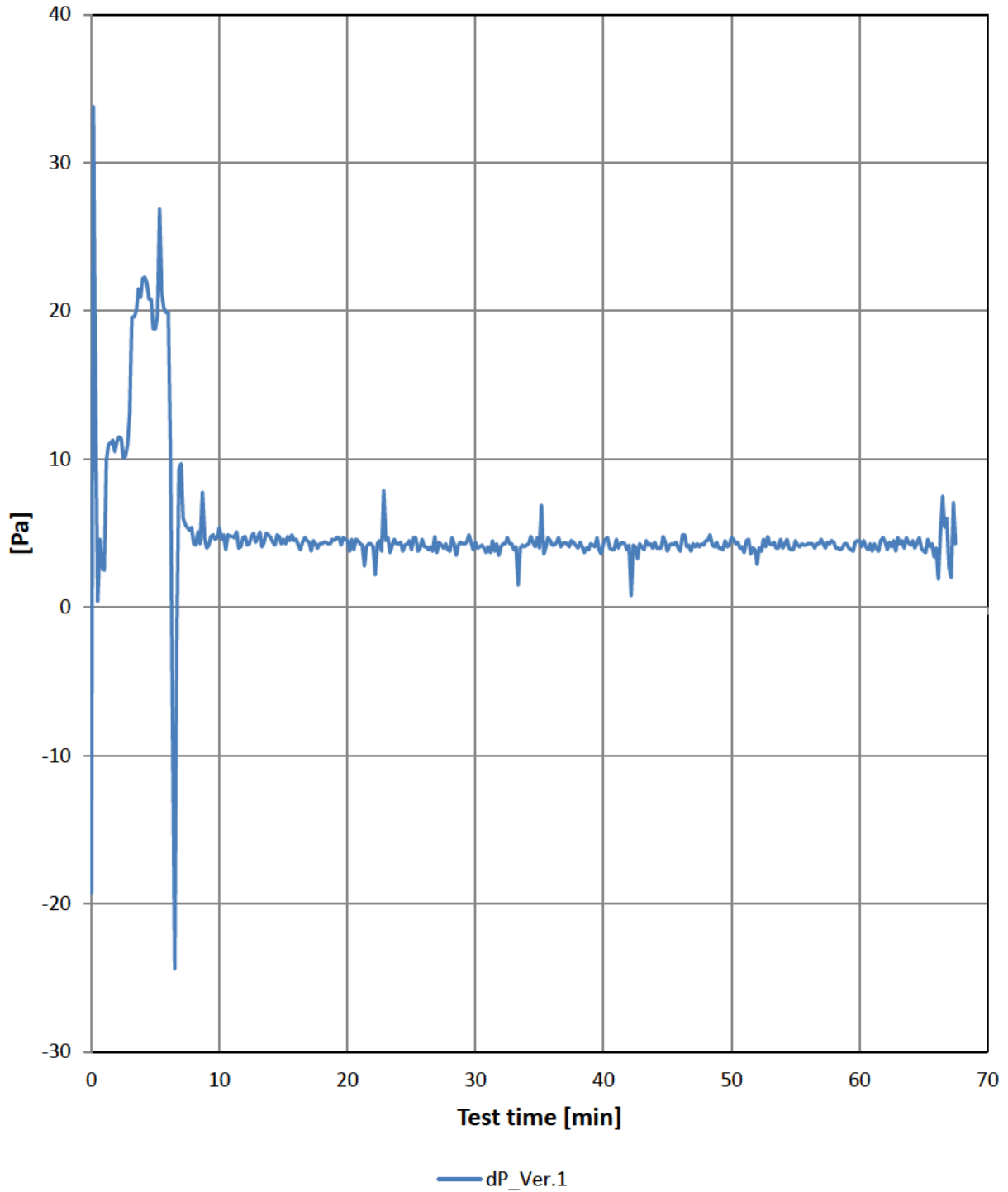
Furnace temperature

Furnace temperature

Time Minutes	Measured			Norm	Area under curve		Dev. [%]	Limit [%]
	Minimum	Average	Maximum	EN 1363-1	Measured	EN 1363-1		
0	18	18	19	20	0	0	0.0	
2	321	401	485	445	350	640	-45.3	
4	508	574	637	544	1363	1639	-16.8	
6	584	640	683	603	2587	2790	-7.3	15
8	601	653	696	645	3880	4041	-4.0	15
10	656	697	741	678	5227	5366	-2.6	15
12	680	713	753	705	6647	6750	-1.5	14
14	694	734	772	728	8090	8185	-1.2	13
15	706	746	783	739	8830	8918	-1.0	13
16	720	758	796	748	9582	9662	-0.8	12
18	742	780	817	766	11120	11176	-0.5	11
20	759	796	832	781	12697	12723	-0.2	10
22	763	796	834	796	14298	14300	0.0	9
24	789	814	844	809	15894	15904	-0.1	8
26	808	832	862	820	17544	17534	0.1	7
28	821	845	873	832	19223	19186	0.2	6
30	834	858	883	842	20925	20859	0.3	5
32	845	867	891	851	22648	22552	0.4	5
34	842	861	888	860	24382	24264	0.5	5
36	845	869	895	869	26099	25994	0.4	5
38	862	887	912	877	27858	27740	0.4	4
40	872	895	919	885	29642	29502	0.5	4
42	878	902	924	892	31440	31279	0.5	4
44	873	893	915	899	33236	33070	0.5	4
46	874	893	914	906	35021	34875	0.4	4
48	890	915	942	912	36830	36692	0.4	4
50	905	931	958	918	38677	38522	0.4	3
52	920	943	967	924	40551	40364	0.5	3
54	906	930	948	930	42418	42218	0.5	3
56	908	934	953	935	44281	44083	0.5	3
58	914	940	959	940	46155	45958	0.4	3
60	918	945	965	945	48041	47844	0.4	3
62	926	951	969	950	49937	49739	0.4	3
64	936	959	978	955	51846	51644	0.4	3
66	956	989	1022	960	53785	53559	0.4	3
67	935	973	1005	962	54771	54520	0.5	3

Vertical furnace pressure

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



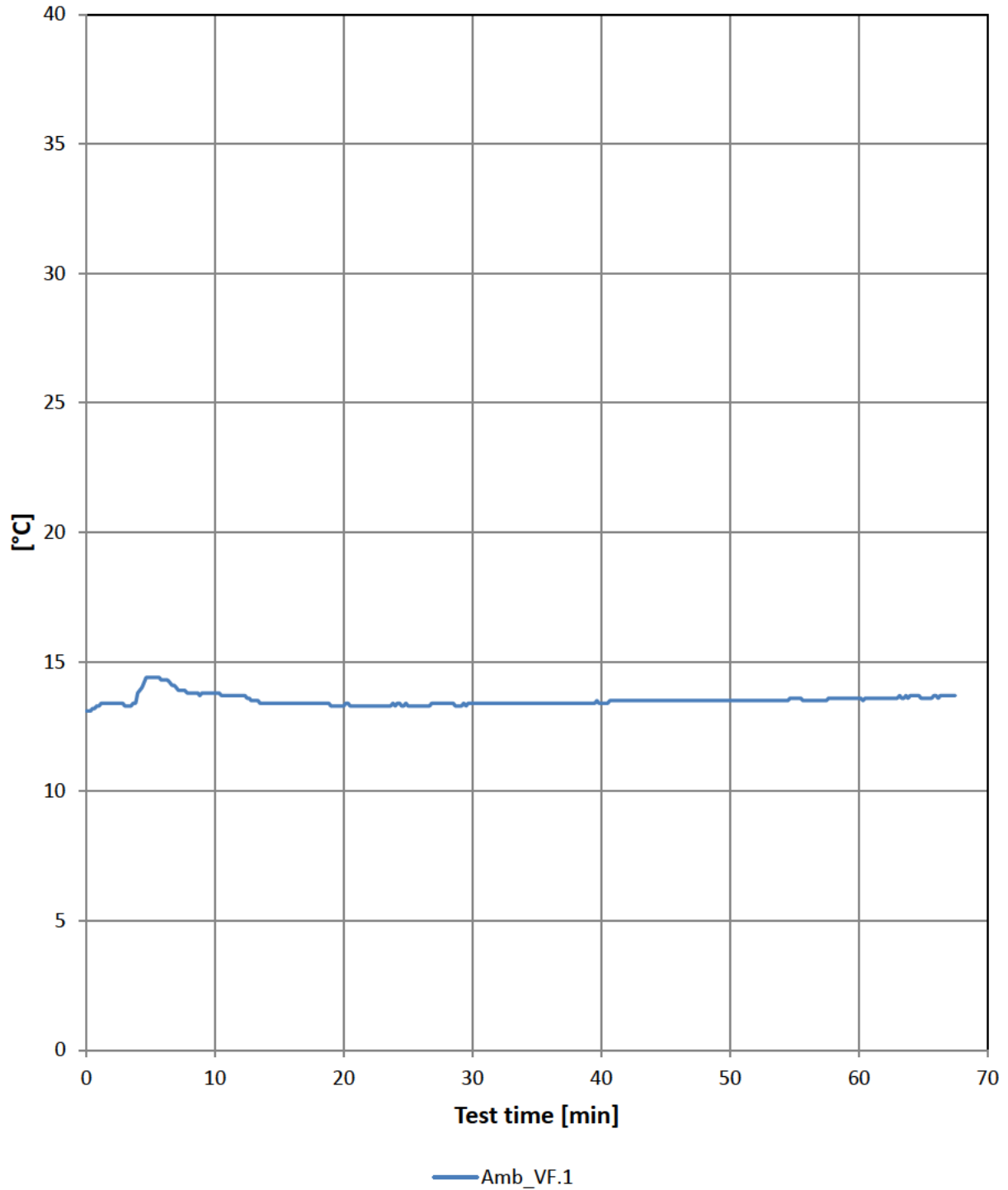
Vertical furnace pressure

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

Min. / Pa	dP_Ver.1
0	-19.3
2	11.2
4	22.2
6	19.9
8	4.3
10	5.4
12	4.8
14	4.7
15	4.6
16	4.6
18	4.3
20	4.5
22	4.1
24	4.3
26	4.1
28	3.8
30	4.4
32	4.1
34	4.2
36	4.2
38	4.0
40	4.3
42	4.2
44	4.4
46	3.8
48	4.5
50	4.7
52	2.9
54	4.0
56	4.3
58	4.4
60	4.5
62	4.4
64	4.2
66	4.0
67	2.7

Ambient temperature

The ambient temperature in the laboratory during the test



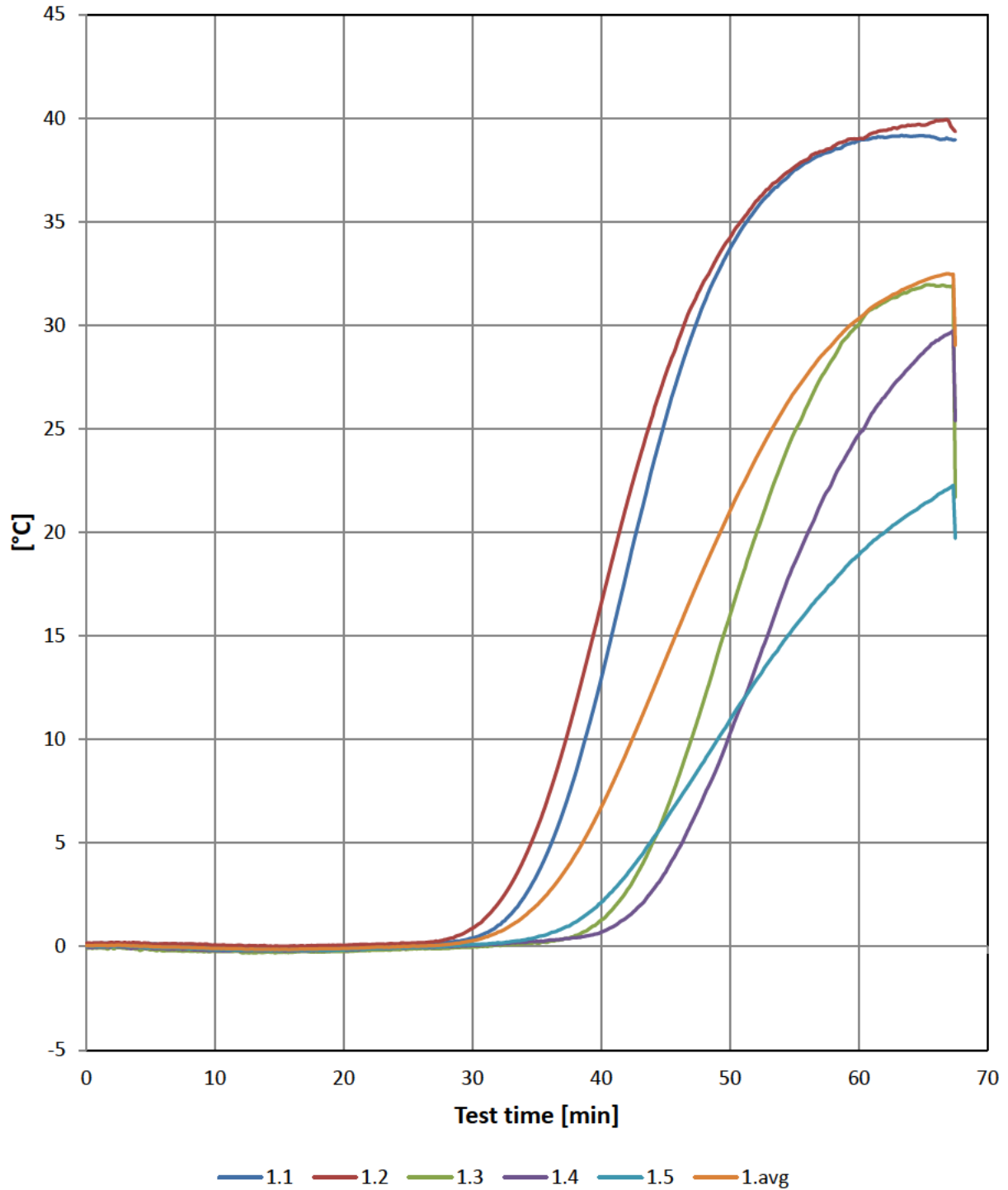
Ambient temperature

The ambient temperature in the laboratory during the test

Min. / °C	Amb VF.1
0	13.1
2	13.4
4	13.8
6	14.3
8	13.8
10	13.8
12	13.7
14	13.4
15	13.4
16	13.4
18	13.4
20	13.3
22	13.3
24	13.3
26	13.3
28	13.4
30	13.4
32	13.4
34	13.4
36	13.4
38	13.4
40	13.4
42	13.5
44	13.5
46	13.5
48	13.5
50	13.5
52	13.5
54	13.5
56	13.5
58	13.6
60	13.6
62	13.6
64	13.7
66	13.7
67	13.7

Average temperature rise

Measured with 5 thermocouples on the unexposed side



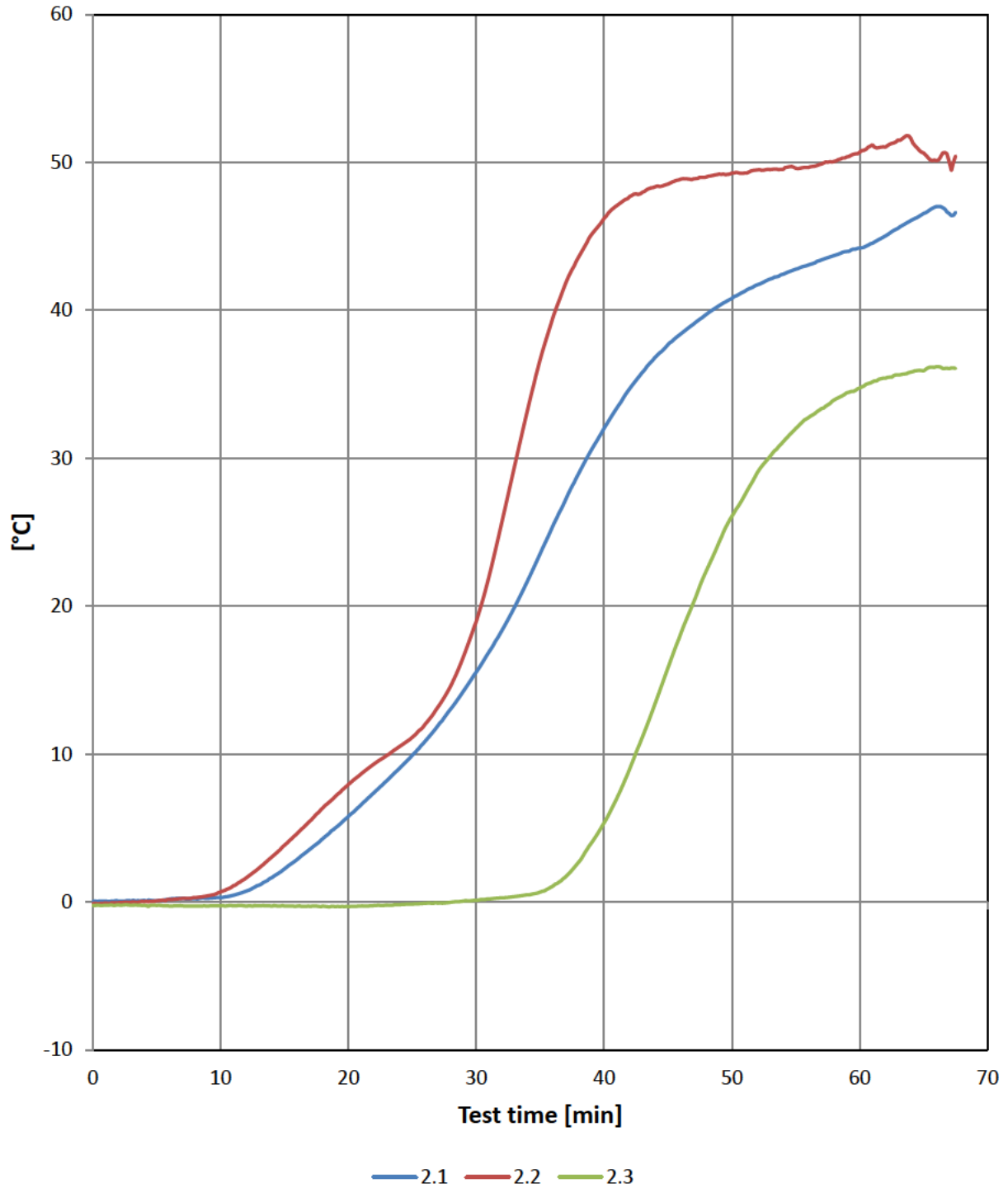
Average temperature rise

Measured with 5 thermocouples on the unexposed side

Min. / °C	1.1	1.2	1.3	1.4	1.5	1.Avg	1.Max
0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0
30	0	1	0	0	0	0	1
32	1	2	0	0	0	1	2
34	2	4	0	0	0	1	4
36	5	7	0	0	1	3	7
38	8	12	1	0	1	4	12
40	13	17	1	1	2	7	17
42	18	21	3	1	3	9	21
44	23	26	5	3	5	12	26
46	28	29	8	5	7	15	29
48	31	32	12	7	9	18	32
50	34	34	16	10	11	21	34
52	36	36	20	13	13	24	36
54	37	37	23	17	15	26	37
56	38	38	26	20	16	28	38
58	38	39	28	23	18	29	39
60	39	39	30	25	19	30	39
62	39	39	31	27	20	31	39
64	39	40	32	28	21	32	40
66	39	40	32	29	22	32	40
67	39	40	32	30	22	32	40
Failure [min]	-	-	-	-	-	-	-
Failure °C	180	180	180	180	180	140	180

Maximum temperature rise

Maximum temperatures on the unexposed side



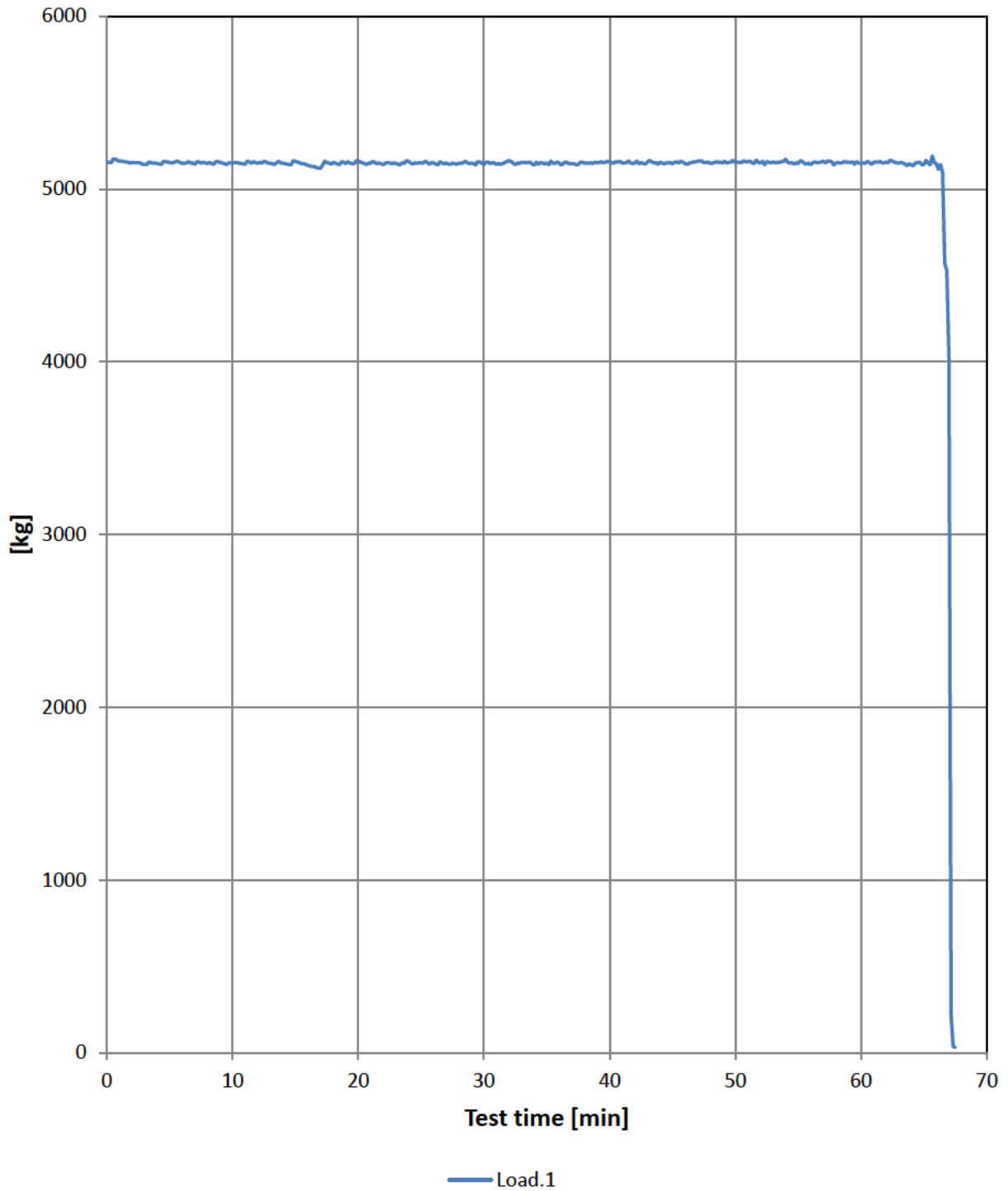
Maximum temperature rise

Maximum temperatures on the unexposed side

Min. / °C	2.1	2.2	2.3	2.Max
0	0	0	0	0
2	0	0	0	0
4	0	0	0	0
6	0	0	0	0
8	0	0	0	0
10	0	1	0	1
12	1	2	0	2
14	2	3	0	3
15	2	4	0	4
16	3	5	0	5
18	4	6	0	6
20	6	8	0	8
22	7	9	0	9
24	9	11	0	11
26	11	12	0	12
28	13	15	0	15
30	16	19	0	19
32	18	26	0	26
34	22	33	0	33
36	25	40	1	40
38	29	44	3	44
40	32	46	5	46
42	35	48	9	48
44	37	48	13	48
46	38	49	18	49
48	40	49	22	49
50	41	49	26	49
52	42	50	29	50
54	42	50	31	50
56	43	50	33	50
58	44	50	34	50
60	44	51	35	51
62	45	51	35	51
64	46	52	36	52
66	47	50	36	50
67	47	50	36	50
Failure [min]	-	-	-	-
Failure °C	180	180	180	180

Load per cylinder

Load per cylinder during test



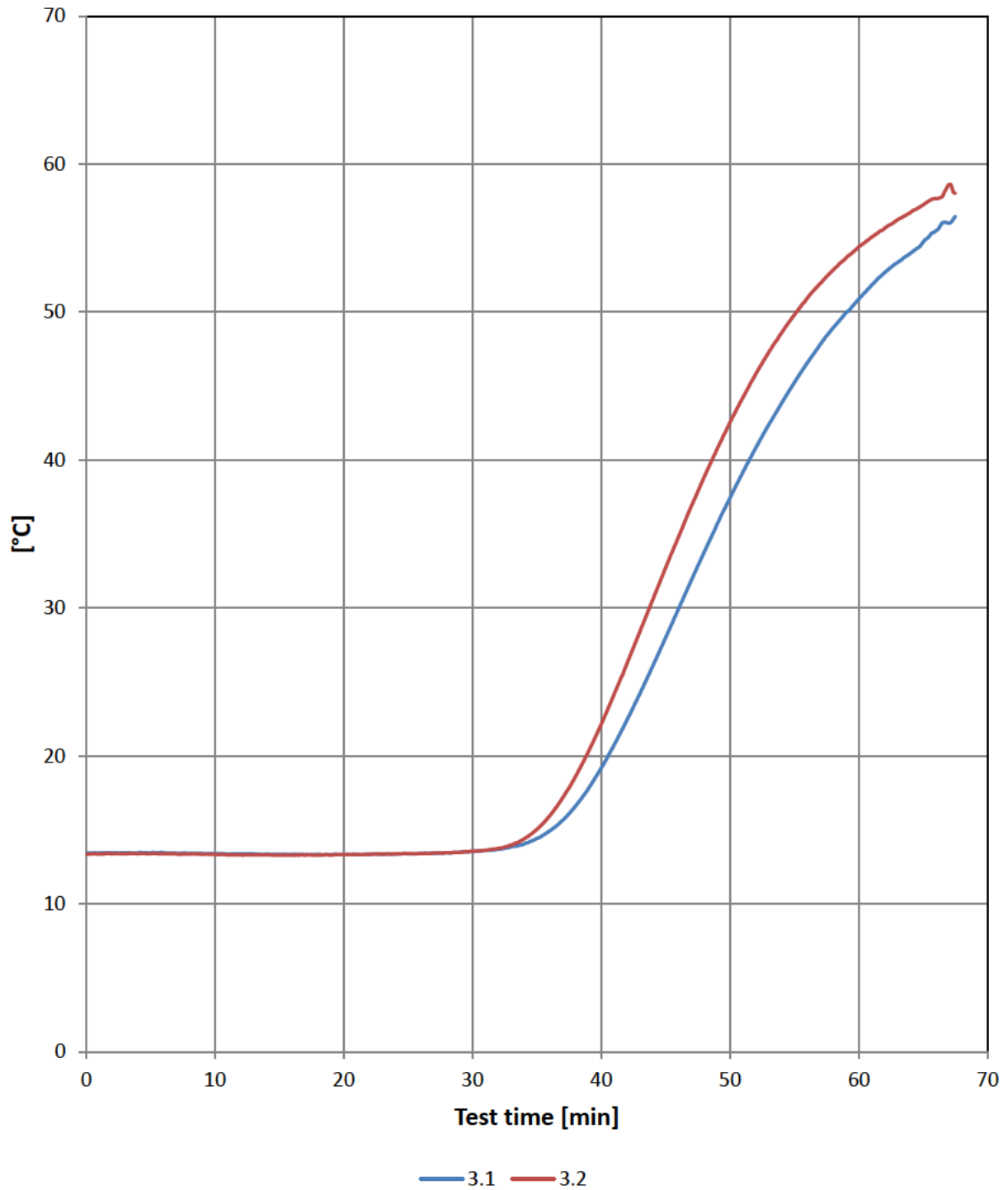
Load per cylinder

Load per cylinder during test

Min. / kg	Load.1
0	5157
2	5155
4	5148
6	5149
8	5149
10	5151
12	5150
14	5150
15	5160
16	5138
18	5152
20	5162
22	5142
24	5160
26	5152
28	5150
30	5142
32	5165
34	5139
36	5150
38	5150
40	5158
42	5151
44	5156
46	5148
48	5150
50	5155
52	5150
54	5173
56	5142
58	5151
60	5149
62	5155
64	5142
66	5148
67	4018

Internal temperature - between clay boards

Placed on center board 250 mm from the edge at each side at mid height



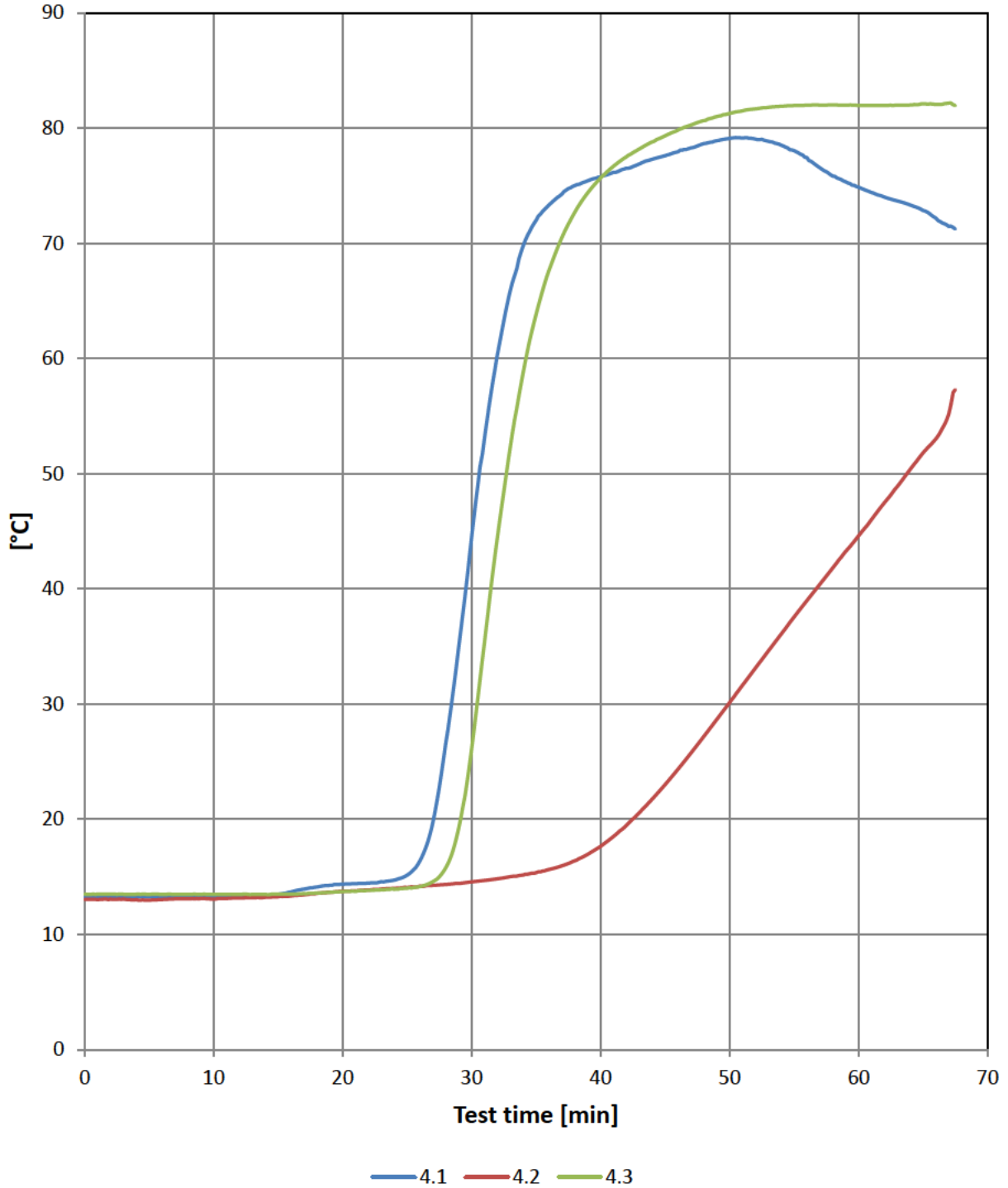
Internal temperature - between clay boards

Placed on center board 250 mm from the edge at each side at mid height

Min. / °C	3.1	3.2	3.Max
0	13	13	13
2	13	13	13
4	13	13	13
6	13	13	13
8	13	13	13
10	13	13	13
12	13	13	13
14	13	13	13
15	13	13	13
16	13	13	13
18	13	13	13
20	13	13	13
22	13	13	13
24	13	13	13
26	13	13	13
28	13	13	13
30	14	14	14
32	14	14	14
34	14	14	14
36	15	16	16
38	17	19	19
40	19	22	22
42	22	26	26
44	26	31	31
46	30	35	35
48	34	39	39
50	37	43	43
52	41	46	46
54	44	49	49
56	47	51	51
58	49	53	53
60	51	54	54
62	53	56	56
64	54	57	57
66	56	58	58
67	56	59	59
Failure [min]	-	-	-
Failure °C	180	180	180

Additional thermocouples - Internal temperature - between studs and clay boards

mid height, 4.1 and 4.2 is placed on stud 2 and 3 from the left, and 4.3 is placed on insulation between stud 3 and 4.



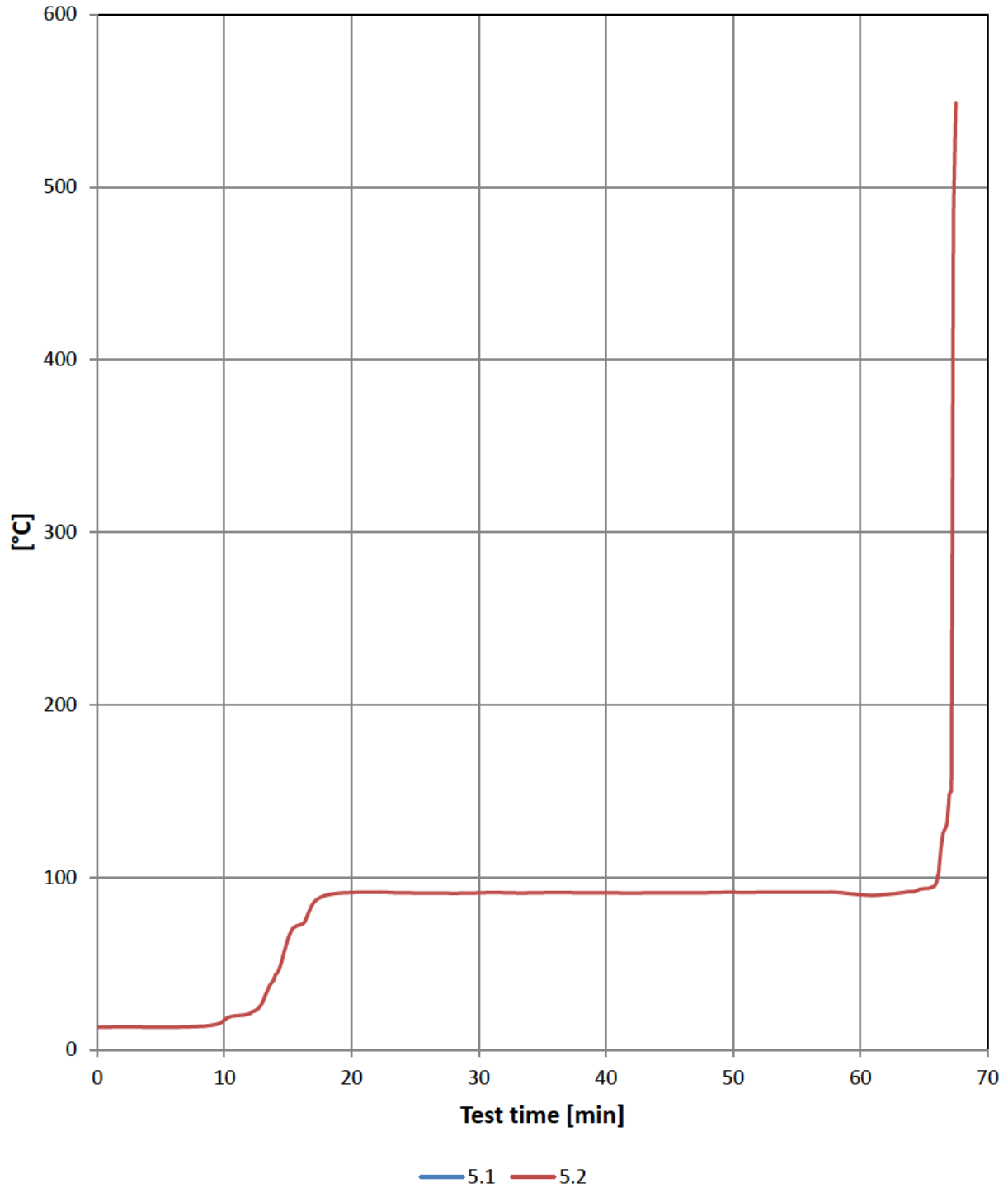
Additional thermocouples - Internal temperature - between studs and clay boards

mid height, 4.1 and 4.2 is placed on stud 2 and 3 from the left, and 4.3 is placed on insulation between stud 3 and 4.

Min. / °C	4.1	4.2	4.3	4.Max
0	13	13	14	14
2	13	13	14	14
4	13	13	13	13
6	13	13	14	14
8	13	13	13	13
10	13	13	13	13
12	13	13	13	13
14	13	13	13	13
15	13	13	13	13
16	14	13	14	14
18	14	14	14	14
20	14	14	14	14
22	14	14	14	14
24	15	14	14	15
26	16	14	14	16
28	27	14	16	27
30	44	15	26	44
32	60	15	44	60
34	70	15	59	70
36	73	16	68	73
38	75	16	73	75
40	76	18	76	76
42	77	19	78	78
44	77	22	79	79
46	78	24	80	80
48	79	27	81	81
50	79	30	81	81
52	79	33	82	82
54	79	36	82	82
56	77	39	82	82
58	76	42	82	82
60	75	45	82	82
62	74	47	82	82
64	73	50	82	82
66	72	53	82	82
67	71	55	82	82
Failure [min]	-	-	-	-
Failure °C	180	180	180	180

Internal temperature - on studs

Placed on the back side of the unexposed wooden studs at stud 3 and 4 from the left.



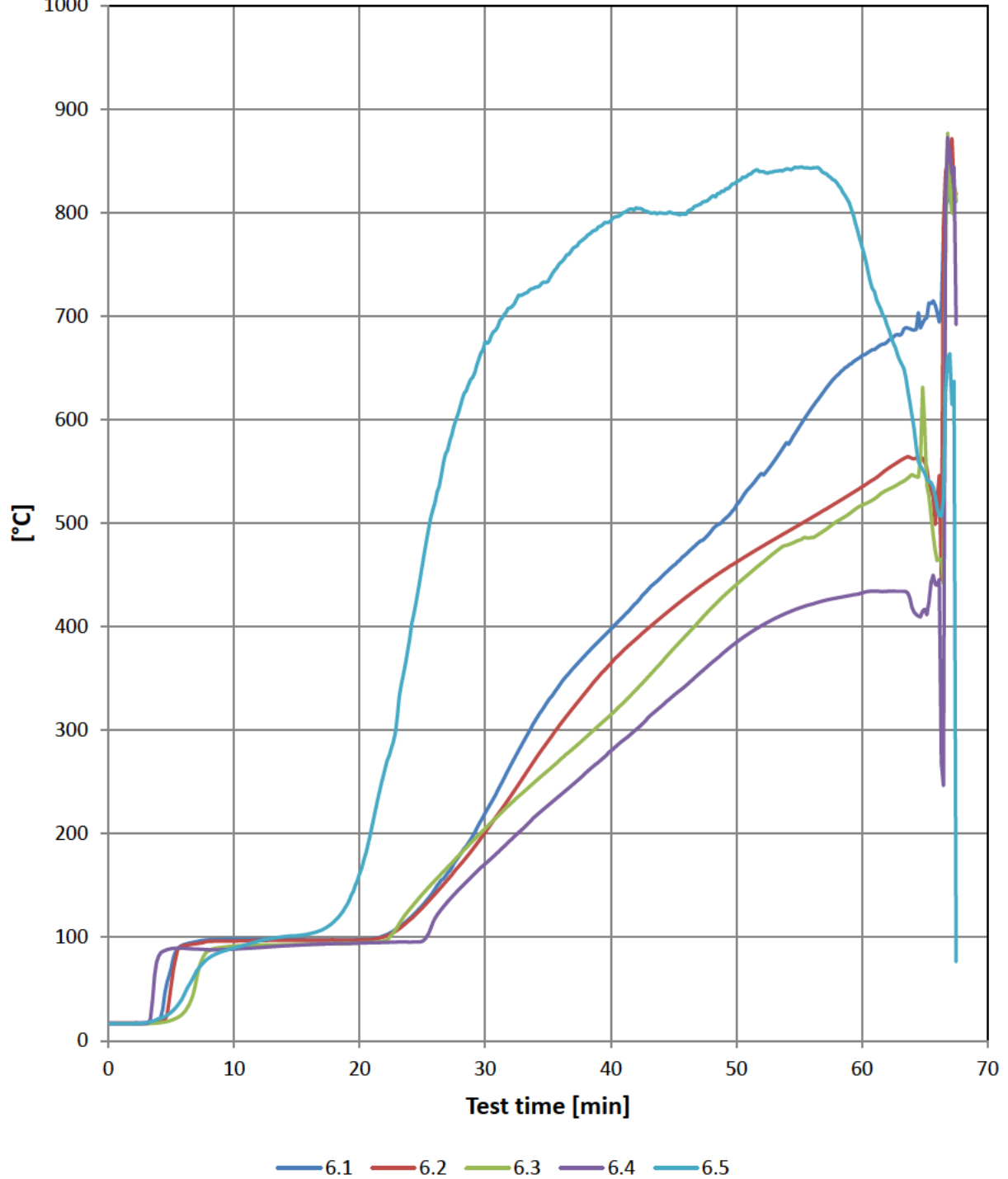
Internal temperature - on studs

Placed on the back side of the unexposed wooden studs at stud 3 and 4 from the left.

Min. / °C	5.1	5.2	5.Max
0	0	13	13
2	0	13	13
4	0	13	13
6	0	13	13
8	0	14	14
10	0	17	17
12	0	21	21
14	0	43	43
15	0	64	64
16	0	73	73
18	0	90	90
20	0	91	91
22	0	91	91
24	0	91	91
26	0	91	91
28	0	91	91
30	0	91	91
32	0	91	91
34	0	91	91
36	0	91	91
38	0	91	91
40	0	91	91
42	0	91	91
44	0	91	91
46	0	91	91
48	0	91	91
50	0	91	91
52	0	91	91
54	0	91	91
56	0	91	91
58	0	91	91
60	0	90	90
62	0	90	90
64	0	92	92
66	0	97	97
67	0	148	148
Failure [min]	-	67.17	67.17
Failure °C	180	180	180

Additional thermocouples - Internal temperature - between studs and clay board exposed side

6.1 and 6.2 is placed 750 mm from top on insulation between 2 and 3, and 3 and 4 respectively. 6.3 and 6.4 is placed mid height on studs 2 and 3 from the left. 6.5 is placed 750 mm from bottom on 1000



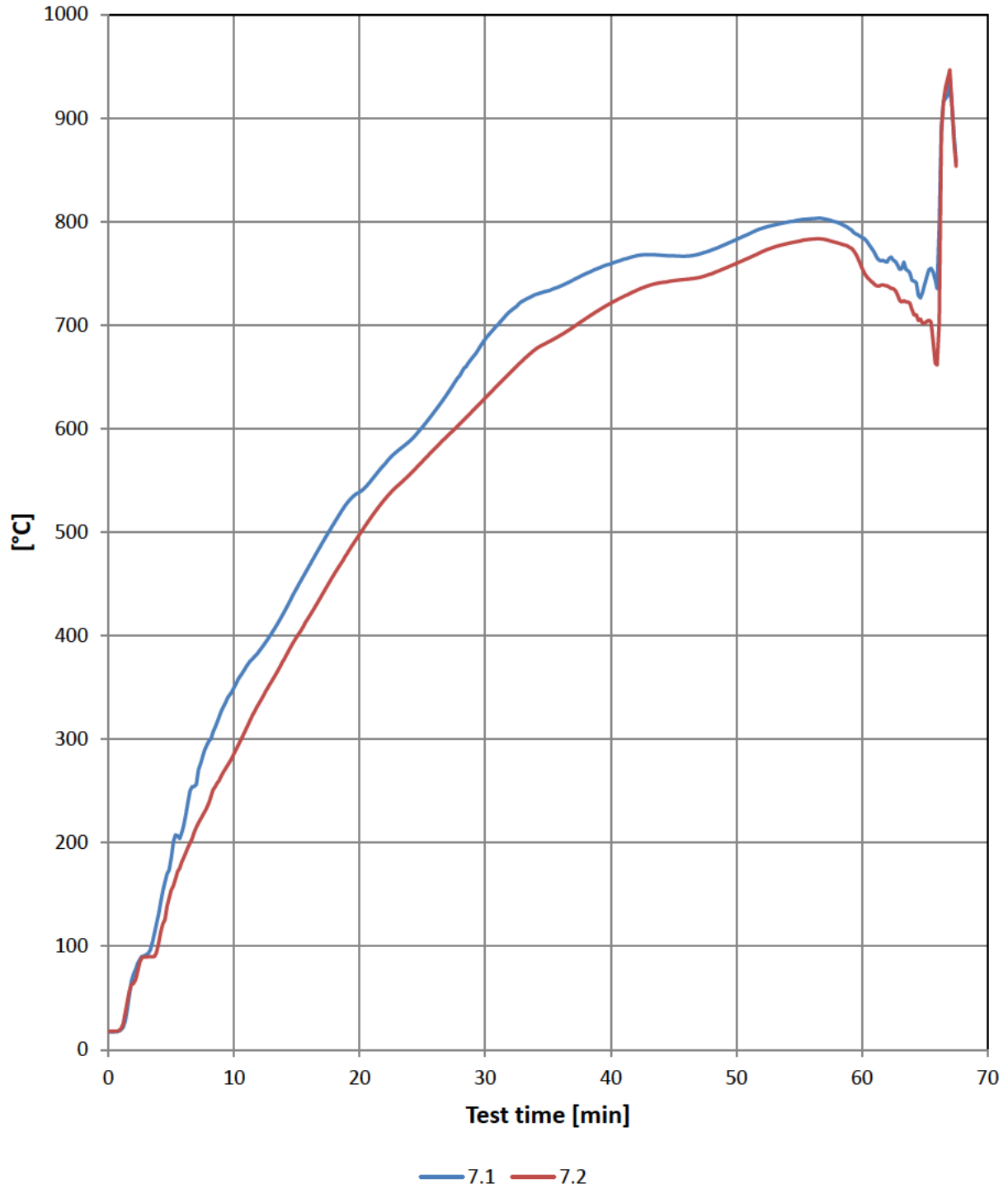
Additional thermocouples - Internal temperature - between studs and clay board exposed side

6.1 and 6.2 is placed 750 mm from top on insulation between 2 and 3, and 3 and 4 respectively. 6.3 and 6.4 is placed mid height on studs 2 and 3 from the left. 6.5 is placed 750 mm from bottom on

Min. / °C	6.1	6.2	6.3	6.4	6.5	6.Max
0	17	17	17	16	17	17
2	17	17	17	16	17	17
4	21	18	17	82	21	82
6	93	92	27	89	44	93
8	98	96	87	88	80	98
10	98	96	92	89	90	98
12	98	97	93	90	96	98
14	98	97	93	92	101	101
15	98	97	93	92	102	102
16	98	97	93	93	103	103
18	98	97	94	94	116	116
20	98	98	95	94	162	162
22	102	101	97	95	261	261
24	118	117	127	95	389	389
26	147	142	155	118	520	520
28	180	170	180	147	612	612
30	220	201	205	171	675	675
32	265	236	229	194	708	708
34	310	272	251	217	728	728
36	345	306	272	237	752	752
38	373	337	293	259	776	776
40	398	365	315	280	792	792
42	423	388	339	301	805	805
44	448	409	365	323	800	800
46	470	428	392	343	798	798
48	493	446	418	365	815	815
50	518	462	441	385	830	830
52	548	477	461	401	840	840
54	578	491	479	413	843	843
56	611	506	486	422	843	843
58	643	520	502	428	829	829
60	662	535	518	433	768	768
62	675	552	532	434	691	691
64	687	562	547	419	604	687
66	704	522	464	440	514	704
67	831	864	821	857	664	864
Failure [min]	28.00	28.67	28.00	30.83	20.33	20.33
Failure °C	180	180	180	180	180	180

Additional thermocouples - Internal temperature - between clay boards exposed side

Placed on the left side full board 250 mm from the edge at each side at mid height of construction

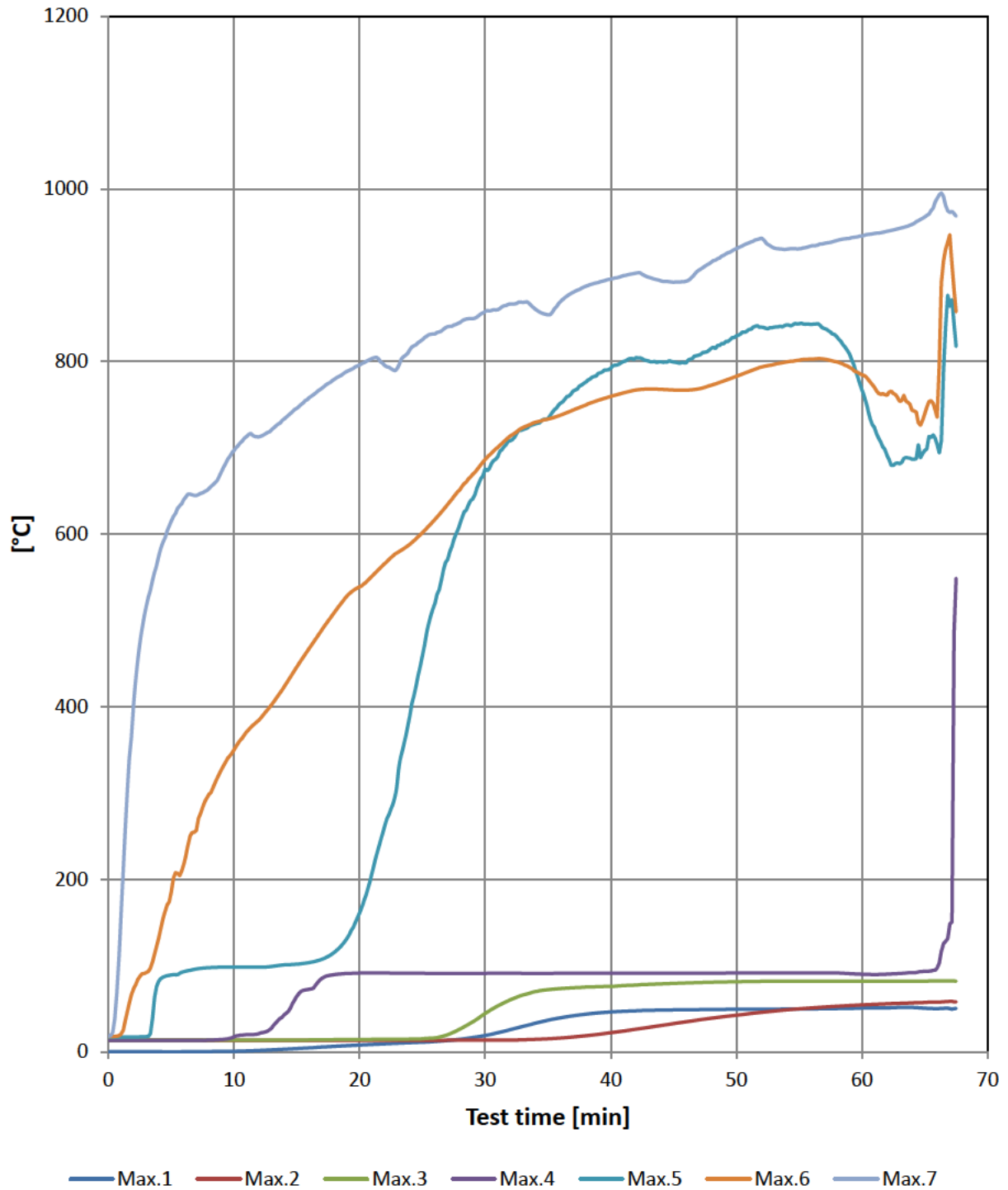


Additional thermocouples - Internal temperature - between clay boards exposed side

Placed on the left side full board 250 mm from the edge at each side at mid height of construction

Min. / °C	7.1	7.2	7.Max
0	18	18	18
2	73	64	73
4	131	103	131
6	217	185	217
8	298	239	298
10	350	287	350
12	385	335	385
14	423	378	423
15	446	399	446
16	468	419	468
18	510	460	510
20	539	498	539
22	566	532	566
24	588	556	588
26	617	581	617
28	652	605	652
30	687	630	687
32	714	654	714
34	730	677	730
36	738	690	738
38	750	706	750
40	759	721	759
42	767	733	767
44	768	741	768
46	767	744	767
48	773	750	773
50	783	760	783
52	794	771	794
54	800	779	800
56	803	783	803
58	800	780	800
60	785	756	785
62	761	738	761
64	743	715	743
66	735	662	735
67	940	947	947
Failure [min]	4.83	5.67	4.83
Failure °C	180	180	180

Maximum temperature in the construction layers

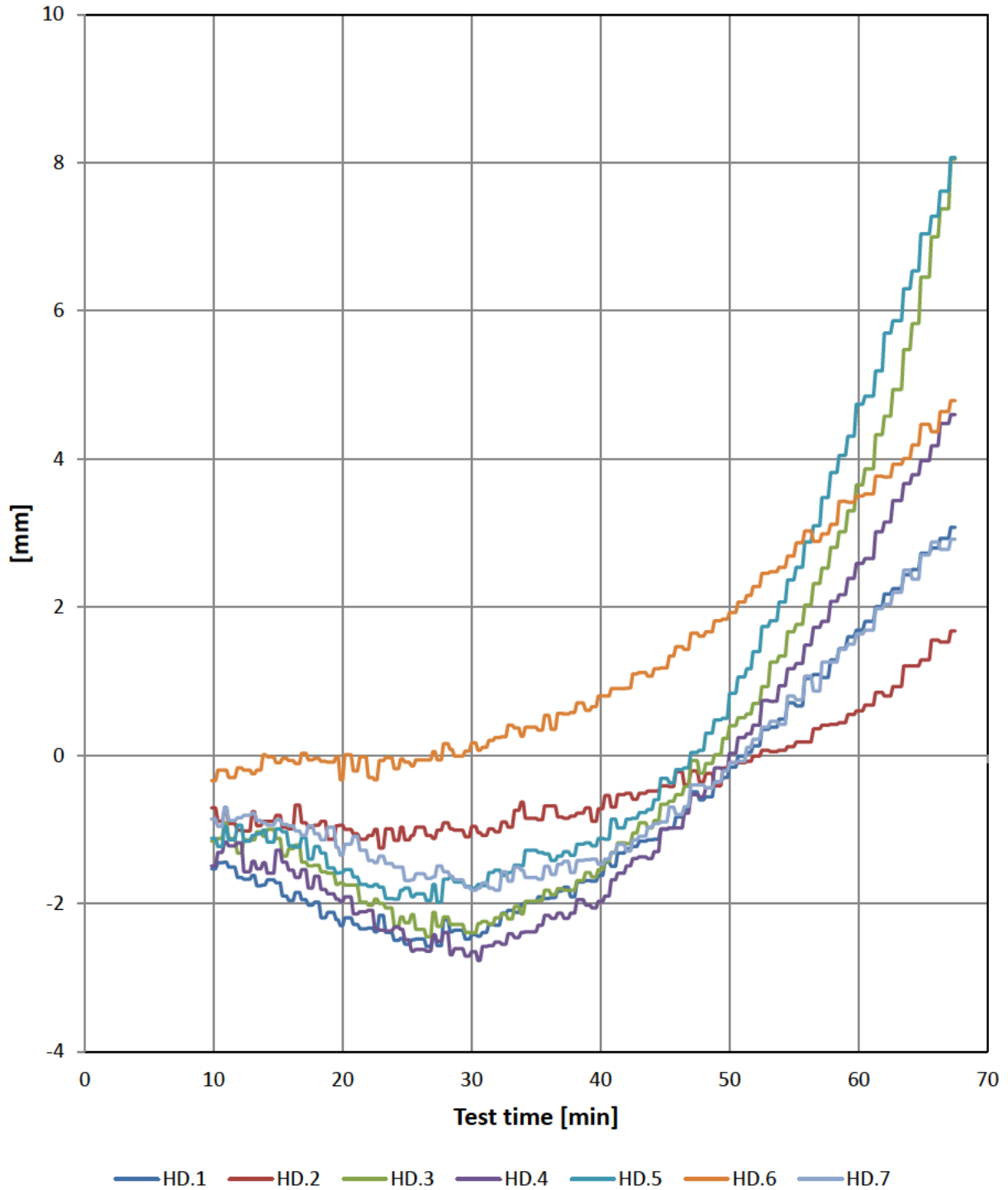


Maximum temperature in the construction layers

Min. / °C	Max.1	Max.2	Max.3	Max.4	Max.5	Max.6	Max.7
0	0	13	14	13	17	18	18
2	0	13	14	13	17	73	401
4	0	13	13	13	82	131	574
6	0	13	14	13	93	217	640
8	0	13	13	14	98	298	653
10	1	13	13	17	98	350	697
12	2	13	13	21	98	385	713
14	3	13	13	43	101	423	734
15	4	13	13	64	102	446	746
16	5	13	14	73	103	468	758
18	6	13	14	90	116	510	780
20	8	13	14	91	162	539	796
22	9	13	14	91	261	566	796
24	11	13	15	91	389	588	814
26	12	13	16	91	520	617	832
28	15	13	27	91	612	652	845
30	19	14	44	91	675	687	858
32	26	14	60	91	708	714	867
34	33	14	70	91	728	730	861
36	40	16	73	91	752	738	869
38	44	19	75	91	776	750	887
40	46	22	76	91	792	759	895
42	48	26	78	91	805	767	902
44	48	31	79	91	800	768	893
46	49	35	80	91	798	767	893
48	49	39	81	91	815	773	915
50	49	43	81	91	830	783	931
52	50	46	82	91	840	794	943
54	50	49	82	91	843	800	930
56	50	51	82	91	843	803	934
58	50	53	82	91	829	800	940
60	51	54	82	90	768	785	945
62	51	56	82	90	691	761	951
64	52	57	82	92	687	743	959
66	50	58	82	97	704	735	989
67	50	59	82	148	864	947	973

Horizontal deformation

Negative values indicate movement towards the furnace



The deformation data malfunctions the first 10 min of the test.

Horizontal deformation

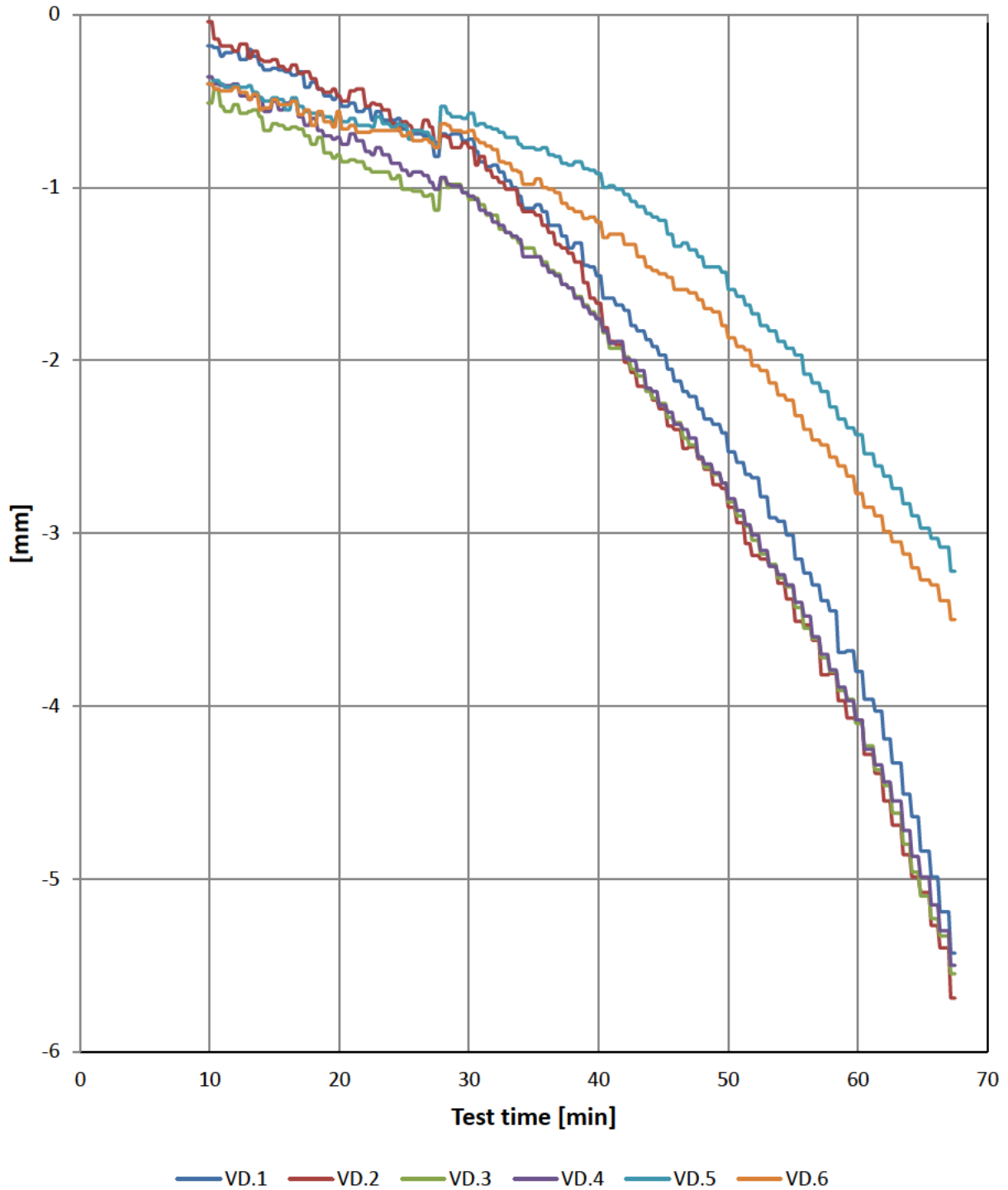
Negative values indicate movement towards the furnace

Min. / mm	HD.1	HD.2	HD.3	HD.4	HD.5	HD.6	HD.7
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	-1.5	-0.7	-1.2	-1.5	-1.1	-0.3	-0.9
12	-1.7	-1.0	-1.3	-1.2	-0.9	-0.2	-0.8
14	-1.8	-0.9	-1.1	-1.5	-1.0	0.0	-0.9
15	-1.7	-0.8	-1.1	-1.3	-1.0	-0.1	-0.9
16	-2.0	-1.0	-1.3	-1.6	-1.2	-0.1	-1.0
18	-2.0	-0.9	-1.5	-1.6	-1.2	0.0	-1.1
20	-2.3	-0.9	-1.7	-2.0	-1.6	-0.3	-1.4
22	-2.3	-1.1	-2.0	-2.1	-1.8	-0.3	-1.4
24	-2.5	-1.2	-2.3	-2.3	-1.9	-0.2	-1.5
26	-2.5	-1.0	-2.4	-2.6	-1.9	-0.1	-1.6
28	-2.2	-0.9	-2.2	-2.4	-1.7	0.2	-1.6
30	-2.4	-1.0	-2.4	-2.7	-1.8	0.2	-1.8
32	-2.3	-1.0	-2.2	-2.5	-1.6	0.2	-1.8
34	-2.0	-0.6	-2.1	-2.4	-1.5	0.3	-1.6
36	-1.9	-0.7	-1.8	-2.2	-1.3	0.5	-1.5
38	-1.9	-0.8	-1.8	-2.1	-1.4	0.6	-1.6
40	-1.6	-0.7	-1.5	-2.0	-1.1	0.8	-1.5
42	-1.3	-0.5	-1.2	-1.5	-0.9	0.9	-1.3
44	-1.1	-0.5	-1.0	-1.4	-0.7	1.1	-1.0
46	-0.8	-0.2	-0.5	-1.0	-0.2	1.5	-0.8
48	-0.6	-0.4	-0.2	-0.6	0.1	1.6	-0.4
50	-0.2	-0.1	0.4	0.0	0.8	1.9	-0.1
52	0.1	0.0	0.7	0.4	1.4	2.3	0.2
54	0.5	0.1	1.3	0.9	2.1	2.5	0.4
56	1.0	0.2	2.0	1.5	2.9	3.0	1.1
58	1.3	0.4	2.8	2.1	3.8	3.1	1.3
60	1.7	0.6	3.7	2.6	4.7	3.5	1.6
62	2.2	0.8	4.6	3.2	5.7	3.8	2.0
64	2.4	1.2	5.5	3.7	6.3	4.0	2.5
66	2.8	1.6	7.0	4.2	7.3	4.4	2.9
67	2.9	1.5	7.4	4.5	7.6	4.6	2.8

The deformation data malfunctions the first 10 min of the test.

Vertical deformation

Negative values indicate downwards movement



The deformation data malfunctions the first 10 min of the test.

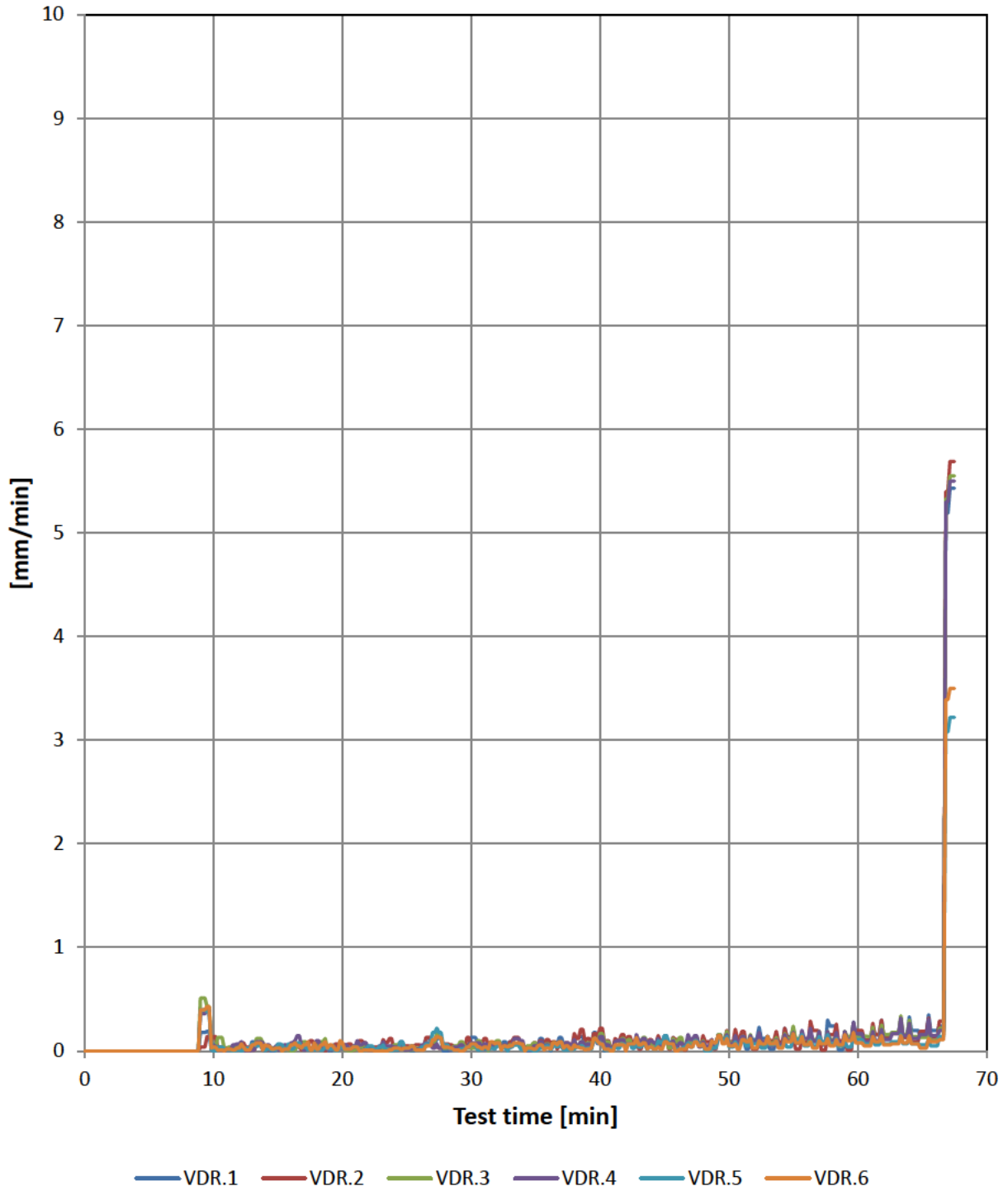
Vertical deformation

Negative values indicate downwards movement

Min. / mm	VD.1	VD.2	VD.3	VD.4	VD.5	VD.6	VD.Max
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	-0.2	0.0	-0.5	-0.4	-0.4	-0.4	0.0
12	-0.2	-0.2	-0.5	-0.4	-0.4	-0.4	-0.2
14	-0.3	-0.3	-0.6	-0.5	-0.5	-0.6	-0.3
15	-0.3	-0.3	-0.6	-0.5	-0.5	-0.5	-0.3
16	-0.3	-0.3	-0.7	-0.5	-0.6	-0.5	-0.3
18	-0.4	-0.4	-0.8	-0.6	-0.6	-0.6	-0.4
20	-0.5	-0.5	-0.8	-0.7	-0.6	-0.6	-0.5
22	-0.5	-0.5	-0.9	-0.8	-0.6	-0.7	-0.5
24	-0.6	-0.6	-1.0	-0.9	-0.6	-0.7	-0.6
26	-0.7	-0.7	-1.0	-0.9	-0.7	-0.7	-0.7
28	-0.7	-0.7	-1.0	-0.9	-0.5	-0.6	-0.5
30	-0.7	-0.8	-1.1	-1.1	-0.6	-0.7	-0.6
32	-0.9	-0.9	-1.2	-1.2	-0.7	-0.8	-0.7
34	-1.1	-1.1	-1.3	-1.3	-0.8	-0.9	-0.8
36	-1.1	-1.2	-1.4	-1.5	-0.8	-1.0	-0.8
38	-1.4	-1.4	-1.6	-1.6	-0.9	-1.1	-0.9
40	-1.5	-1.7	-1.8	-1.8	-0.9	-1.2	-0.9
42	-1.7	-2.0	-2.0	-2.0	-1.0	-1.3	-1.0
44	-1.9	-2.2	-2.2	-2.2	-1.2	-1.5	-1.2
46	-2.1	-2.4	-2.4	-2.4	-1.3	-1.6	-1.3
48	-2.3	-2.6	-2.6	-2.6	-1.4	-1.7	-1.4
50	-2.5	-2.9	-2.8	-2.8	-1.6	-1.9	-1.6
52	-2.7	-3.1	-3.0	-3.0	-1.7	-2.0	-1.7
54	-2.9	-3.3	-3.3	-3.2	-1.9	-2.2	-1.9
56	-3.2	-3.5	-3.6	-3.5	-2.1	-2.4	-2.1
58	-3.5	-3.8	-3.8	-3.8	-2.3	-2.6	-2.3
60	-3.8	-4.1	-4.1	-4.1	-2.4	-2.8	-2.4
62	-4.2	-4.6	-4.5	-4.4	-2.7	-3.0	-2.7
64	-4.5	-4.9	-4.8	-4.7	-2.8	-3.1	-2.8
66	-5.0	-5.3	-5.2	-5.2	-3.0	-3.3	-3.0
67	-5.2	-5.4	-5.3	-5.3	-3.1	-3.4	-3.1
Failure [min]	-	-	-	-	-	-	-
Failuremm	30.0	30.0	30.0	30.0	30.0	30.0	30.0

The deformation data malfunctions the first 10 min of the test.

Vertical deformation rate



The deformation data malfunctions the first 10 min of the test.

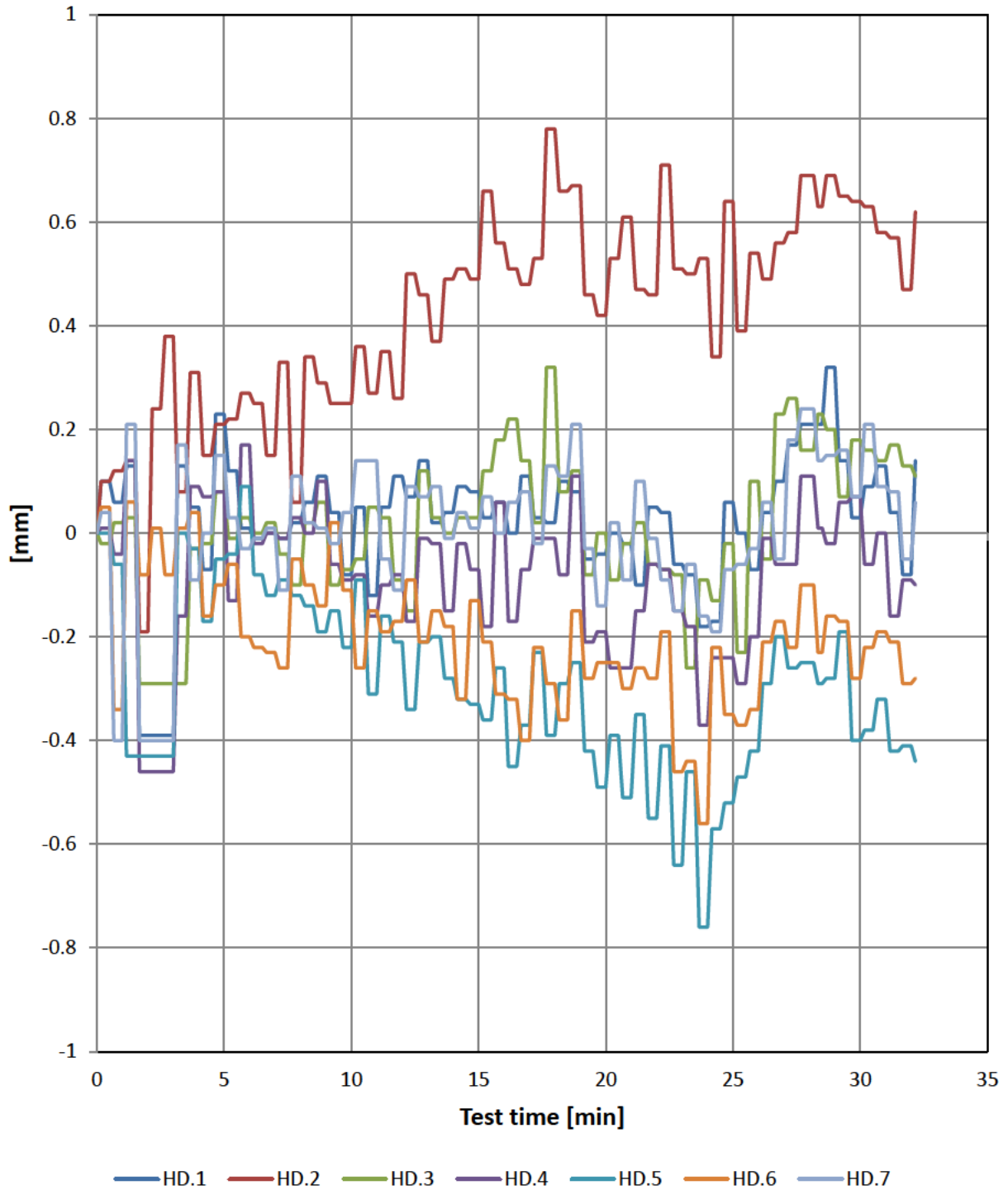
Vertical deformation rate

Min. / mm/min	VDR.1	VDR.2	VDR.3	VDR.4	VDR.5	VDR.6	VDR.Max
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.06	0.14	0.02	0.05	0.00	0.04	0.14
12	0.05	0.04	0.05	0.07	0.01	0.03	0.07
14	0.02	0.00	0.04	0.02	0.00	0.06	0.06
15	0.02	0.06	0.03	0.01	0.07	0.03	0.07
16	0.00	0.02	0.00	0.08	0.02	0.06	0.08
18	0.08	0.08	0.05	0.10	0.02	0.02	0.10
20	0.04	0.03	0.03	0.02	0.03	0.08	0.08
22	0.02	0.01	0.02	0.02	0.05	0.01	0.05
24	0.05	0.01	0.06	0.04	0.01	0.03	0.06
26	0.01	0.06	0.03	0.02	0.01	0.01	0.06
28	0.00	0.07	0.03	0.05	0.06	0.04	0.07
30	0.13	0.05	0.03	0.08	0.06	0.07	0.13
32	0.09	0.07	0.10	0.06	0.05	0.08	0.10
34	0.07	0.04	0.03	0.10	0.02	0.07	0.10
36	0.08	0.11	0.07	0.06	0.05	0.03	0.11
38	0.10	0.17	0.10	0.11	0.02	0.06	0.17
40	0.13	0.22	0.17	0.14	0.07	0.07	0.22
42	0.09	0.06	0.07	0.01	0.04	0.00	0.09
44	0.09	0.11	0.07	0.10	0.04	0.04	0.11
46	0.06	0.11	0.09	0.03	0.02	0.00	0.11
48	0.09	0.15	0.10	0.09	0.06	0.07	0.15
50	0.06	0.09	0.08	0.07	0.04	0.05	0.09
52	0.11	0.02	0.08	0.09	0.07	0.03	0.11
54	0.08	0.09	0.05	0.06	0.04	0.03	0.09
56	0.07	0.09	0.06	0.12	0.05	0.06	0.12
58	0.24	0.16	0.11	0.10	0.07	0.05	0.24
60	0.16	0.20	0.13	0.17	0.11	0.08	0.20
62	0.14	0.14	0.16	0.11	0.07	0.06	0.16
64	0.33	0.22	0.30	0.27	0.14	0.15	0.33
66	0.20	0.13	0.10	0.15	0.05	0.09	0.20
67	5.19	5.40	5.33	5.30	3.08	3.39	5.40
Failure [min]	-	-	-	-	-	-	-
Failuremm/mi	9.00	9.00	9.00	9.00	9.00	9.00	9.00

The deformation data malfunctions the first 10 min of the test.

Horizontal deformation during loading

Negative values indicate movement towards the furnace



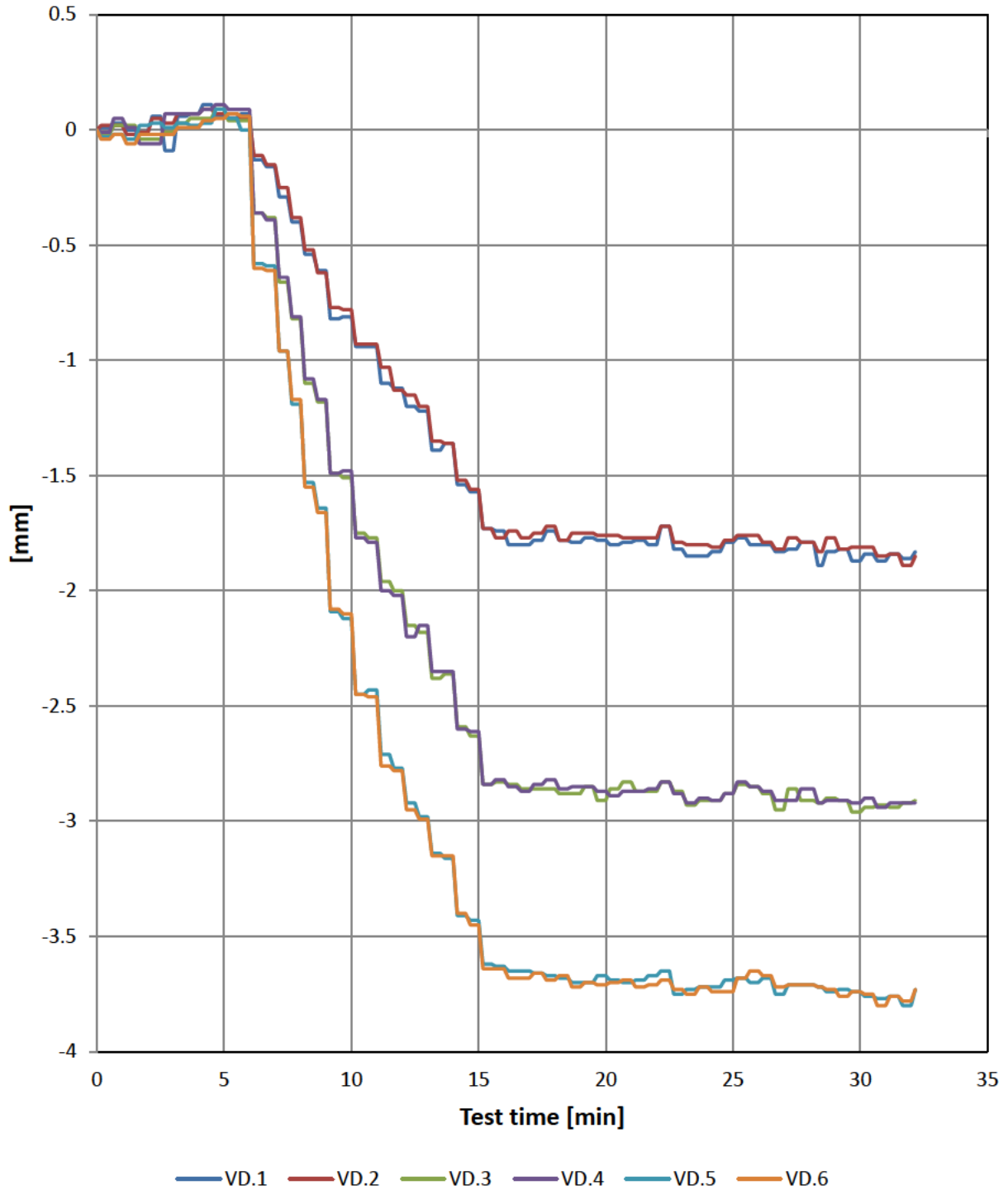
Horizontal deformation during loading

Negative values indicate movement towards the furnace

Min. / mm	HD.1	HD.2	HD.3	HD.4	HD.5	HD.6	HD.7
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.1	0.1	0.0	0.0	-0.1	-0.3	-0.4
2	-0.4	-0.2	-0.3	-0.5	-0.4	-0.1	-0.4
3	-0.4	0.4	-0.3	-0.5	-0.4	-0.1	-0.4
4	0.1	0.3	0.0	0.1	0.0	0.0	-0.1
5	0.2	0.2	0.1	0.1	-0.1	-0.1	0.2
6	0.0	0.3	0.0	0.2	0.1	-0.2	0.0
7	0.0	0.2	0.0	0.0	-0.1	-0.2	0.0
8	0.0	0.1	-0.1	0.0	-0.1	-0.1	0.1
9	0.1	0.3	0.1	0.1	-0.2	-0.1	0.0
10	-0.1	0.3	-0.1	-0.1	-0.2	-0.1	0.0
11	-0.1	0.3	0.1	-0.2	-0.3	-0.2	0.1
12	0.1	0.3	-0.1	-0.1	-0.2	-0.2	-0.1
13	0.1	0.5	0.1	0.0	-0.2	-0.2	0.1
14	0.0	0.5	0.0	-0.2	-0.3	-0.2	0.0
15	0.1	0.5	0.0	-0.1	-0.3	-0.1	0.0
16	0.1	0.6	0.2	0.1	-0.3	-0.3	0.0
17	0.1	0.5	0.1	-0.1	-0.4	-0.4	0.1
18	0.0	0.8	0.3	0.0	-0.4	-0.3	0.1
19	0.1	0.7	0.1	0.1	-0.3	-0.2	0.2
20	0.0	0.4	0.0	-0.2	-0.5	-0.3	-0.1
21	0.0	0.6	0.0	-0.3	-0.5	-0.3	-0.1
22	0.1	0.5	-0.1	-0.1	-0.6	-0.3	0.0
23	-0.1	0.5	-0.1	-0.2	-0.6	-0.5	-0.2
24	-0.2	0.5	-0.1	-0.4	-0.8	-0.6	-0.2
25	0.1	0.6	0.0	-0.2	-0.5	-0.4	-0.1
26	-0.1	0.5	0.1	-0.2	-0.4	-0.3	0.0
27	0.1	0.6	0.2	-0.1	-0.2	-0.2	-0.1
28	0.2	0.7	0.2	0.1	-0.3	-0.1	0.2
29	0.3	0.7	0.2	0.0	-0.3	-0.2	0.2
30	0.0	0.6	0.2	0.1	-0.4	-0.3	0.1
31	0.1	0.6	0.1	0.0	-0.3	-0.2	0.1
32	-0.1	0.5	0.1	-0.1	-0.4	-0.3	-0.1

Vertical deformation during loading

Negative values indicate downwards movement



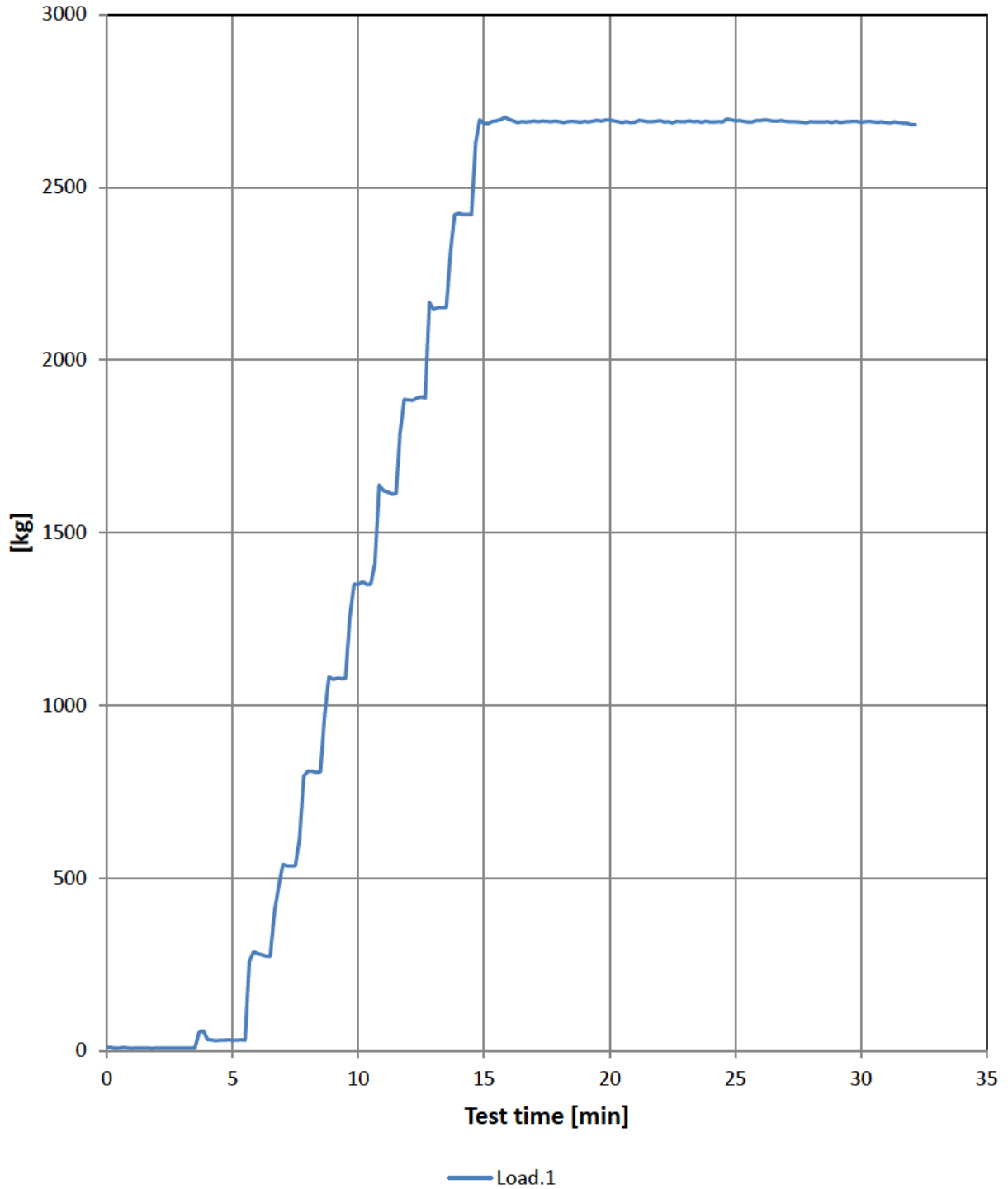
Vertical deformation during loading

Negative values indicate downwards movement

Min. / mm	VD.1	VD.2	VD.3	VD.4	VD.5	VD.6
0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.1	0.0	0.0
2	0.0	0.0	0.0	-0.1	0.0	0.0
3	-0.1	0.0	0.0	0.1	0.0	0.0
4	0.1	0.1	0.1	0.1	0.0	0.0
5	0.1	0.1	0.1	0.1	0.1	0.1
6	0.1	0.1	0.0	0.1	0.0	0.1
7	-0.2	-0.2	-0.4	-0.4	-0.6	-0.6
8	-0.4	-0.4	-0.8	-0.8	-1.2	-1.2
9	-0.6	-0.6	-1.2	-1.2	-1.6	-1.7
10	-0.8	-0.8	-1.5	-1.5	-2.1	-2.1
11	-0.9	-0.9	-1.8	-1.8	-2.4	-2.5
12	-1.1	-1.1	-2.0	-2.0	-2.8	-2.8
13	-1.2	-1.2	-2.2	-2.2	-3.0	-3.0
14	-1.4	-1.4	-2.4	-2.4	-3.2	-3.2
15	-1.6	-1.6	-2.6	-2.6	-3.4	-3.5
16	-1.7	-1.8	-2.8	-2.8	-3.6	-3.6
17	-1.8	-1.8	-2.9	-2.9	-3.7	-3.7
18	-1.7	-1.7	-2.9	-2.8	-3.7	-3.7
19	-1.8	-1.8	-2.9	-2.9	-3.7	-3.7
20	-1.8	-1.8	-2.9	-2.9	-3.7	-3.7
21	-1.8	-1.8	-2.8	-2.9	-3.7	-3.7
22	-1.8	-1.8	-2.9	-2.9	-3.7	-3.7
23	-1.8	-1.8	-2.9	-2.9	-3.8	-3.7
24	-1.9	-1.8	-2.9	-2.9	-3.7	-3.7
25	-1.8	-1.8	-2.9	-2.9	-3.7	-3.7
26	-1.8	-1.8	-2.9	-2.9	-3.7	-3.7
27	-1.8	-1.8	-3.0	-2.9	-3.8	-3.7
28	-1.8	-1.8	-2.9	-2.9	-3.7	-3.7
29	-1.8	-1.8	-2.9	-2.9	-3.7	-3.7
30	-1.9	-1.8	-3.0	-2.9	-3.7	-3.7
31	-1.9	-1.9	-2.9	-2.9	-3.8	-3.8
32	-1.9	-1.9	-2.9	-2.9	-3.8	-3.8

Load per cylinder during loading

Load per cylinder



Load per cylinder during loading

Load per cylinder

Min. / kg	Load.1
0	11
1	8
2	8
3	8
4	32
5	31
6	281
7	540
8	810
9	1075
10	1350
11	1622
12	1885
13	2146
14	2425
15	2686
16	2697
17	2692
18	2690
19	2691
20	2695
21	2689
22	2693
23	2691
24	2690
25	2692
26	2694
27	2691
28	2690
29	2691
30	2689
31	2688
32	2681



Photo No. 1 Timber frame of specimen, with seaweed insulation.



Photo No. 2 Timber frame of specimen, with seaweed insulation.



Photo No. 3 Timber frame of specimen, with seaweed insulation and first layer of clay board



Photo No. 4a Unexposed side of test specimen, inner layer of clay boards.



Photo No. 4b Unexposed side of test specimen, outer layer of clay boards, before clay plaster was added.



Photo No. 5a Test specimen seen from exposed side – inner layer of clay boards.



Photo No. 5b Test specimen with clay plaster being added



Photo No. 6 Test specimen seen from unexposed side before test start

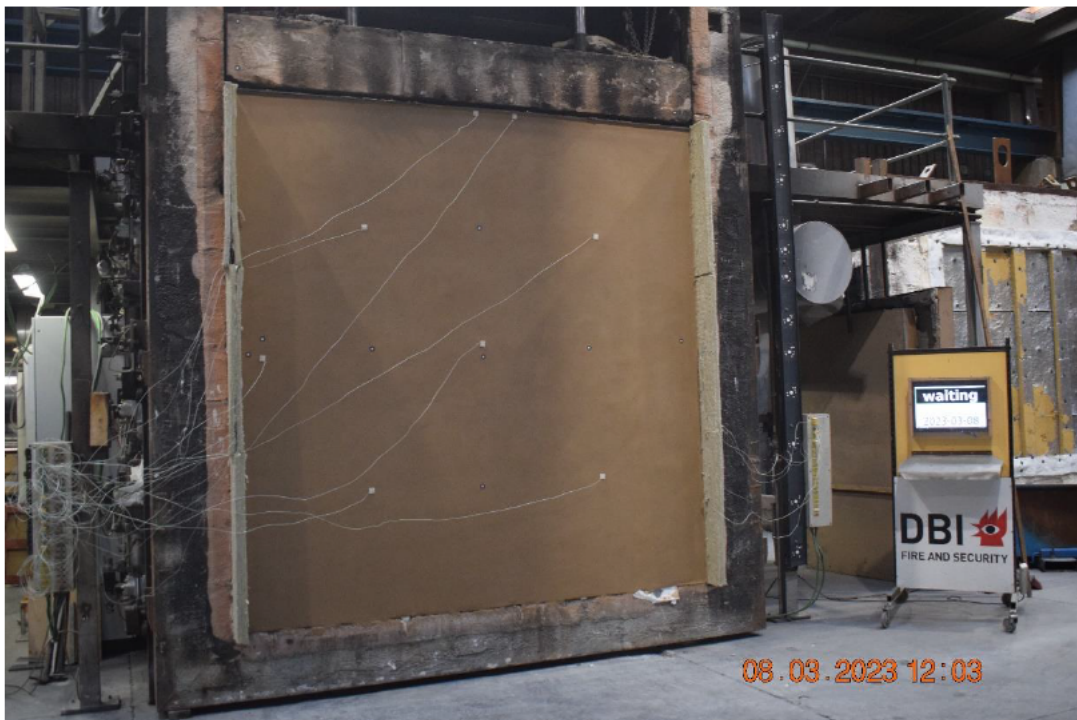


Photo No. 7 Test specimen seen from unexposed side at test start.



Photo No. 8 Test specimen seen from unexposed side after 30 minutes of testing



Photo No. 9 Test specimen seen from unexposed side after 42 minutes of testing



Photo No. 10 Test specimen seen from unexposed side after 60 minutes of testing



Photo No. 11 Test specimen seen from unexposed side after 67 minutes of testing



Photo No. 12 Test specimen after test seen from unexposed side



Photo No. 13 Test specimen seen from exposed side right after test



Photo No. 14 Test specimen doing disassembly



Photo No. 15 Test specimen during disassembly



Photo No. 16 Test specimen doing disassembly



Photo No. 17 Test specimen during disassembly



Photo No. 18 Test specimen during disassembly