



Test Report

Loadbearing roof

Name of sponsor: Nordic Build A/S
Product name: Loadbearing roof
File no.: PGA11340A
Test date: 16-01-2019 **Date:** 28-01-2019
Pages: 10 **Encl.:** 44
Ref: RBI / ADR



DBI

Client information

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Date of test

The test was conducted on 16-01-2019.

Purpose of test

Examination of the fire-resistance of a loadbearing and separating roof.

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 1365-2:2014 Fire resistance test for loadbearing elements – Part 2: Floors and roofs

Test specimen

The trade name and sponsors identification mark is stated below:

Trade name:	Loadbearing roof
Identification mark:	None

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

The sponsor delivered one test specimen for fire testing.

The process of verification was carried out by DBI - Danish Institute of Fire and Security Technology. The laboratory oversaw the fabrication of the test specimen, material for verification of density, thickness, moisture and organic content were sampled during the inspection.



Drawings and description

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

Type	Drawing No.	Dated	Subject
Drawing	1	11.12.2018	Tagelement
Drawing	2	11.12.2018	Tagelement
Drawing	3	11.12.2018	Tagelement vederlagsdetalje
Drawing	4	11.12.2018	Tagelement vederlagsdetalje
Drawing	5	11.12.2018	Tagelement
Drawing	6	11.12.2018	Tagelement tværsnit
Drawing	7	11.12.2018	Tagelement Produktionstegning
Drawing	8	11.12.2018	Tagelement Produktionstegning
Drawing	9	11.12.2018	Tagelement Produktionstegning
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 assembly, the test and after the test.

The sponsor carried out the mounting of the test specimen.

Test specimen

External measures: Full length: 6172 mm Width: 2900 mm Thickness: 474 mm

The test specimen was a loadbearing roof construction made of elements of steel, M4 composite boards and stone wool. The test specimen consisted of 12 elements – further documentation see drawing 2, 5 and 6.

The test specimen was built of individual elements with a width of 250 mm – further documentation see drawing 6.

The elements 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/m to the flanges of steel. The vertical joints in the M4 composite boards were also glued. 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 8.



The self weight of the construction was 0.58 kN/m².

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 height of 472 mm and were installed with two joints in the longitudinal direction of the test specimen – 1850 mm / 2400 mm / 1850 mm.
Insulation	420 mm stone wool insulation designated Rockwool Flexibatts 34 with a measured density of 42 kg/m ³ . The nominal density is not indicated. The stone wool was installed in full length of the test specimen – 6100 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	M4 Composite
Density	kg/m ³	42	1001	1001
Thickness	mm		15	15
Moisture content	%	0.55	14.06	23.06
Organic content	%	2.1	-	-
Sampling method		Extra material	Extra material	Extra material
Drying temperature		105 °C	55 °C	105 °C

Test conditions

Conditioning

The test specimen was delivered on the 14-01-2019 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 length and width of 6000 x 3070 mm (exposed area). The loadbearing roof element was supported 50 mm in from the furnace edges resulting in a total loaded roof span of 6100 mm.

Free edges between the roof and the furnace frame were established along both vertical edges of the test specimen (2 x 25 mm stone wool in each side) to allow for unrestrained deformation of the test specimen.



Loading

The test specimen was loaded with a total applied load of 21.0 kN (1.21 kN/m²) placed as two line loads in the two quarter sections each on 10.5 kN.

The moment of force in the deck from the applied load during the fire test was 5.43 kNm/m.

The total applied load of 21.0 kN corresponds to a load of 2141 kg. With a total weight of the loading equipment of 681 kg, the load delivered from the piston was set to 1460 kg.

Prior to the uploading, the applied load was verified by placing the piston under a load cell. The oil pressure needed to obtain the required load 1460 kg was determined. This pressure was controlled during the test.

The load was applied as a downward oriented point load in the quarter sections of the deck, e.g. there was no eccentricity in the loading conditions.

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. The fully applied load was kept during the full extend of the fire test.

The self weight of the construction was 0.58 kN/m² giving a moment of force in the deck of 2.61 kNm/m (with a 6000 mm span).

The total moment of force in the deck originating from the load and the self weight was 5.43 kNm/m + 2.61 kNm/m = 8.04 kNm/m.

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 pressure was kept at 20 Pa just below the aerated concrete deck. The pressure differential was measured 100 mm below the loaded deck, which gives a pressure set point of approximately 20 Pa at the height of the measuring device.



Test results

Duration of the test was 36 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 | Horizontal furnace pressure
The differential pressure in the furnace during the test, measured 100 mm below the test specimen |
| Enclosures 4.0 and 4.1 | Ambient temperature
The ambient temperature in the laboratory during the test |
| Enclosures 5.0 and 5.1 | Average temperature
Temperature rise on the unexposed side |
| Enclosures 6.0 and 6.1 | Maximum temperatures
Temperature rise on the unexposed side |
| Enclosures 7.0 and 7.1 | Load
The load on the deck during the test |
| Enclosures 8.0 and 8.1 | Deformation
The vertical deflection measured on the unexposed side (positive values indicates movement towards the furnace) |
| Enclosures 9.0 and 9.1 | Deformation per minute
D1, D3: at the edges, D2: in the center |
| Enclosures 10.0 and 10.1 | Load during loading phase
Total load prior to the test |
| Enclosures 11.0 and 11.1 | Deformation during loading phase
The vertical deflection measured prior to the test on the unexposed side (positive values indicates movement towards the furnace) |



Visual observations:

Time / Minutes	Visual observations:	U = Unexposed side E = Exposed side
0	Test commences	
4	Visual deformation seen from unexposed side	U
6	Nothing to observe on exposed side	E
8	Faint smoke development at mid length, free edge located by loading equipment	U
11	Increased smoke development along free edge, both sides of the test specimen	U
16	The tongue and groove locks seem to connect on the entire surface	E
19	Significant increased deformation seen from unexposed side	U
23	Nothing new to observe on exposed side	E
26	Increased smoke development along both simple supported ends	U
31	Nothing new to observe regarding smoke development	U
32	Nothing new to observe on exposed side	E
34	Significant increased deformation seen from unexposed side	U
36	Test stopped	

After the test, the test specimen was examined:

- The glued joints in the M4 composite boards failed during the test
- The movement in the simple support was limited
- The connection in the tongue and groove locks was intact

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 1365-2:2014 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): 36 minutes

- The load on the test specimen was maintained during the entire test
- The measured vertical deflection did not exceed the criteria of $C = L^2/(h \times 400) = 189.9$ mm during the test
- The measured rate of vertical deflection did exceed the criteria of $dC/dt = L^2/(h \times 9000) = 8.4$ mm/min after 33.83 minutes of testing

Note: according to EN 1363-1:2012 §11.1 the criteria for rate of deflection does not apply in the first 10 minutes of the fire test.

**DBI****Integrity (E): 36 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): 36 minutes

- During the test no failure of insulation occurred to failure of integrity
- 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 1365-2:2014, 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.

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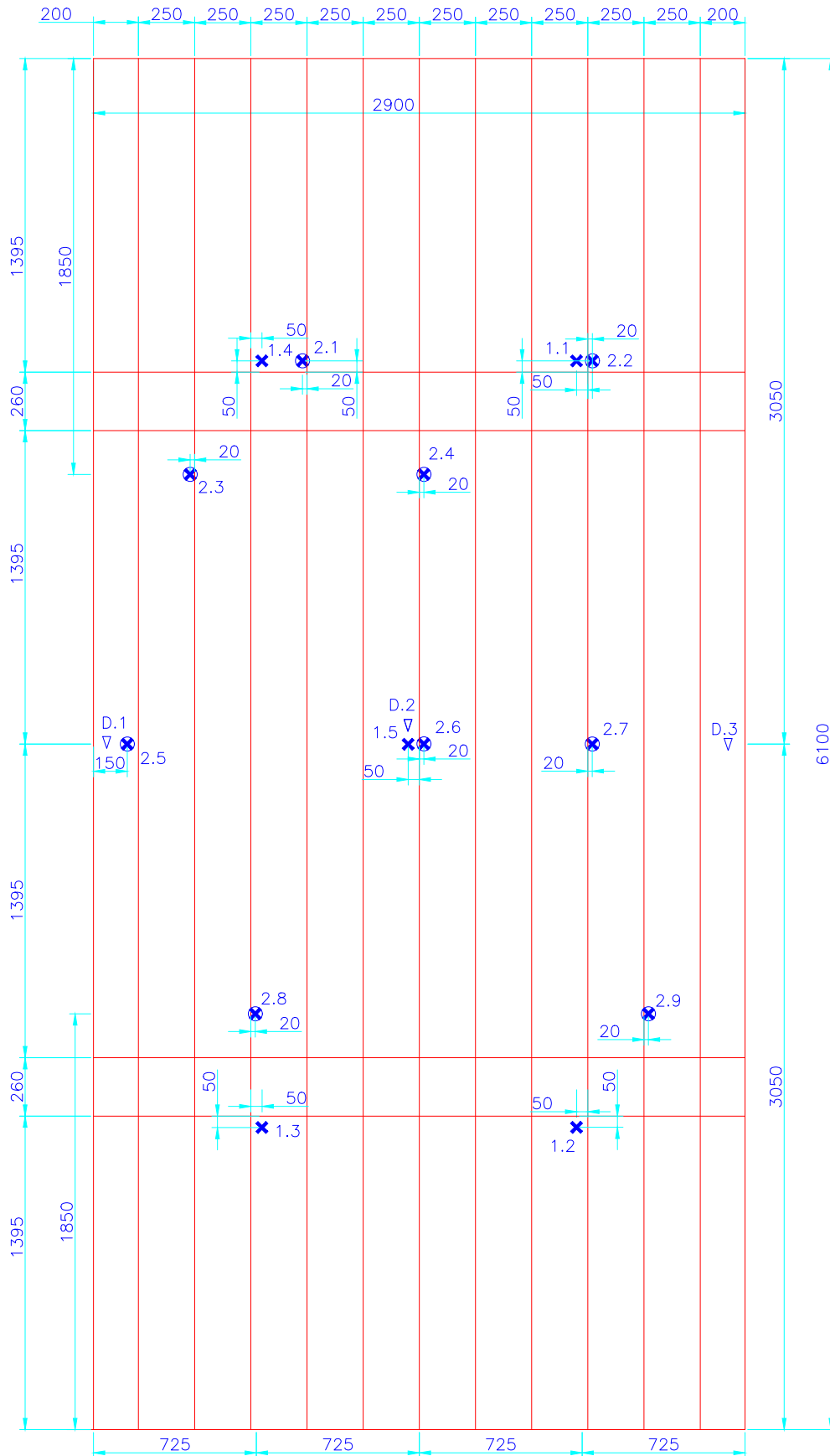
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Enclosures:

DBI drawings:	1
DBI graphs and tables:	20
Photo sheets:	7
Sponsors drawings:	16

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

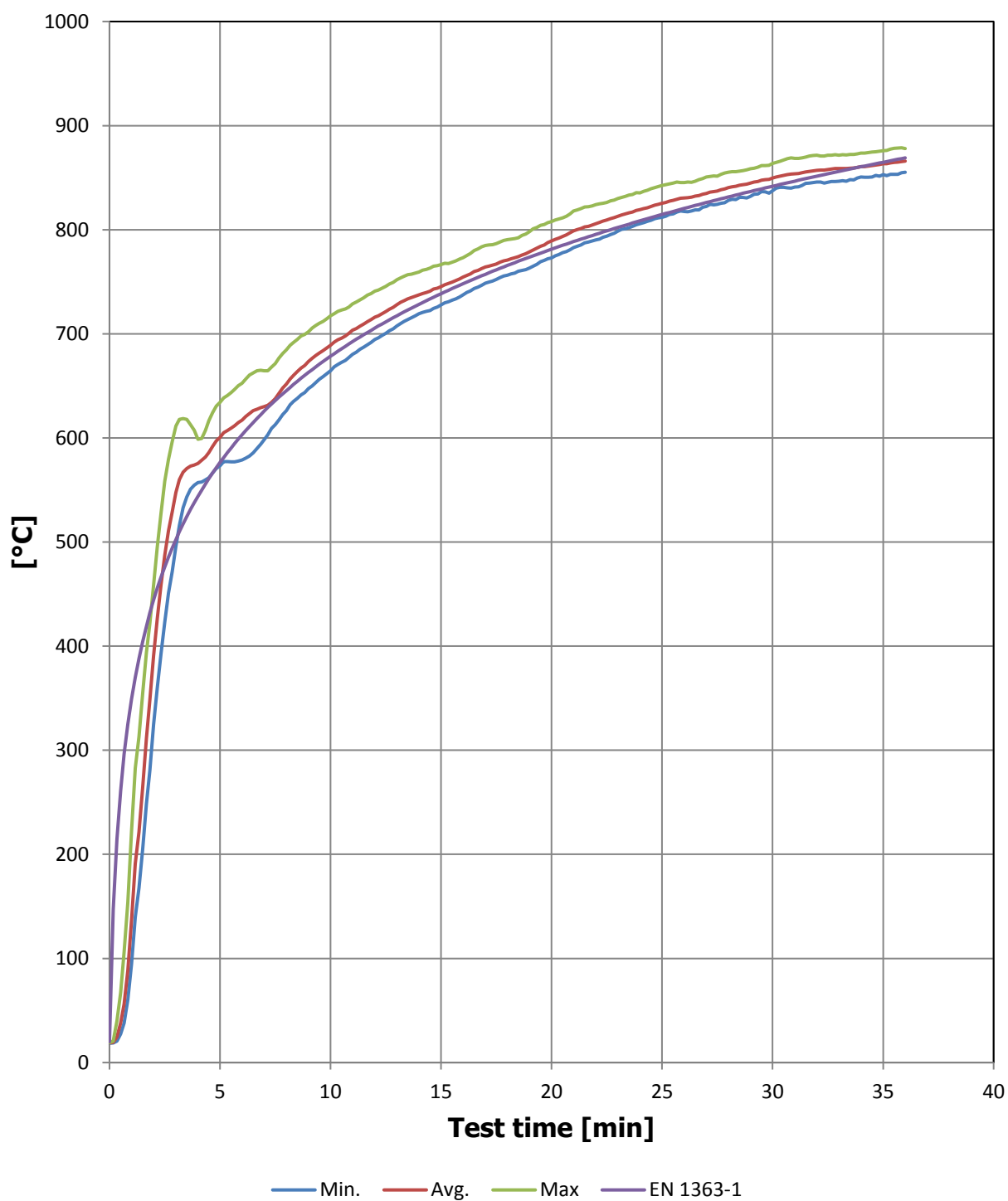
All measurements are in mm

Danish Institute of Fire and security Technology

Sponsor: Nordic Build A/S
 Subject: Loadbearing roof

File No.: PGA11340A
 Test date: 16-01-2019
 Enclosure: 1.1

Furnace



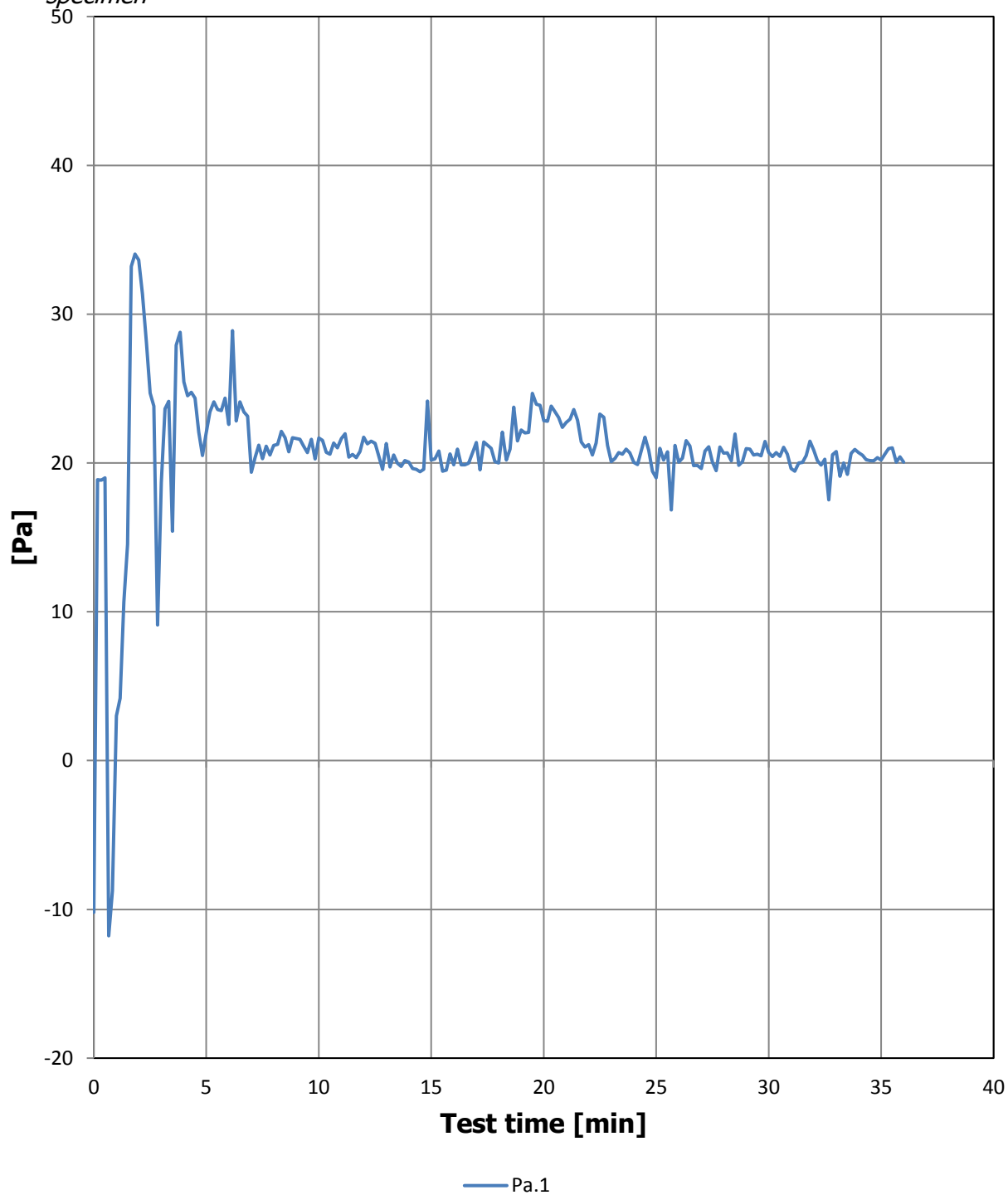


Furnace

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	
1	95	137	223	349	51	238	-78,7	
2	325	391	459	445	318	640	-50,4	
3	496	548	612	502	798	1115	-28,4	
4	557	575	599	544	1366	1639	-16,7	
5	573	601	634	576	1953	2200	-11,2	
6	579	617	653	603	2562	2790	-8,2	15
7	598	630	665	626	3187	3405	-6,4	15
8	626	652	685	645	3827	4041	-5,3	15
9	647	674	702	663	4490	4695	-4,4	15
10	665	689	717	678	5171	5366	-3,6	15
11	680	703	729	693	5868	6051	-3,0	15
12	695	716	741	705	6577	6750	-2,6	14
13	708	728	752	717	7299	7462	-2,2	14
14	719	738	759	728	8032	8185	-1,9	13
15	728	745	767	739	8773	8918	-1,6	13
16	738	754	773	748	9523	9662	-1,4	12
17	749	764	785	757	10282	10414	-1,3	12
18	756	771	791	766	11050	11176	-1,1	11
19	763	779	798	774	11824	11945	-1,0	11
20	773	789	808	781	12608	12723	-0,9	10
21	783	799	818	789	13402	13508	-0,8	10
22	790	806	824	796	14204	14300	-0,7	9
23	799	813	830	802	15013	15099	-0,6	9
24	806	819	835	809	15830	15904	-0,5	8
25	812	825	843	815	16652	16716	-0,4	8
26	818	831	845	820	17480	17534	-0,3	7
27	822	835	851	826	18313	18357	-0,2	7
28	828	840	855	832	19150	19186	-0,2	6
29	832	845	859	837	19993	20020	-0,1	6
30	837	850	864	842	20840	20859	-0,1	5
31	841	854	868	847	21692	21703	-0,1	5
32	846	857	872	851	22547	22552	0,0	5
33	847	859	872	856	23405	23406	0,0	5
34	851	861	874	860	24264	24264	0,0	5
35	853	863	876	865	25126	25127	0,0	5
36	855	866	878	869	25991	25994	0,0	5

Horizontal furnace pressure

The differential pressure in the furnace during the test, measured 100 mm below the test specimen





Horizontal furnace pressure

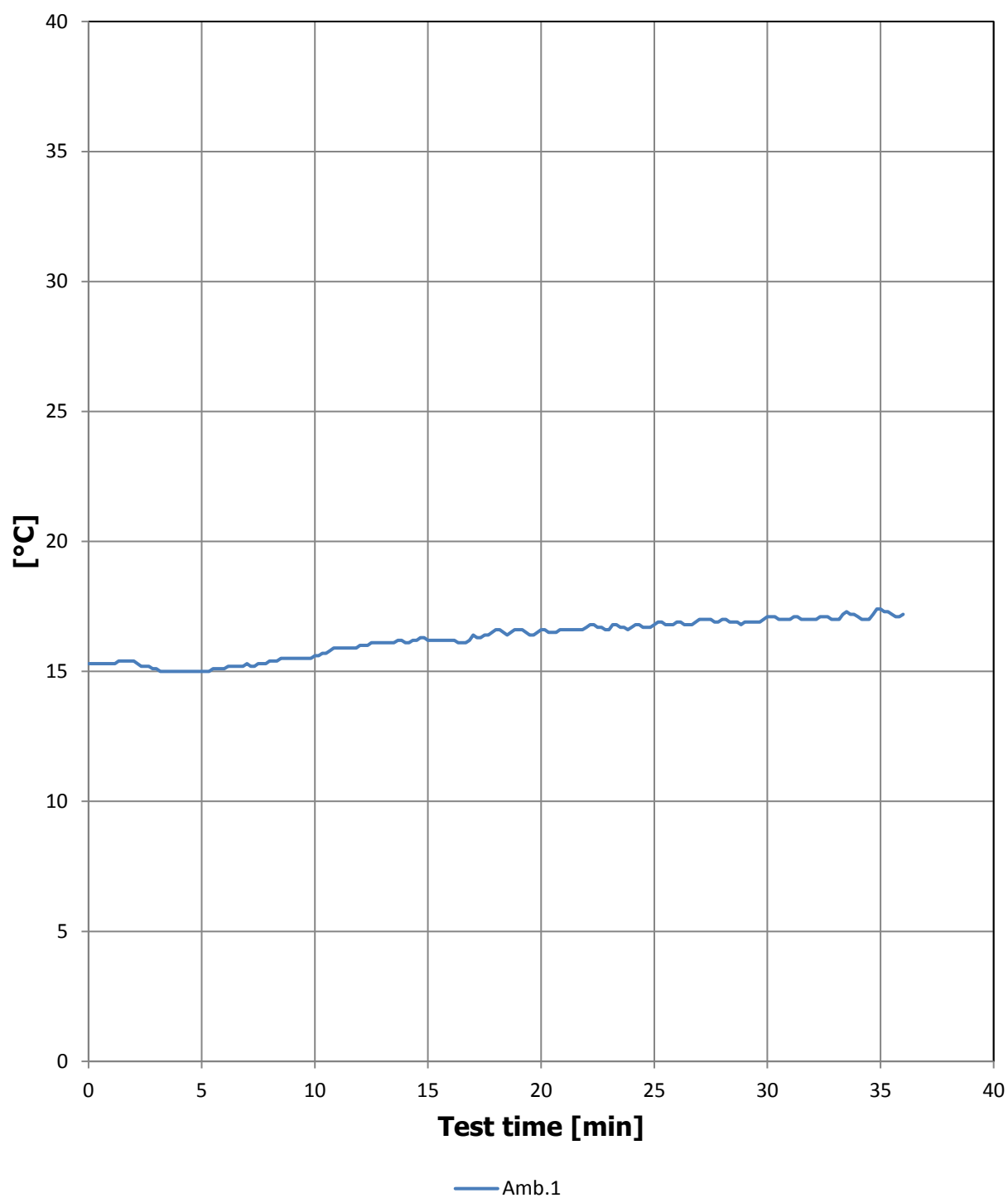
The differential pressure in the furnace during the test, measured 100 mm below the test specimen

Min. / Pa	Pa.1
0	-10,2
1	3,0
2	33,6
3	18,7
4	25,4
5	22,0
6	22,6
7	19,4
8	21,2
9	21,6
10	21,7
11	21,6
12	21,7
13	21,3
14	20,1
15	20,2
16	19,9
17	21,4
18	20,0
19	22,2
20	22,8
21	22,7
22	21,2
23	20,1
24	20,0
25	19,0
26	20,1
27	19,6
28	20,7
29	21,0
30	20,7
31	19,6
32	20,9
33	20,8
34	20,7
35	20,2
36	20,1



Ambient temperature

The ambient temperature in the laboratory during the test



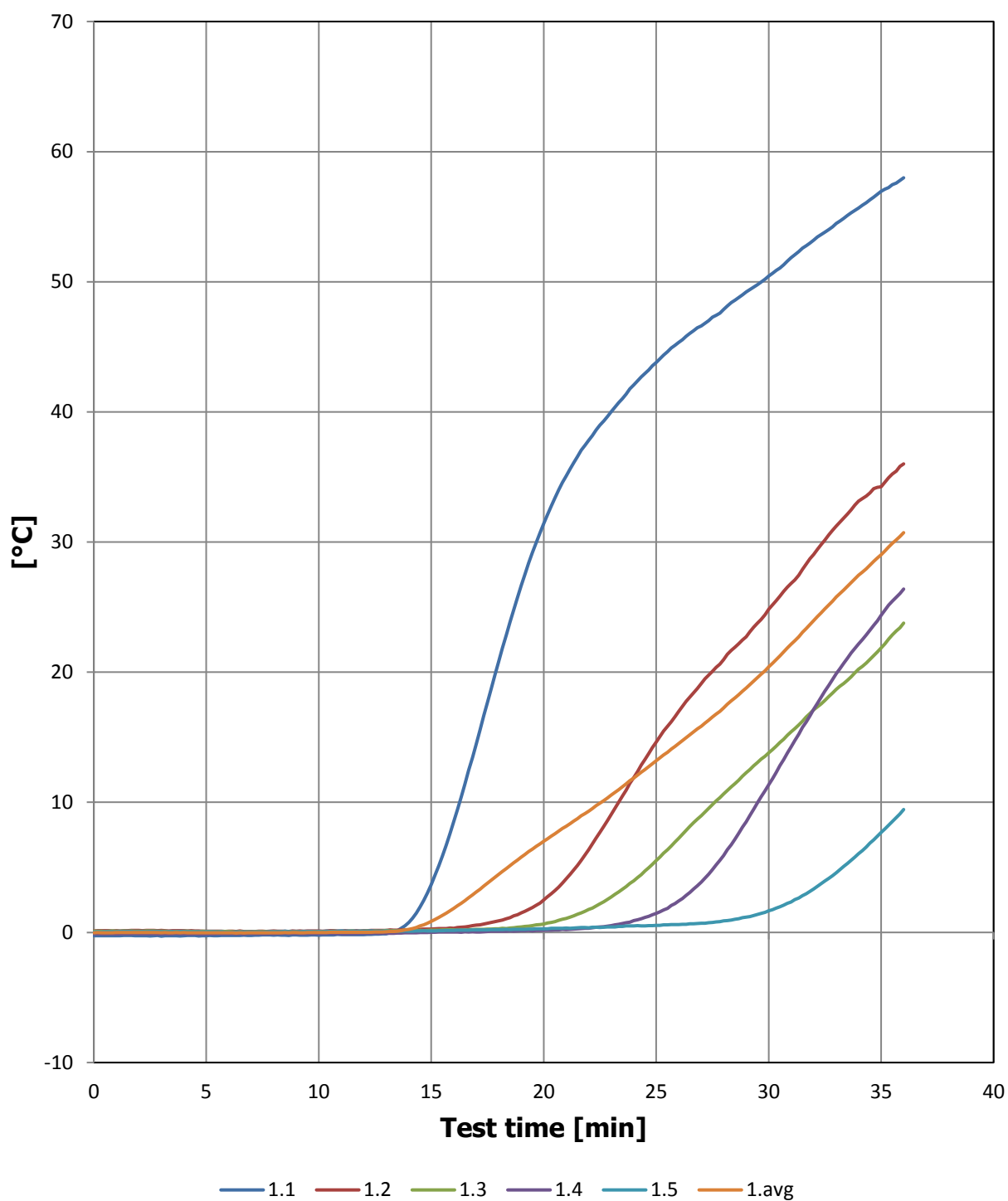
Ambient temperature

The ambient temperature in the laboratory during the test

Min. / °C	Amb.1
0	15,3
1	15,3
2	15,4
3	15,1
4	15,0
5	15,0
6	15,1
7	15,3
8	15,4
9	15,5
10	15,6
11	15,9
12	16,0
13	16,1
14	16,1
15	16,2
16	16,2
17	16,4
18	16,6
19	16,6
20	16,6
21	16,6
22	16,7
23	16,6
24	16,7
25	16,8
26	16,9
27	17,0
28	17,0
29	16,9
30	17,1
31	17,0
32	17,0
33	17,0
34	17,1
35	17,4
36	17,2

Average temperature

Temperature rise on the unexposed side





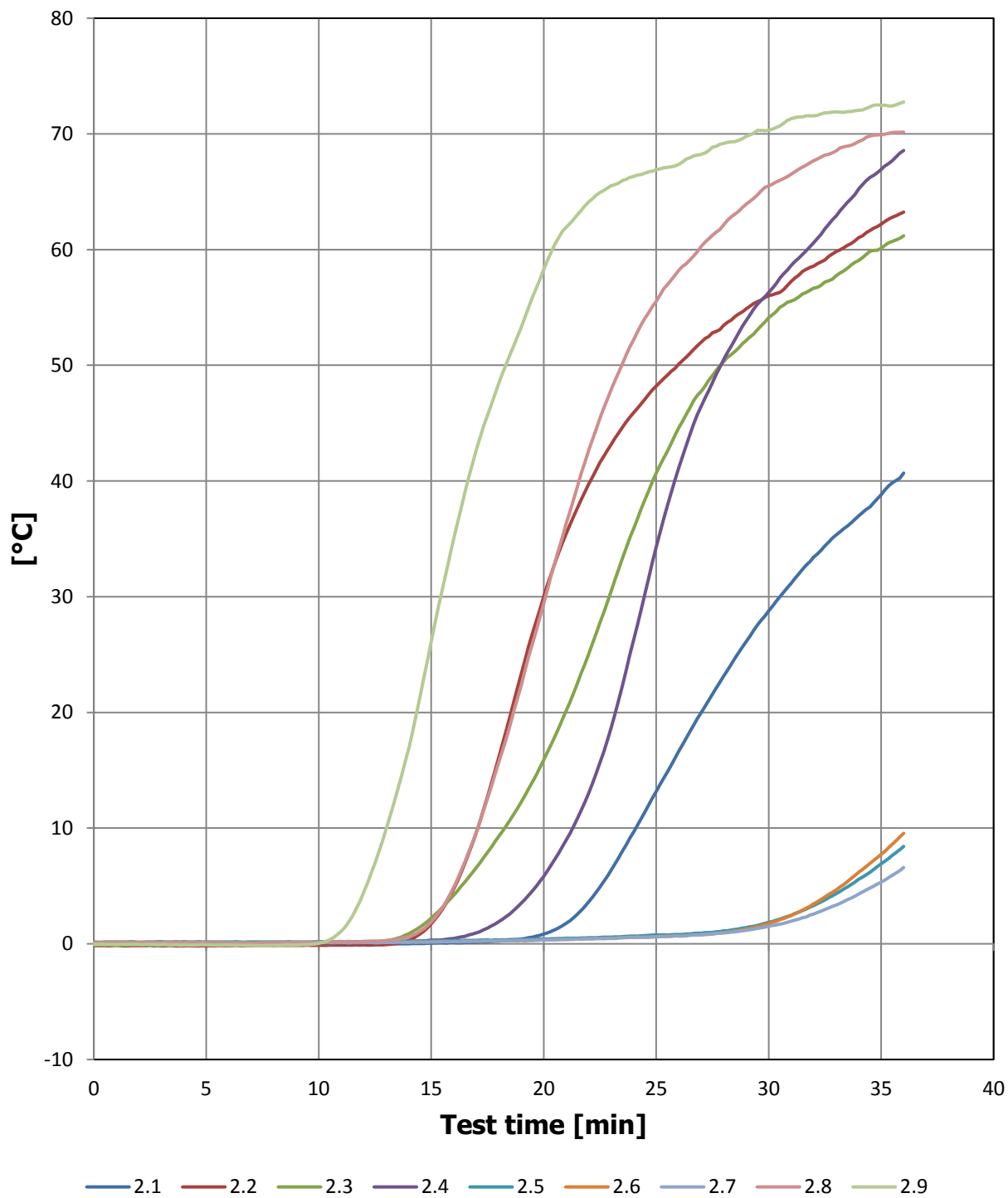
Average temperature

Temperature rise 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
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	1	0	0	0	0	0	1
15	4	0	0	0	0	1	4
16	9	0	0	0	0	2	9
17	15	1	0	0	0	3	15
18	21	1	0	0	0	4	21
19	27	1	0	0	0	6	27
20	31	2	1	0	0	7	31
21	35	4	1	0	0	8	35
22	38	6	2	0	0	9	38
23	40	9	3	1	0	11	40
24	42	12	4	1	1	12	42
25	44	15	6	1	1	13	44
26	45	17	7	2	1	15	45
27	47	19	9	4	1	16	47
28	48	21	11	6	1	17	48
29	49	23	12	9	1	19	49
30	50	25	14	11	2	20	50
31	52	27	15	14	2	22	52
32	53	29	17	17	3	24	53
33	54	31	19	20	5	26	54
34	56	33	20	22	6	27	56
35	57	34	22	24	8	29	57
36	58	36	24	26	9	31	58
Failure [min]	-	-	-	-	-	-	-
Failure °C	180	180	180	180	180	140	180

Maximum temperatures

Temperature rise on the unexposed side





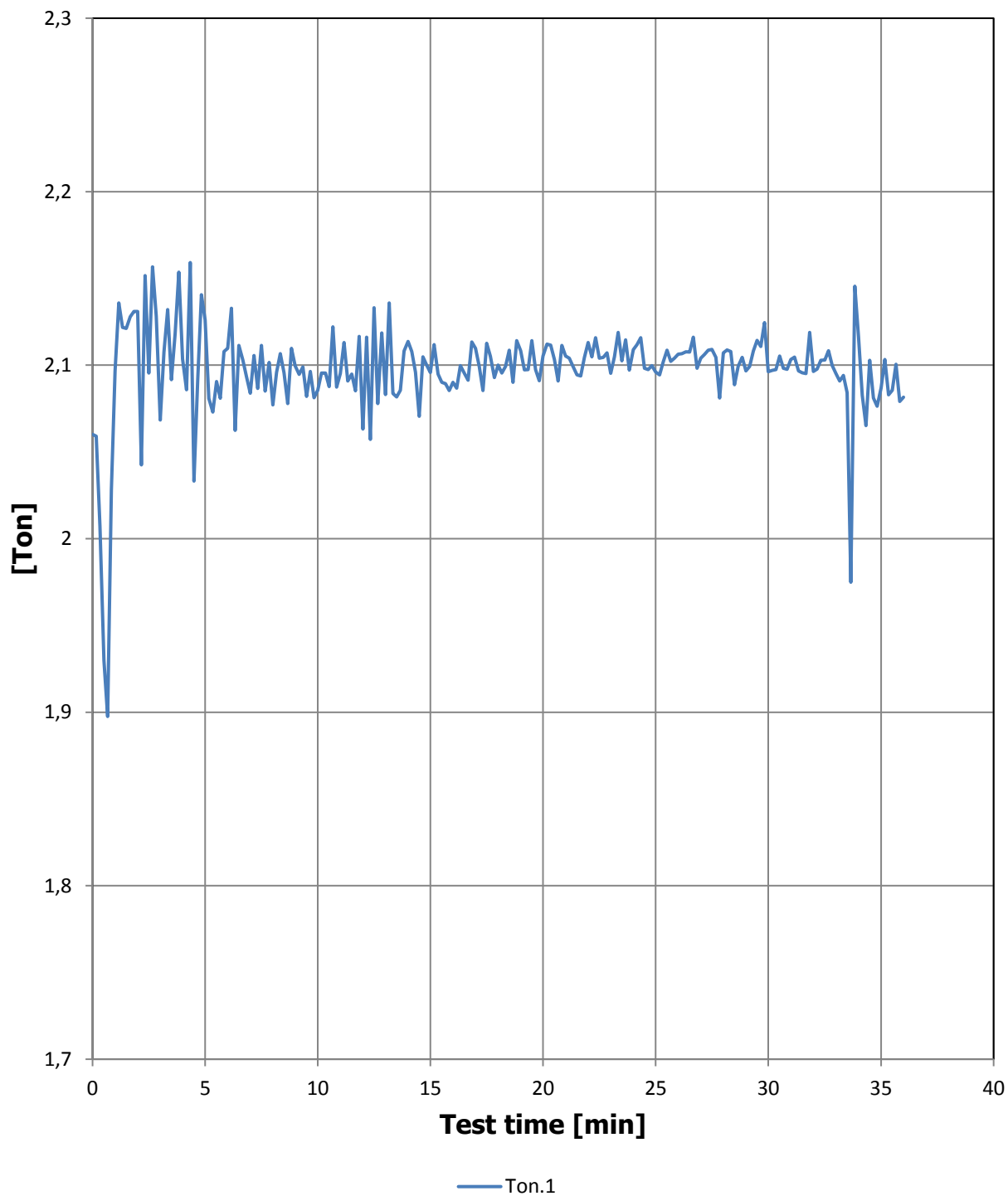
Maximum temperatures

Temperature rise on the unexposed side

Min. / °C	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.Max
0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	1	1
12	0	0	0	0	0	0	0	0	4	4
13	0	0	0	0	0	0	0	0	10	10
14	0	0	1	0	0	0	0	1	17	17
15	0	2	2	0	0	0	0	2	26	26
16	0	5	4	0	0	0	0	5	35	35
17	0	10	7	1	0	0	0	10	43	43
18	0	16	9	2	0	0	0	16	48	48
19	0	23	12	4	0	0	0	22	53	53
20	1	30	16	6	0	0	0	29	58	58
21	2	35	20	9	0	0	0	36	62	62
22	4	40	25	13	1	0	0	43	64	64
23	6	43	31	19	1	0	0	48	66	66
24	10	46	36	26	1	1	1	52	66	66
25	13	48	41	34	1	1	1	56	67	67
26	17	50	45	41	1	1	1	58	67	67
27	20	52	48	46	1	1	1	60	68	68
28	23	53	50	50	1	1	1	62	69	69
29	26	55	52	54	1	1	1	64	70	70
30	29	56	54	56	2	2	2	66	70	70
31	31	57	56	59	2	2	2	67	71	71
32	33	59	57	61	3	3	3	68	72	72
33	35	60	58	63	4	5	3	69	72	72
34	37	61	59	65	6	6	4	69	72	72
35	39	62	60	67	7	8	5	70	72	72
36	41	63	61	69	8	10	7	70	73	73
Failure [min]	-	-	-	-	-	-	-	-	-	-
Failure °C	180	180	180	180	180	180	180	180	180	180

Load

The load on the deck during the test



Graph showing indication of load, determined from oil pressure measurement in piston

Load

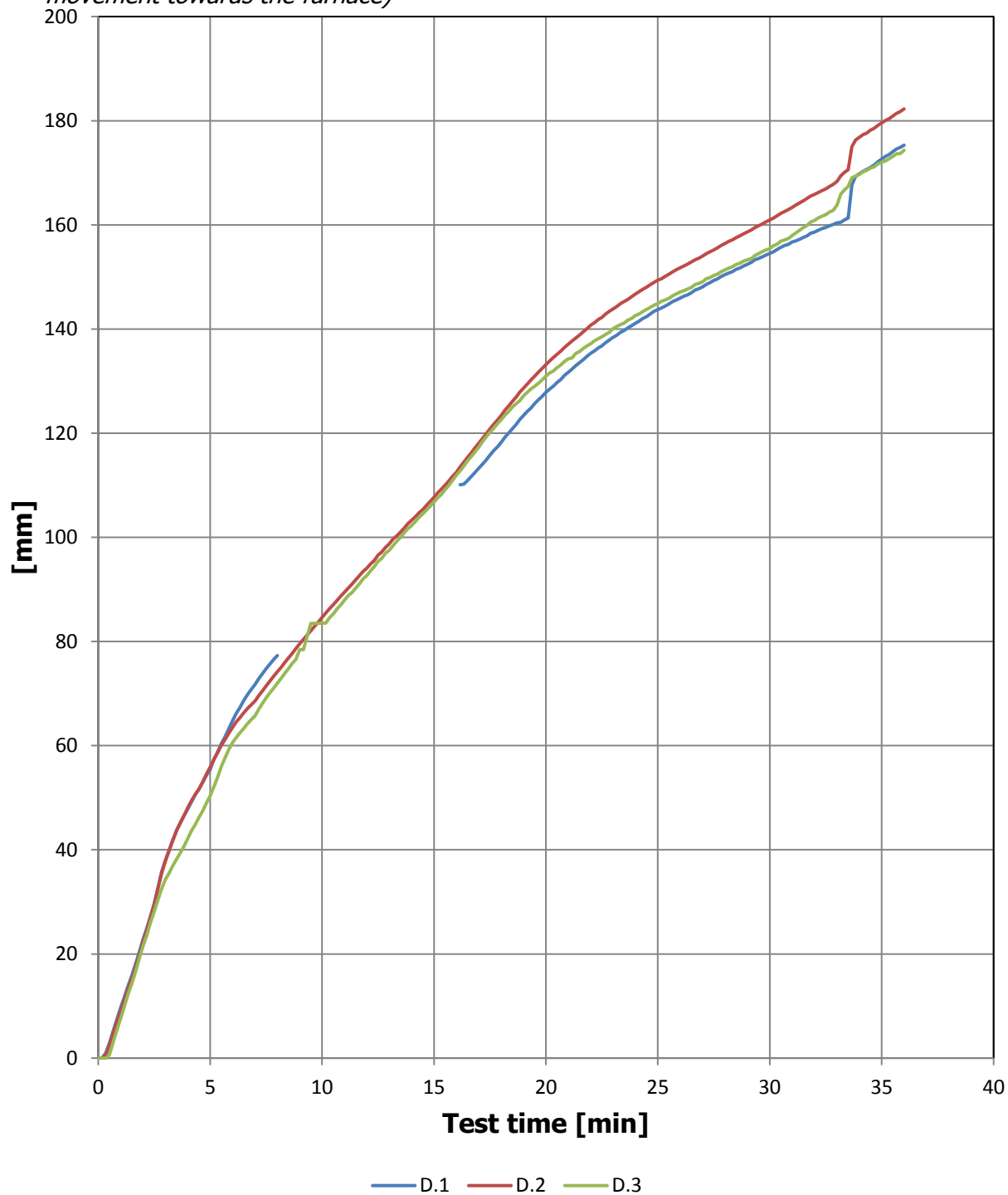
The load on the deck during the test

Min. / Ton	Ton.1
0	2,06
1	2,10
2	2,13
3	2,07
4	2,10
5	2,13
6	2,11
7	2,08
8	2,08
9	2,10
10	2,09
11	2,10
12	2,06
13	2,08
14	2,11
15	2,10
16	2,09
17	2,11
18	2,10
19	2,11
20	2,11
21	2,11
22	2,11
23	2,10
24	2,11
25	2,10
26	2,11
27	2,10
28	2,11
29	2,10
30	2,10
31	2,10
32	2,10
33	2,10
34	2,12
35	2,09
36	2,08

Graph showing indication of load, determined from oil pressure measurement in piston

Deformation

The vertical deflection measured on the unexposed side (positive values indicates movement towards the furnace)





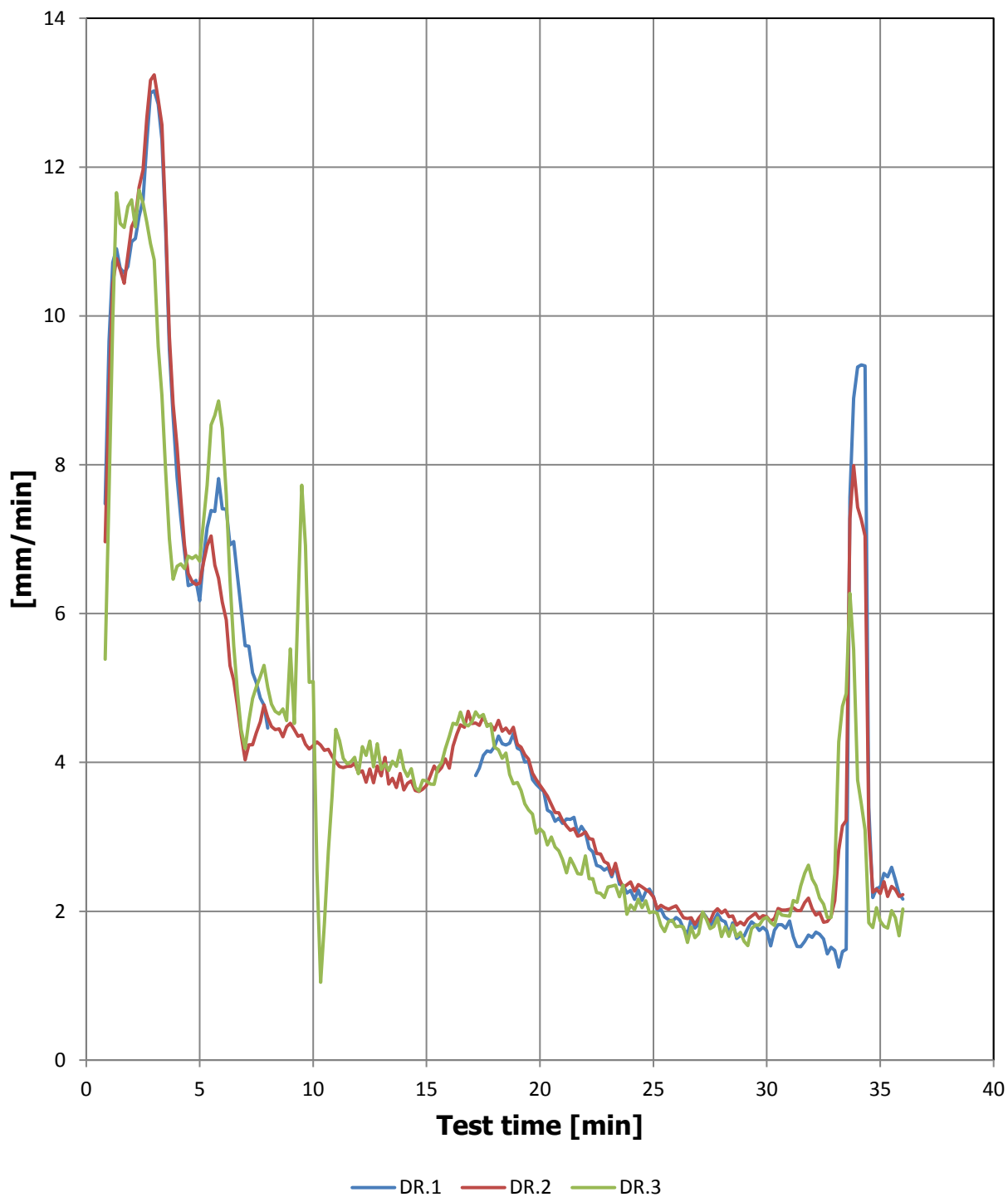
Deformation

The vertical deflection measured on the unexposed side (positive values indicates movement towards the furnace)

Min. / mm	D.1	D.2	D.3	D.Max
0	0,0	0,0	0,0	0,0
1	9,7	9,0	7,6	9,7
2	22,7	22,3	21,5	22,7
3	37,9	37,8	34,3	37,9
4	47,9	48,1	42,2	48,1
5	55,4	55,9	50,4	55,9
6	64,8	63,5	60,6	64,8
7	71,8	68,6	65,7	71,8
8	77,3	74,2	72,0	77,3
9	0,0	79,5	78,4	79,5
10	0,0	84,6	83,5	84,6
11	0,0	89,5	88,0	89,5
12	0,0	94,1	92,7	94,1
13	0,0	98,7	97,5	98,7
14	0,0	103,3	102,3	103,3
15	0,0	107,7	106,8	107,7
16	0,0	112,5	112,0	112,5
17	113,3	118,0	117,3	118,0
18	118,2	123,4	122,6	123,4
19	123,4	128,7	127,2	128,7
20	127,8	133,1	130,9	133,1
21	131,7	137,1	134,3	137,1
22	135,3	140,7	137,2	140,7
23	138,4	143,9	140,1	143,9
24	141,1	146,7	142,6	146,7
25	143,7	149,3	144,9	149,3
26	146,0	151,8	147,1	151,8
27	148,1	154,0	149,1	154,0
28	150,5	156,4	151,3	156,4
29	152,4	158,6	153,3	158,6
30	154,5	160,9	155,4	160,9
31	156,7	163,3	157,9	163,3
32	158,6	165,8	160,9	165,8
33	160,4	168,3	163,8	168,3
34	169,8	176,8	169,7	176,8
35	172,6	179,6	172,0	179,6
36	175,3	182,3	174,3	182,3
Failure [min]	-	-	-	-
Failure [mm]	189,9	189,9	189,9	189,9

Deformation per minute

D1, D3: at the edges, D2: in the center



Note: according to EN 1363-1:2012 §11.1 the criteria for rate of deflection does not apply in the first 10 minutes of the fire test.



Deformation per minute

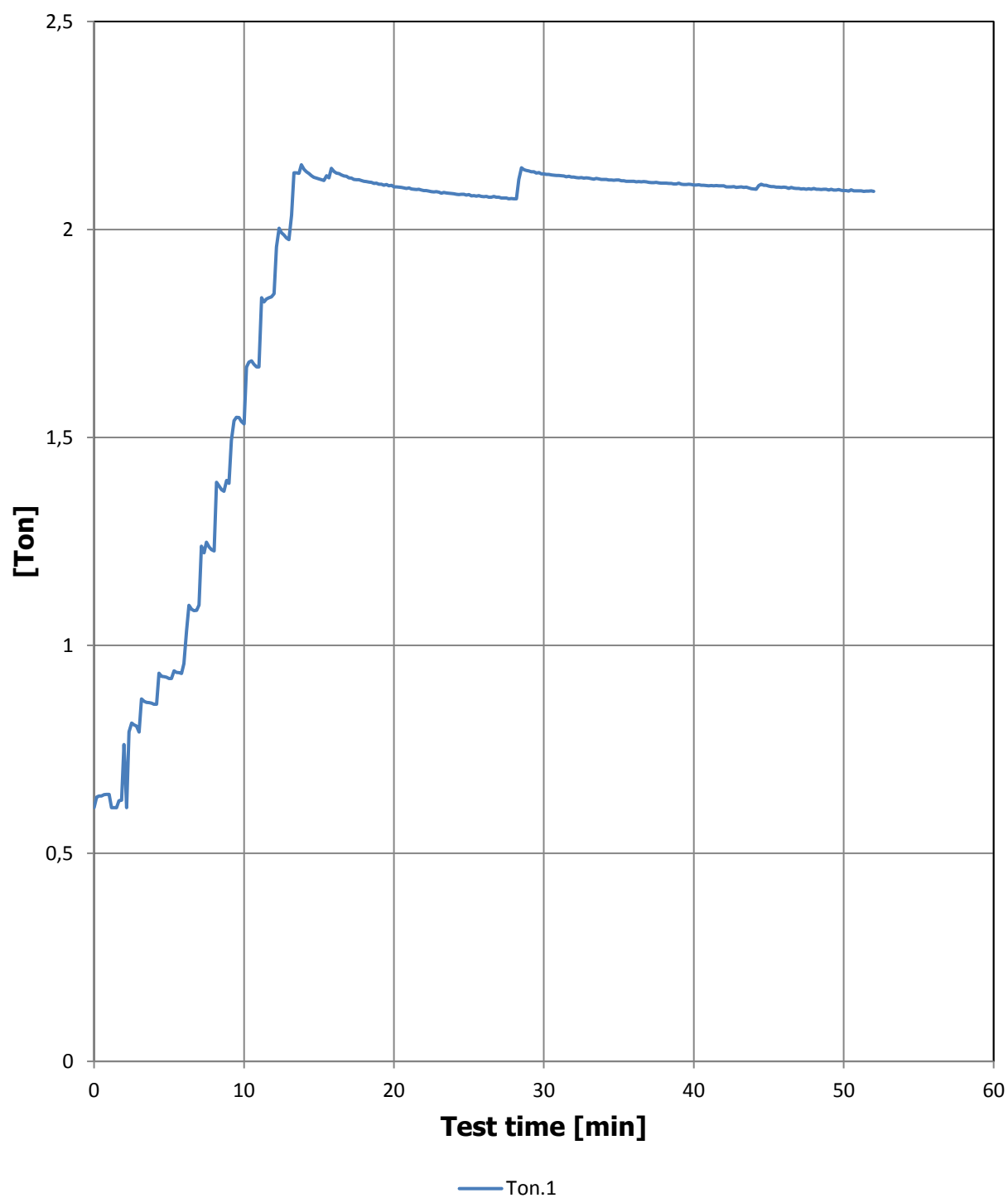
D1, D3: at the edges, D2: in the center

Min. / mm/min	DR.1	DR.2	DR.3	DR.Max
0	0,00	0,00	0,00	0,00
1	9,66	8,98	7,62	9,66
2	11,00	11,20	11,56	11,56
3	13,02	13,24	10,75	13,24
4	7,83	8,24	6,63	8,24
5	6,17	6,41	6,71	6,71
6	7,41	6,15	8,49	8,49
7	5,57	4,03	4,19	5,57
8	4,46	4,60	5,01	5,01
9	0,00	4,53	5,52	5,52
10	0,00	4,23	5,09	5,09
11	0,00	4,00	4,44	4,44
12	0,00	3,86	3,85	3,86
13	0,00	3,82	3,90	3,90
14	0,00	3,63	3,91	3,91
15	0,00	3,69	3,75	3,75
16	0,00	3,92	4,35	4,35
17	0,00	4,52	4,54	4,54
18	4,21	4,43	4,21	4,43
19	4,19	4,24	3,73	4,24
20	3,65	3,69	3,11	3,69
21	3,18	3,22	2,70	3,22
22	3,06	3,06	2,74	3,06
23	2,59	2,64	2,33	2,64
24	2,28	2,39	2,08	2,39
25	2,20	2,19	1,99	2,20
26	1,92	2,07	1,79	2,07
27	1,83	1,91	1,70	1,91
28	1,88	1,98	1,66	1,98
29	1,67	1,82	1,59	1,82
30	1,74	1,93	1,92	1,93
31	1,87	2,03	1,93	2,03
32	1,65	2,04	2,43	2,43
33	1,47	2,14	2,50	2,50
34	9,32	7,43	3,76	9,32
35	2,32	2,24	1,87	2,32
36	2,16	2,22	2,03	2,22
Failure [min]	33,83	-	-	33,83
Failure [mm/min]	8,40	8,40	8,40	8,40

Note: according to EN 1363-1:2012 §11.1 the criteria for rate of deflection does not apply in the first 10 minutes of the fire test.

Load during loading phase

Total load prior to the test



Graph showing indication of load, determined from oil pressure measurement in piston

Load during loading phase

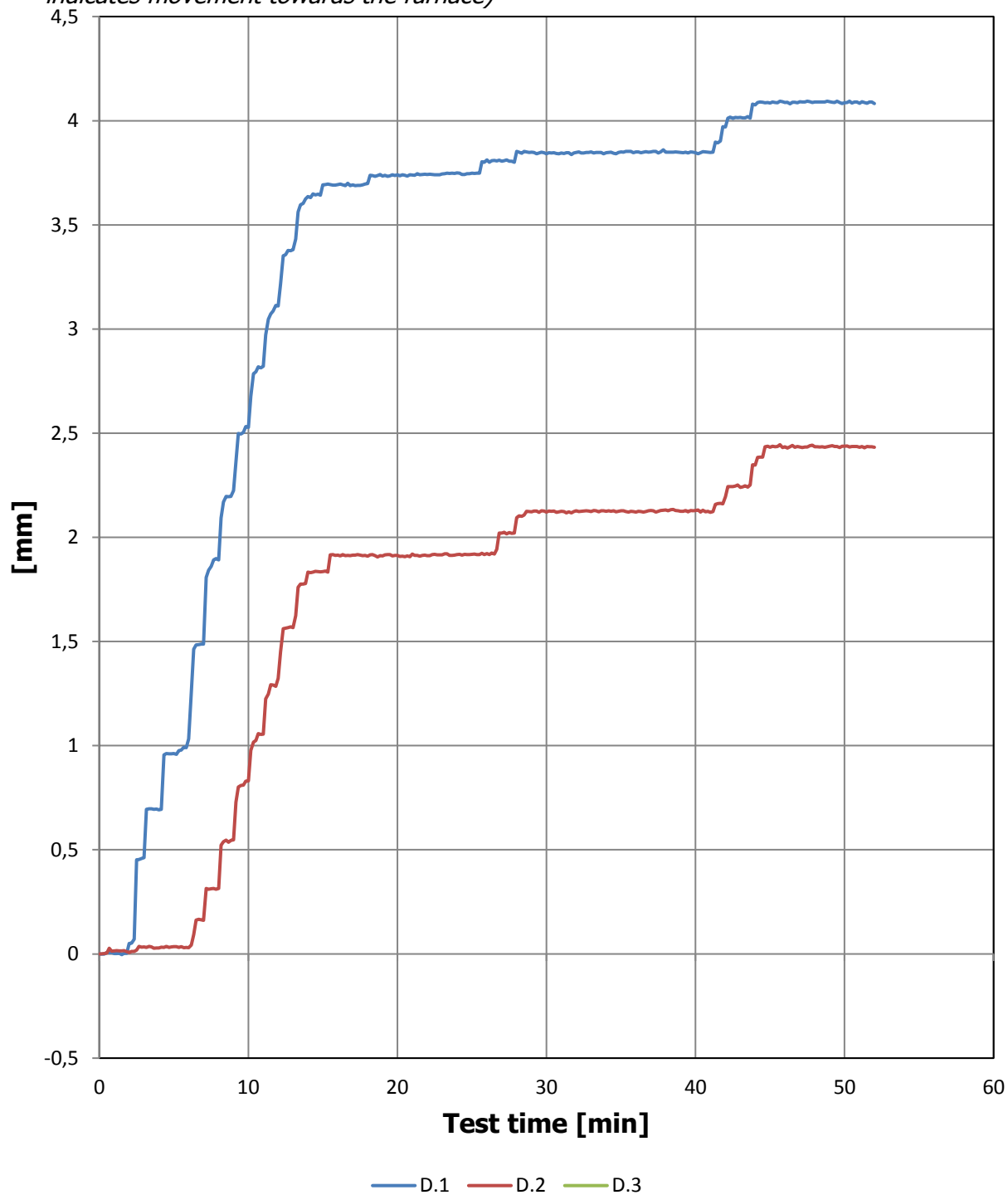
Total load prior to the test

Min. / Ton	Ton.1
0	0,61
2	0,76
4	0,86
6	0,96
8	1,23
10	1,53
12	1,85
14	2,14
15	2,12
16	2,14
18	2,12
20	2,10
22	2,09
24	2,09
26	2,08
28	2,07
30	2,13
32	2,13
34	2,12
36	2,12
38	2,11
40	2,11
42	2,11
44	2,10
46	2,10
48	2,10
50	2,09
52	2,09

Graph showing indication of load, determined from oil pressure measurement in piston

Deformation during loading phase

The vertical deflection measured prior to the test on the unexposed side (positive values indicates movement towards the furnace)





Deformation during loading phase

The vertical deflection measured prior to the test on the unexposed side (positive values indicates movement towards the furnace)

Min. / mm	D.1	D.2	D.3	D.Max
0	0,0	0,0		0,0
2	0,1	0,0		0,1
4	0,7	0,0		0,7
6	1,0	0,0		1,0
8	1,9	0,3		1,9
10	2,5	0,8		2,5
12	3,1	1,3		3,1
14	3,6	1,8		3,6
15	3,7	1,8		3,7
16	3,7	1,9		3,7
18	3,7	1,9		3,7
20	3,7	1,9		3,7
22	3,7	1,9		3,7
24	3,7	1,9		3,7
26	3,8	1,9		3,8
28	3,9	2,1		3,9
30	3,8	2,1		3,8
32	3,8	2,1		3,8
34	3,8	2,1		3,8
36	3,8	2,1		3,8
38	3,8	2,1		3,8
40	3,8	2,1		3,8
42	4,0	2,2		4,0
44	4,1	2,3		4,1
46	4,1	2,4		4,1
48	4,1	2,4		4,1
50	4,1	2,4		4,1
52	4,1	2,4		4,1

Failure [min]	-	-	-	-
Failure [mm]	189,9	189,9	189,9	189,9



Photo No. 1 The set-up of the test specimen at the sponsors location



Photo No. 2 The set-up of an individual insulated beam at the sponsors location



Photo No. 3 The glued joint in a M4 composite board during set-up at the sponsors location

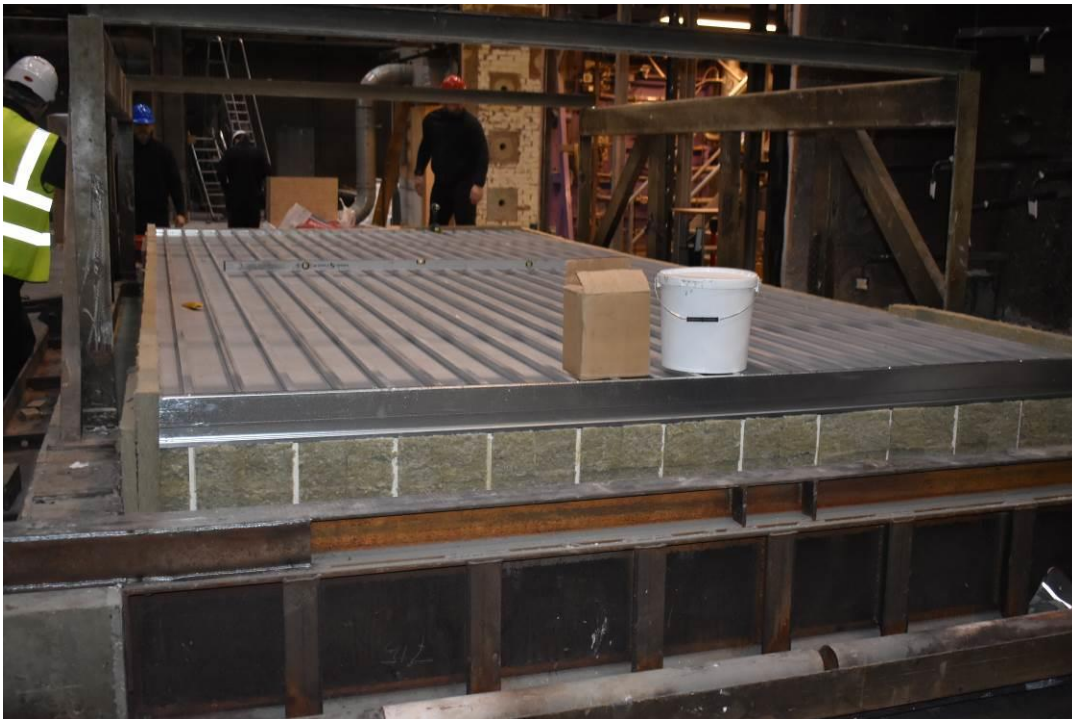


Photo No. 4 The test specimen during set-up in the test frame



Photo No. 5 The test specimen simple supported in the test frame before testing



Photo No. 6 The exposed side of the test specimen before testing



Photo No. 7 The set-up of the loading equipment



Photo No. 8 The unexposed side of the test specimen at testing start



Photo No. 9 The unexposed side of the test specimen after 15 minutes of testing



Photo No. 10 The exposed side of the test specimen after 23 minutes of testing



Photo No. 11 The unexposed side after 30 minutes of testing



Photo No. 12 The exposed side of the test specimen after testing

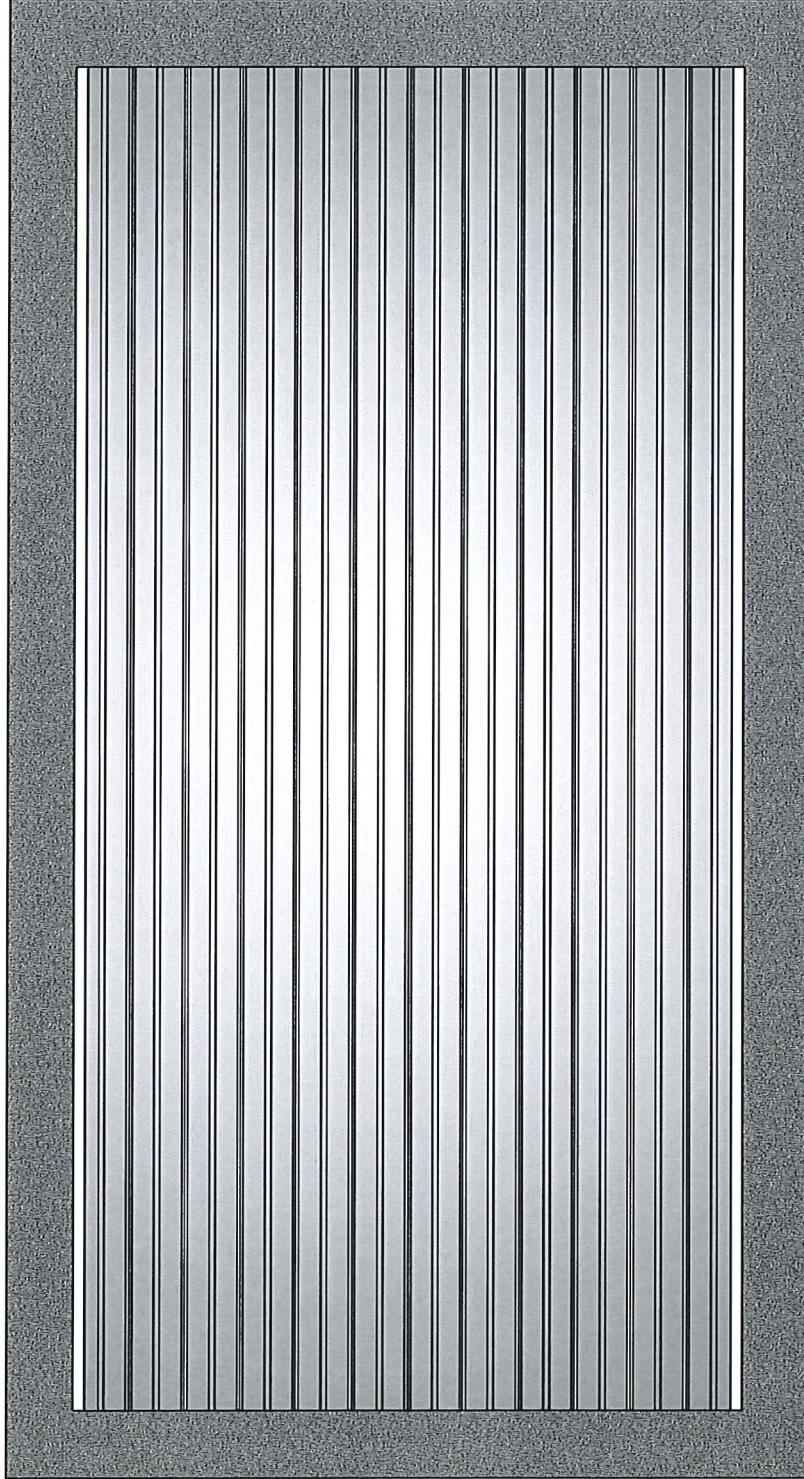


Photo No. 13 The test specimen simple supported in the test frame after testing



Photo No. 14 The glued joint in a M4 composite board after testing

6000,00 mm



2900,00 mm

3000,00 mm

Eksponeret side



Svalehaleprofiler: Standard 250 x 26 mm, (længde variabel), 0,9

Isolering: Rockwool Flexibatts 34, densitet 42 kg.

Kropsplade: M4 Composite. **15mm**

Lim: 2 komponent: Base, ProFect 41176. Hærdet, ProFect 91102

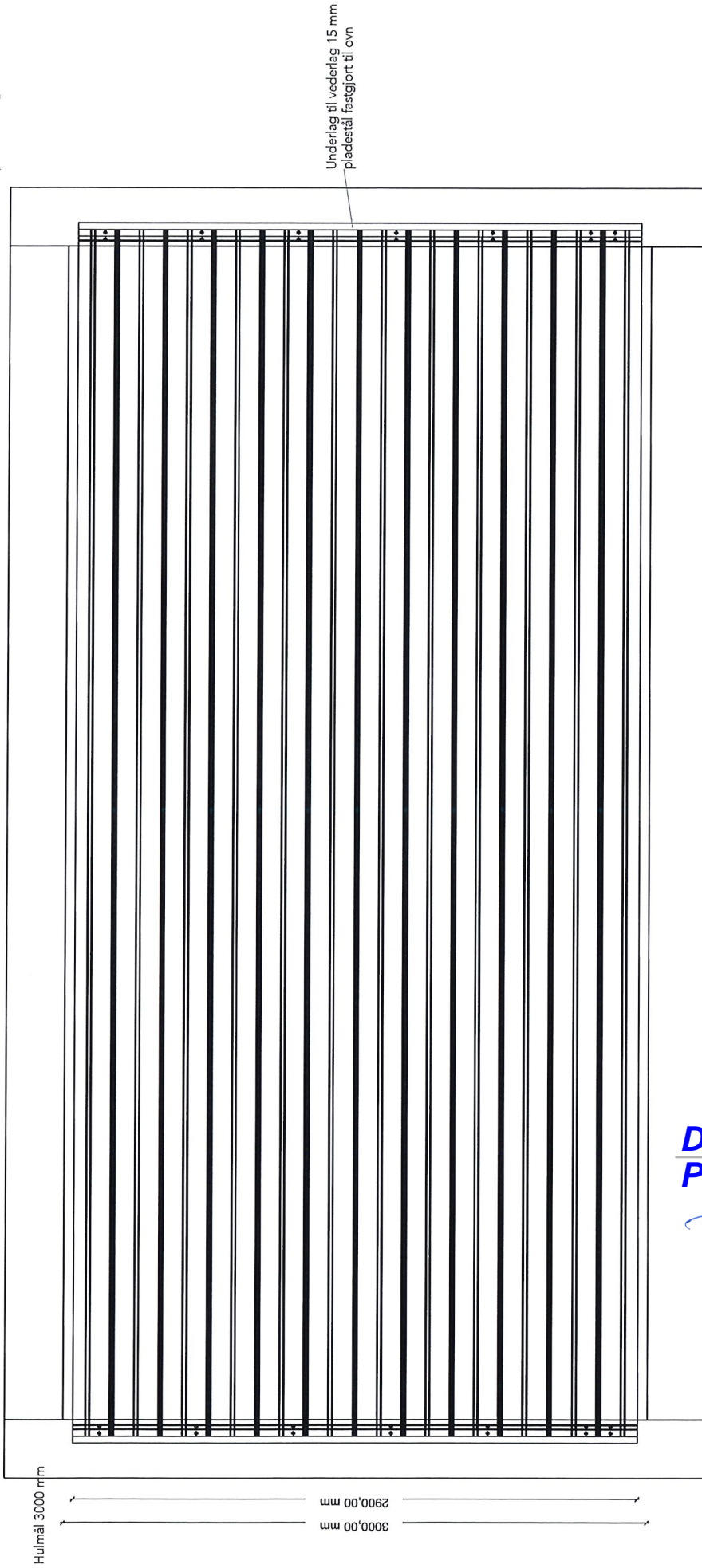
NORDIC BUILD INORGANIC BUILDING SYSTEMS		SNIT:
SAG: Brandtest		Status: Teknisk afklaring
EMNE: Tagelement		SAG: NR.
DATO: 11.12.2018		TEGN. NR.
REV A:		1
MAL: Scale f.m.	UDF af: INK	GODK:
B:	C:	D:

Ikke-eksponeret side

Ikke-eksponeret side

Vederlag kroksplade 50 mm
+ udregende rem 35 mm
Vederlag 50 mm
Eksponeret længde

6170,00 mm
6100,00 mm
6000,00 mm



Underlag til vederlag 15 mm
placetål fastgjort til oven

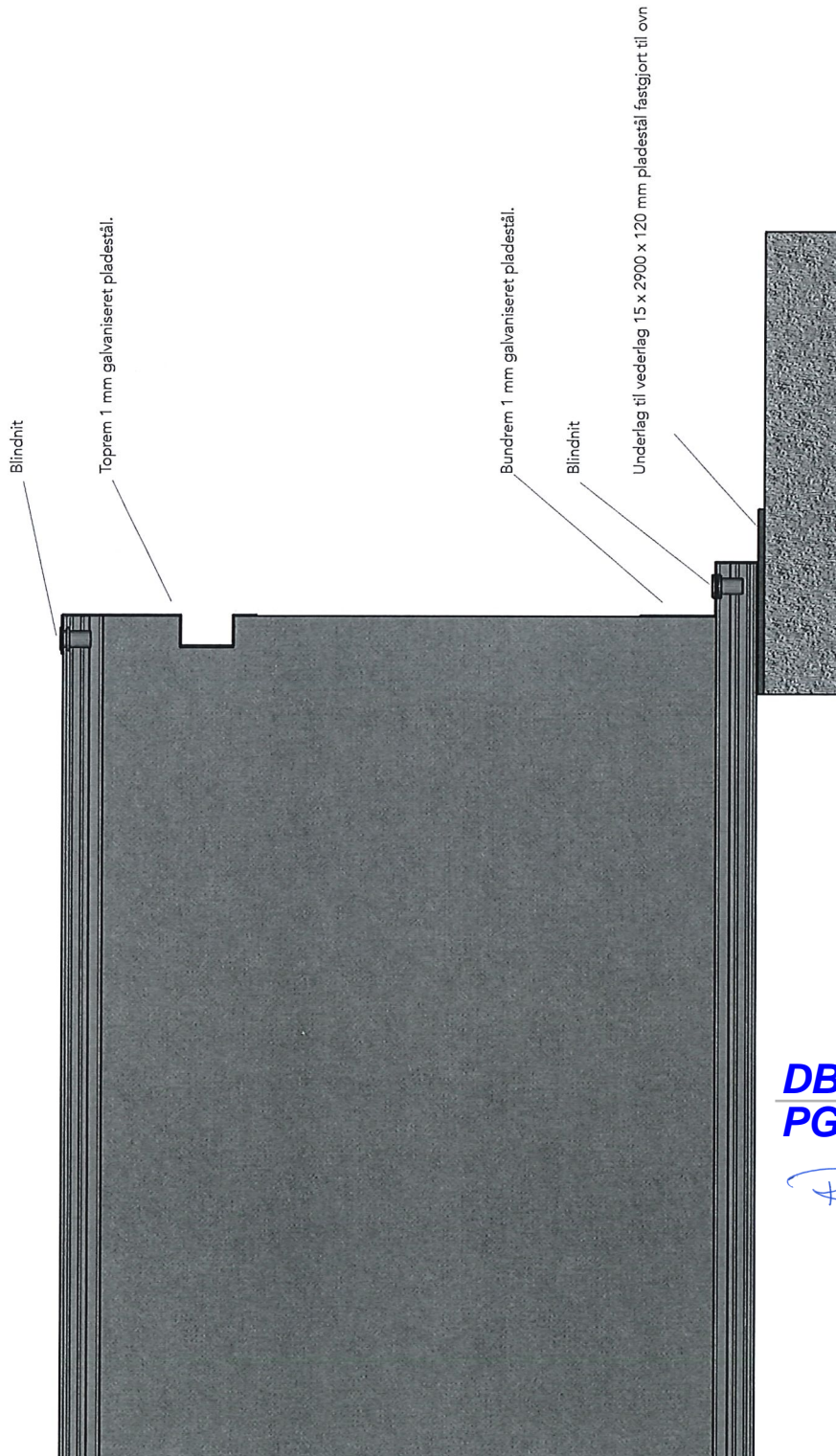
Hulmål 3000 mm

2900,00 mm
3000,00 mm

Elementbredde 2900 mm
50 mm free edge



NORDIC BUILD INORGANIC BUILDING SYSTEMS	SNIT:	
	Status: Teknisk afklaring	
	SAG: NR.	
SAG: Brandtest	TEGN. NR.	2
EMNE: Tagelement		
DATO: 11.12.2018	MÅL: Scale f.m.	UDF af: INK
REV A:	B:	C:
		D:

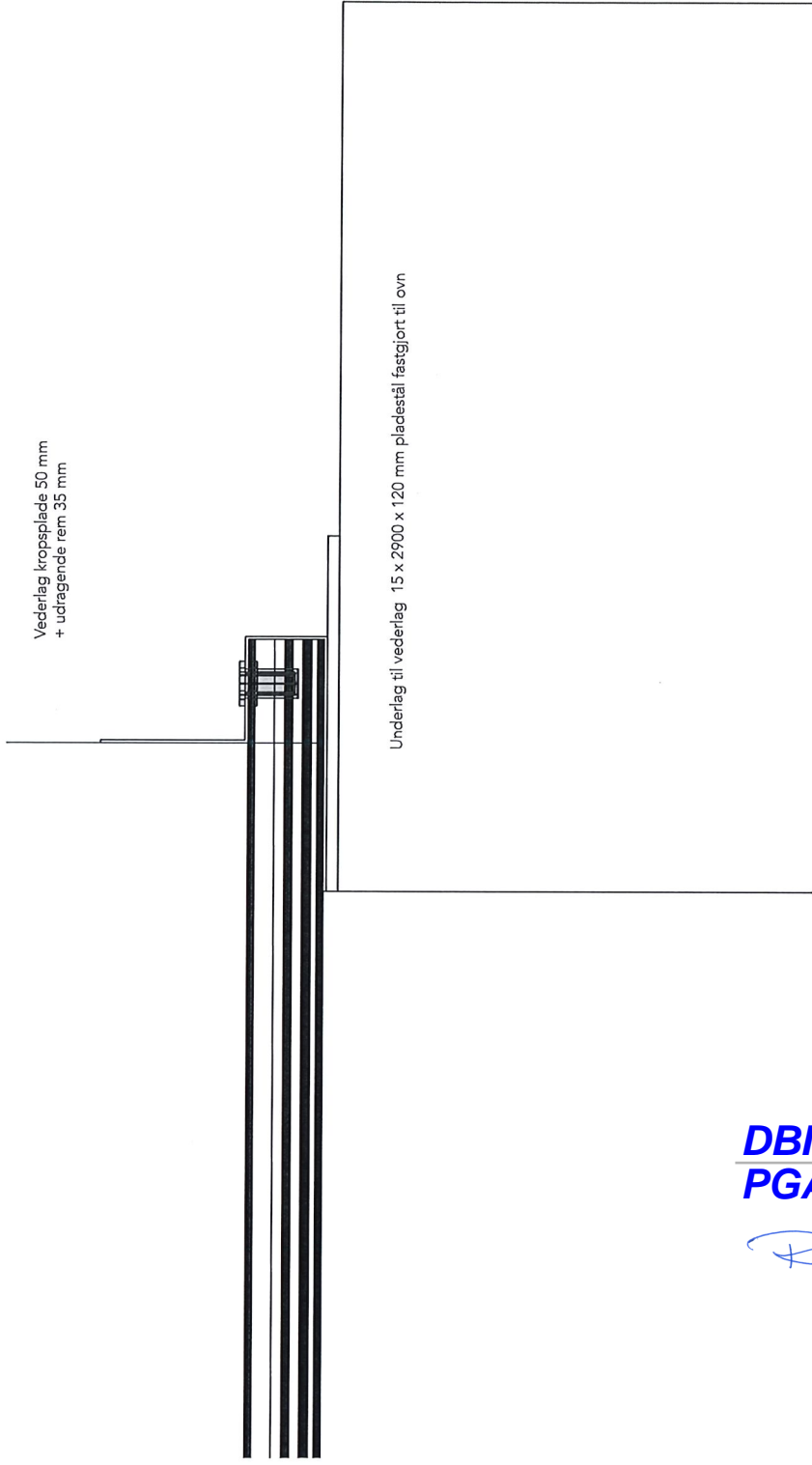


Vederlag, kroksplade 50 mm
+ udragende rem 35 mm



		SNIT:
		Status: Teknisk afklaring
		SAG-NR.
SAG: Brandtest	TEGN. NR.	3
EMNE: Tæglelement vederlagsdetalje		
DATE: 11.12.2018	MÅL: Scale 1:10	UDF af: INK
REV A:	B:	C:
		D:

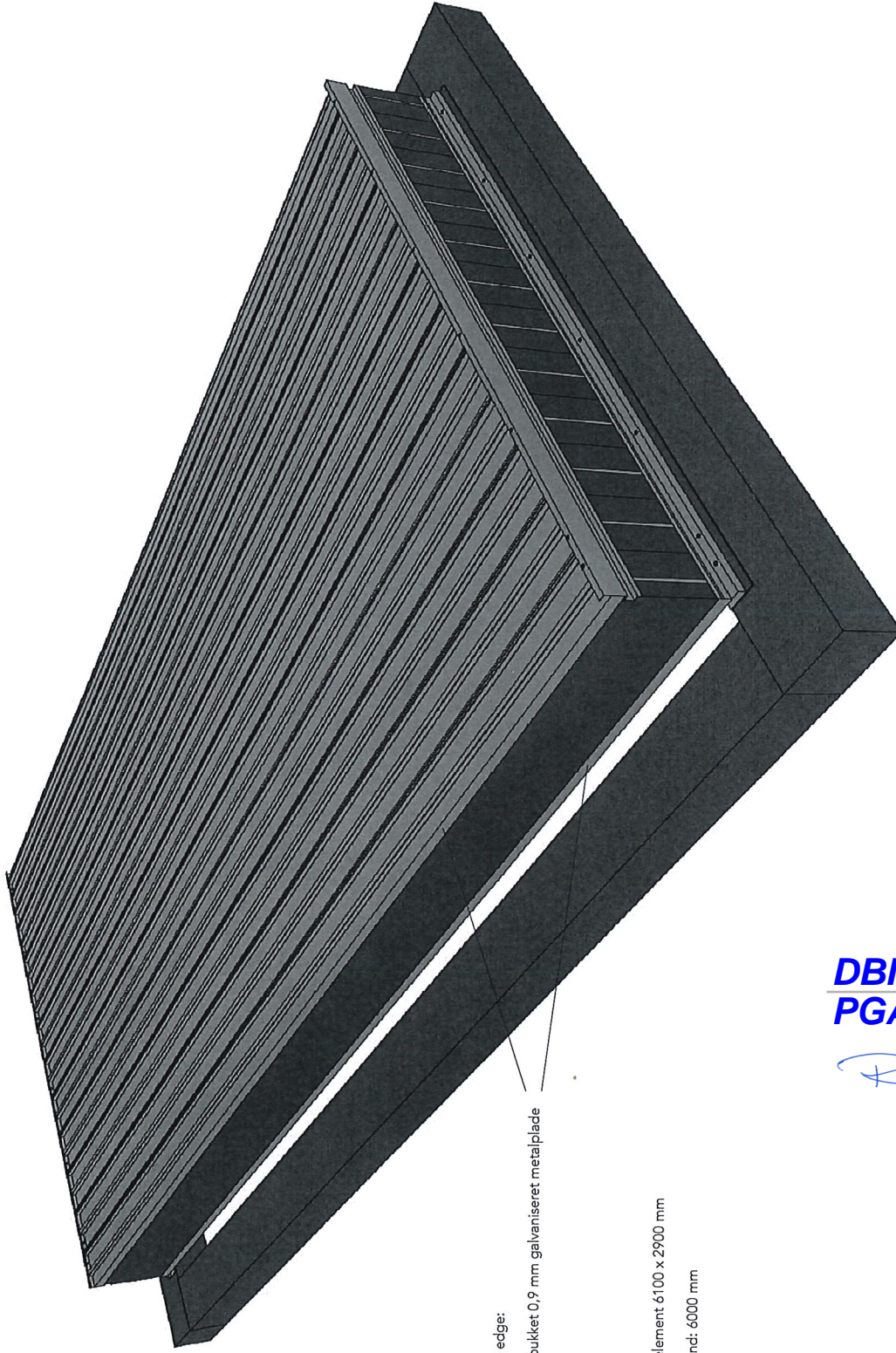
Vederlag kropplade 50 mm
+ udragende rem 35 mm



Underlag til vederlag 15 x 2900 x 120 mm pladestål fastgjort til oven



NORDIC BUILD INORGANIC BUILDING SYSTEMS	SNIT:	
	Status: Teknisk afklaring	
	SAG: NR.	
SAG: Brandtest	TEGN. NR.	4
EMNE: Tægelement vederlagsdetalje		
DATE: 11.12.2018	MÅL: Scale tfm.	UDF af: INK
REV A:	B:	C:
		GODK:
		D:



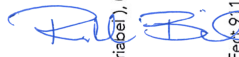


Free edge:

Ombukket 0,9 mm galvaniseret metalplade

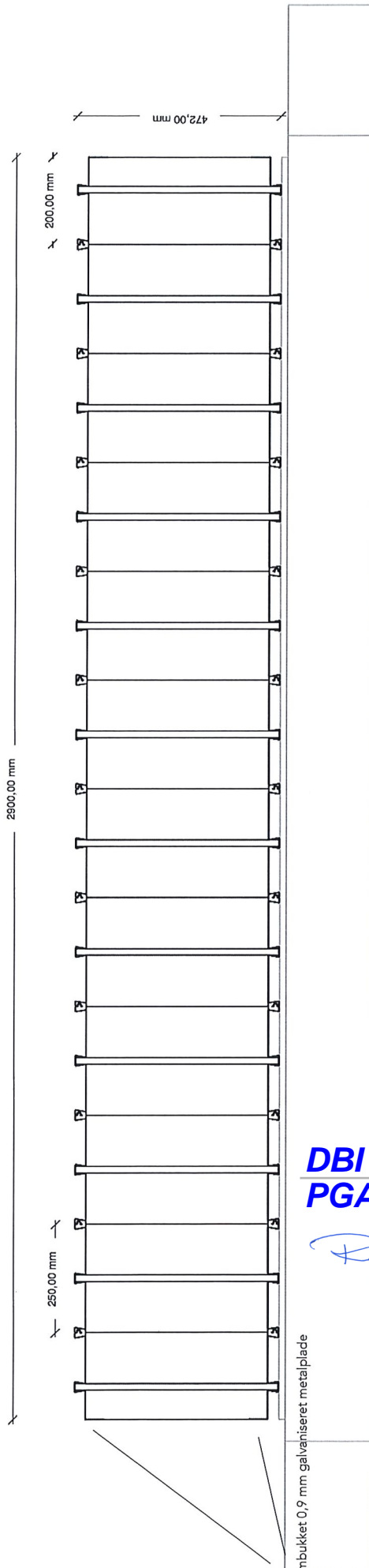
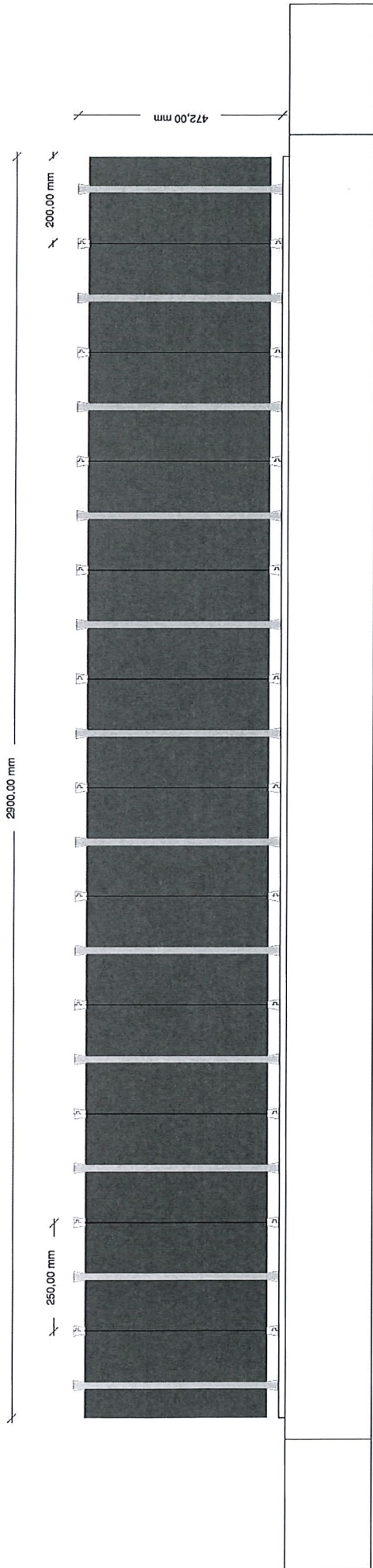
Tagelement 6100 x 2900 mm

Spændi: 6000 mm

Svalerhaleprofiler: Standard 250 x 26 mm, (længde variabel), 0,9 mm (over D + AZ 150)
 Isolering: Rockwool Flexibatts 34, densitet 42 kg.
 Kropsplade: M4 Composite. **15 MM**
 Lim: 2 komponent: Base, ProFect 41176. Hærder, ProFect 91102

		SNIT:
		Status: Teknisk afklaring
		SAG: NR.
SAG: Brandtest		TEGN. NR.
EMNE: Tagelement		5
DATE: 11.12.2018	MÅL: Scale frm.	UDF af: INK
REV A:	B:	C:
		D:



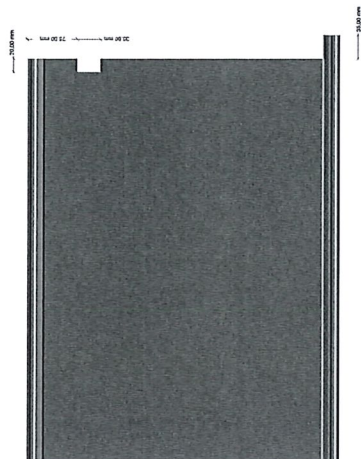
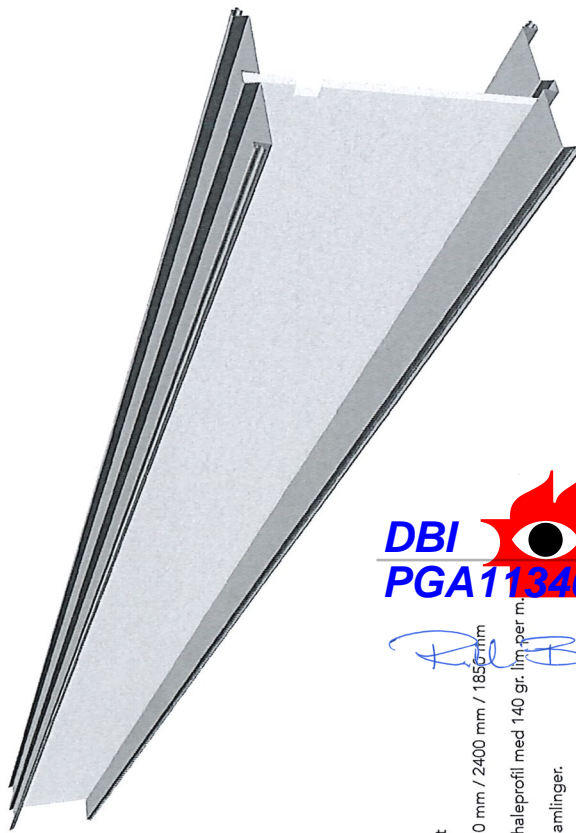
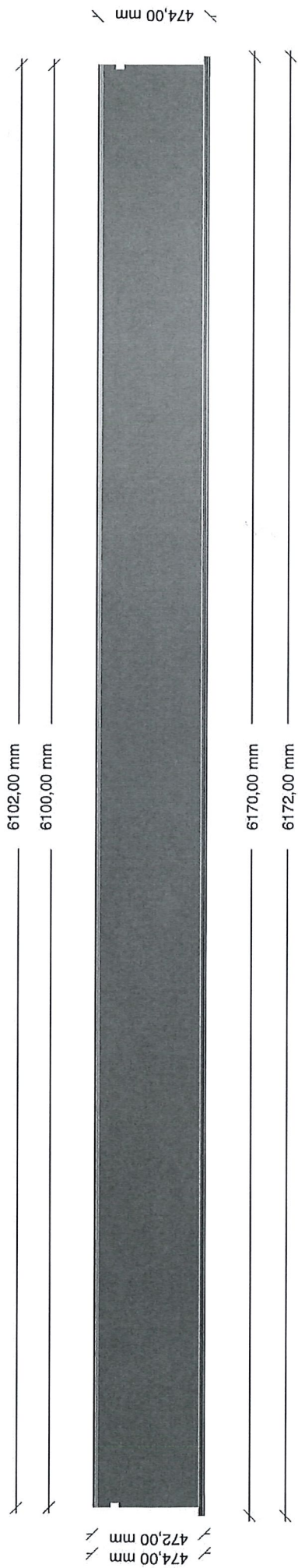
Ombukket 0,9 mm galvaniseret metalplade



Underlag til vederlag 15 x 2900 x 120 mm pladestål fastgjort til oven
 Vederlag kroppsplade 50 mm
 + udtagende rem 35 mm



SNIT:			
Status: Teknisk afklaring			
SAG: NR.			
TEGN. NR.	6		
SAG: Brandtest			
EMNE: Tægelement tværsnit			
DATO: 11.12.2018	MÅL: Scale tfm.	UDF af: INK	GODK:
REV A:	B:	C:	D:



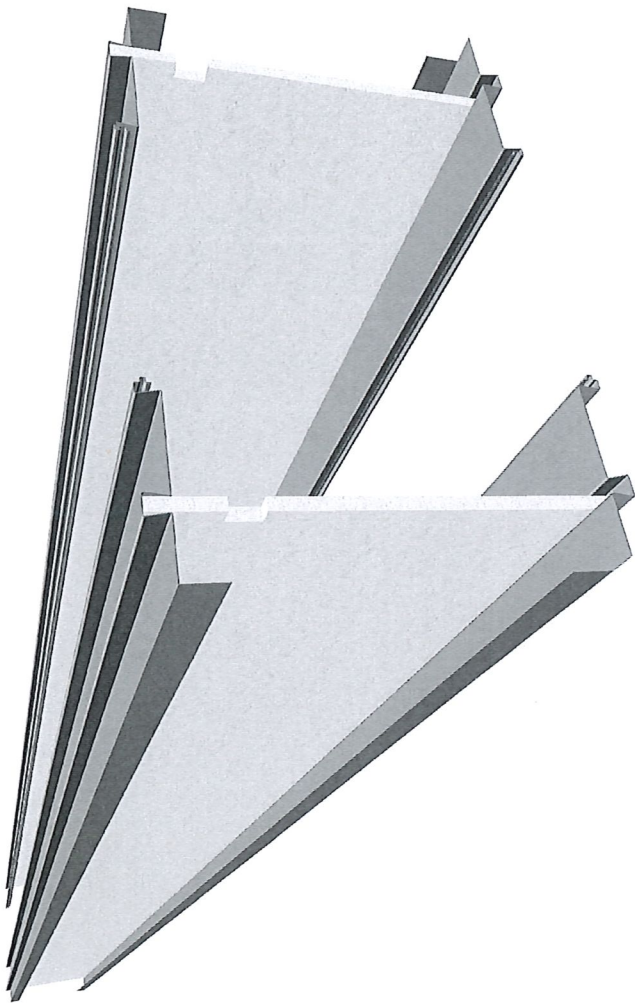
DBI
PGA11340A

DBI

Mængde:
10 stk. SIFS til tagelement
Kropsplade opdeles i 1850 mm / 2400 mm / 1850 mm
Kropsplade limes til svalehaleprofil med 140 gr. lim per m.
Kropsplade limes i pladesamlinger.

3/11

NORDIC BUILD INORGANIC BUILDING SYSTEMS		SNIT:	
		Status:	
		SAG: NR:	
SAG: Brandtest		TEGN. NR.	7
EMNE: Tagelement Produktionstegning		GODK:	
DATO: 11.12.2018	MÅL: Scale tfm.	UDF af: INK	
REV A:	B:	C:	D:



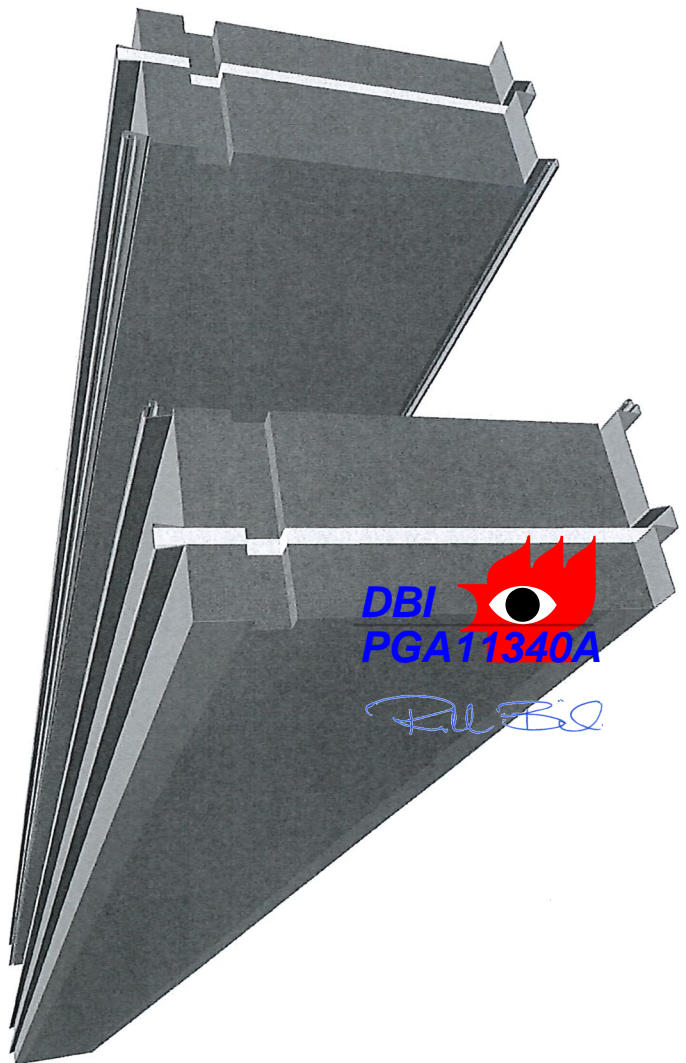
Mængde:

2 stk. edge-SIPS til tagelement

Kropsplade opdeles i 1850 mm / 2400 mm / 1850 mm

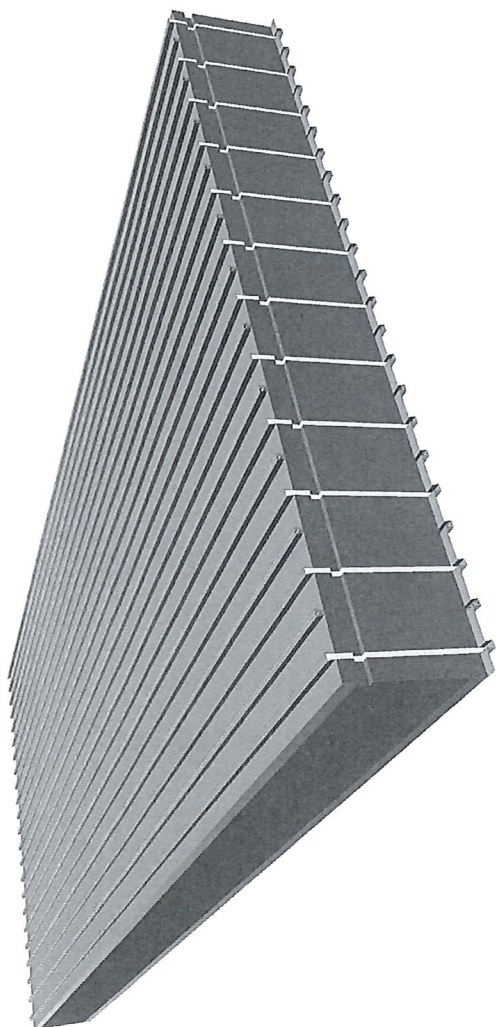
Kropsplade limes til svalehaleprofil med 140 gr. lim per m.

Kropsplade limes i pladesamlinger.



DBI
PGA1340A
RUBO

NORDIC BUILD INORGANIC BUILDING SYSTEMS		SNIT:	
		Status:	
		SAG: NR.	
SAG: Brandtest		TEGN. NR.	8
EMNE: Tagelement Produktionstegning		GODK:	
DATO: 11.12.2018	MÅL: Scale tfm.	UDF af: INK	
REV A:	B:	C:	D:



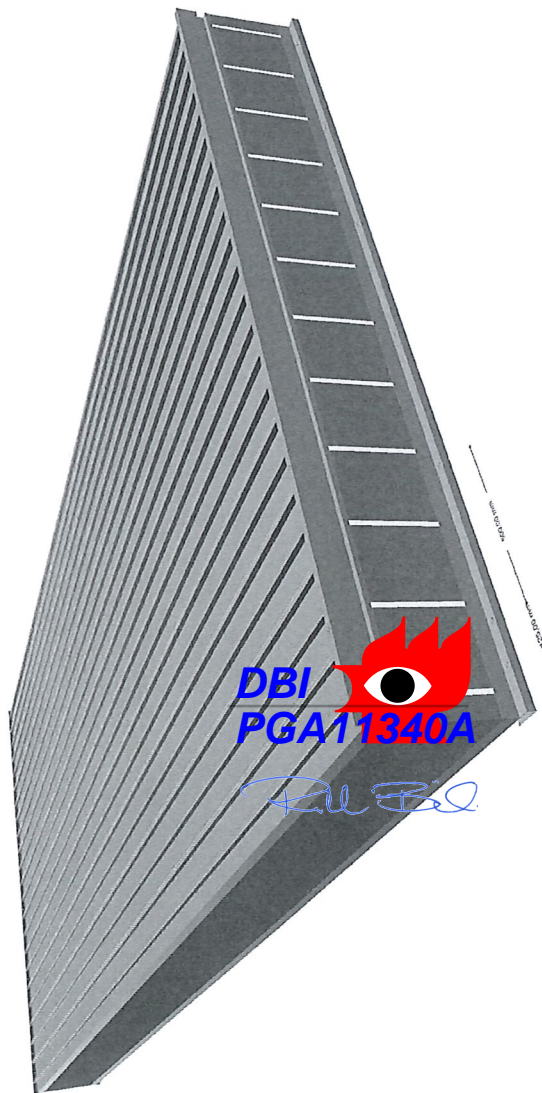
Mængde:

1 stk. tagelement L. 6172 mm x B. 2900 mm x H. 472 mm

SIPS samles med rulle- klemmetang.

Kantprofilerne fastgøres med blindnitter Ø 8 mm

Kantprofilerne fastgøres pr. 500 mm og 125 mm



		SNIT:	
		Status:	
		SAG: NR.	
SAG: Brandtest	TEGN. NR.	9	
EMNE: Tagelement Produktionstegning			
DATE: 11.12.2018	MÅL: Scale t/m.	UDF af: INK	GODK:
REV A:	B:	C:	D:

Cantona M4 komposit

15mm. vindspærreplade af Magnesium Oxide

Materiale

Cantona M4 komposit letvægts vindspærreplade er fremstillet af uorganiske stoffer og forstærkning med glasfibernet sikre stor dimensionsstabilitet. Pladen er diffusionsåben og velegnet som vindspærreplade i ventilerede konstruktioner, med en vandtæt beklædning.

Cantona M4 komposit er brandklasse A1 ubrændbar og er meget modstandsdygtig over for frost, fugt og slag, og kan stå eksponeret i op til 12 måneder.

Anvendelse

Vindspærreplade i konstruktioner med ventileret vandtæt beklædning.

Fugtbestandig - skimmelsvamp

Cantona M4 Komposit vindspærreplade svækkes ikke i våd tilstand, kan ikke rådne eller nedbrydes i fugtigt miljø, og er meget modstandsdygtig overfor angreb af svamp og skimmel.



Tekniske specifikationer for Cantona M4 komposit vindspærreplade

Dimensioner	Enhed	Kvalitet
Længde standard	mm	2400
Bredde standard	mm	1200
Tykkelse standard	mm	15
Densitet	Kg/m ³	1.100
Vægt	15 mm/kg/m ²	16,51
Bøjningsstyrke MPa	MPa	≥6,0
Slagstyrke	KJ/M ²	≥2,0
Udtræksstyrke	N/mm	≥35
Klorid indhold – GB/T 33544-2017	%	0,026
Termisk varmlledningsevne	W/mK	0,19
Termisk modstand	M ² K/W	0,078
Brandegenskaber		
Brand klassifikation - EN 13501-1:2007+A1:2009		A1
Dampdiffusionsmodstand - EN ISO 12572	MNs/g	0,31



FLEXIBATTS 34



PRODUKT

ROCKWOOL FLEXIBATTS 34 er formstabile isoleringsplader fremstillet af ubrændbar, fugt- og vandafvisende ROCKWOOL stenuld. ROCKWOOL FLEXIBATTS 34 er fleksibel i både længde- og bredderetningen. Flexzoner er afmærket på produktets kantflader. ROCKWOOL A/S anbefalede isoleringstykkelser fremgår af [Den lille lune](#).



ANVENDELSE

FLEXIBATTS 34 anvendes til isolering af skråvægskonstruktioner og lette ydervægge. FLEXIBATTS 34 isolerer 8% bedre end FLEXIBATTS 37.

TEKNISKE EGENSKABER

Område	Beskrivelse	Standard																				
Varmeledningsevne	$\lambda_D = 34 \text{ mW/mK}$	EN 13162																				
Varmemodstandsevne	<table border="1"> <tr> <td>mm</td> <td>45</td> <td>70</td> <td>95</td> <td>120</td> <td>145</td> <td>170</td> <td>195</td> <td>220</td> <td>245</td> </tr> <tr> <td>m²K/W</td> <td>1,32</td> <td>2,06</td> <td>2,79</td> <td>3,53</td> <td>4,26</td> <td>5,00</td> <td>5,74</td> <td>6,47</td> <td>7,21</td> </tr> </table>	mm	45	70	95	120	145	170	195	220	245	m ² K/W	1,32	2,06	2,79	3,53	4,26	5,00	5,74	6,47	7,21	EN 12667
mm	45	70	95	120	145	170	195	220	245													
m ² K/W	1,32	2,06	2,79	3,53	4,26	5,00	5,74	6,47	7,21													
Brandklasse	A1	EN 13501-1																				
Fugt	Diffusionstal = MU1 (Samme diffusionsmodstand som luft) Kapillarsugning = 0 m	EN 12086																				
Vandabsorption	Kort tid, WS $\leq 1 \text{ kg/m}^2$	EN 1609																				
Produktcertifikat	Certifikat																					

SORTIMENT (ENHEDER PÅ PALLE)

Type	Dimensioner (mm)	Antal pk. pr. palle	Mængde m ²	DB nr.	Leveringstid
FLEXIBATTS 34	965 x 565 x 45	20	109,05	1899010	24timer
FLEXIBATTS 34	965 x 565 x 70	20	65,43	1899011	24timer
FLEXIBATTS 34	965 x 565 x 95	20	43,62	1899012	24timer
FLEXIBATTS 34	965 x 565 x 120	15	32,71	1899013	24timer
FLEXIBATTS 34	965 x 565 x 145	20	32,72	1899015	24timer
FLEXIBATTS 34	965 x 565 x 170	15	24,53	1899016	24timer
FLEXIBATTS 34	965 x 565 x 195	15	24,53	1899018	24timer
FLEXIBATTS 34	965 x 565 x 220	20	21,81	1899020	24timer
FLEXIBATTS 34	965 x 565 x 245	15	16,36	1899021	24timer

Særlige oplysninger:

ROCKWOOL FLEXIBATTS 34 er fleksibel på de to mørkegrå kolonner i tabellen.



ROCKWOOL FLEXIBATTS 34 kan flekse op til 20 mm på længden og på bredden.
Flexzoner er afmærket på produktets kantflader.

EMBALLERING

ROCKWOOL FLEXIBATTS 34 leveres fuldforpakket og komprimeret.

KVALITETSSIKRING

ROCKWOOL A/S har et kvalitetsstyringssystem, som er certificeret efter DS/EN ISO 9001. ROCKWOOL A/S er medlem af VIF (Dansk forening af fabrikanter af varmeisoleringsmaterialer).

ROCKWOOL produkter er CE-certificerede  og er med i Keymark-ordningen , etableret af den europæiske standardiseringsorganisation CEN. ROCKWOOL A/S er tilsluttet byggeleveranceklauselen for leverancer til byggeri i Danmark. ROCKWOOL Byggeprodukter er løbende under udvikling, og produkternes tekniske specifikationer er angivet med forbehold for ændringer.



Type

2K Polyurthean

Produktbeskrivelse

ProFect® 41176 er en to-komponent, opløsningsmiddelfri polyurethan lim, som giver en stærk og elastisk limfuge. Limen påføres med tandspartel.

ProFect® 41176 bruges altid sammen med hærderen ProFect® 91102.

Anvendelsesområder

ProFect® 41176 er velegnet til limning af metal, træ, isoleringsmaterialer, PVC, beton, glas samt glasfiber

Tekniske data

Farve:	Beige
Viskositet v. 20°C	
• ProFect® 41176:	Ca. 17.000 mPas
• ProFect® 91102:	Ca. 200 mPas
• Blandet:	Ca. 6.500 mPas
Densitet:	
• ProFect® 41176:	1,6 kg/L
• ProFect® 91102:	1,2 kg/L
Shore D-hardness¹	
• ProFect® 91102:	65
Brudforlængelse (DIN 53504)¹	
• Blandet:	15%
Trækstyrke (DIN53504)¹	
• Blandet:	7 N/mm ²
Trækforskydningsstyrke¹	
• Alu - Alu	7 N/mm ²
• Rustfristål - rustfristål	7 N/mm ²
• Bøg - bøg	15 N/mm ²
Pot-life (20°C, 50 RH%):	
• Blandet:	Ca. 4½ minutter
Åbentid (20°C, RH 50%):	
• Blandet:	7½ - 2 minutter
Presse tid, 20°C:	
• Blandet:	25 minutter
Forbrug	
• Blandet:	200 - 600 g/m ²

1) 28 dage, 23°C, 50 %RH.

Arbejdsbetingelser

Overfladerne skal være fri for snavs, støv og fedt. Slipmidler på overfladen kræver specialforbehandling eller slibning.

4,5 dele ProFect® 41176 + 1 del ProFect® 91102 (Vægt)

Vær omhyggelig ved afvejning/afmåling

Blandes med langsomme bevægelser til blandingen er homogen.

Påføres emnerne manuelt eller med 2-komponent påføringsudstyr.

Må ikke blandes med andre lime.

Rengøring

Våd lim fjernes med en tør klud og efterfølgende aftørring med ProFect® 4801.

Hærdet lim fjernes mekanisk.

Opbevaring

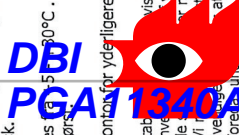
ProFect® 41176 opbevares på 5-15°C. Holdbarhed 6 måneder. Beskyt mod frost. Anvend zædst i ligger først.

Emballage

Kontakt venligst vort salgskontor for yderligere information.

Ansvarsfraskrivelse

De i nærværende produktdatablad givne oplysninger og data har kun til formål at være vejledende i forbindelse med anvendelse af vores produkter. Der gives således ingen garanti eller tages ansvar for eventuelle skader eller mangelfulde resultater, der skyldes forkert installation, mangelfulde håndfærdigheder, afsmitning mv. som måtte opstå ved anvendelse af produktet. Vi påtager os ikke ansvaret for skader eller tab, der skyldes anvendelse af produktet til andre formål, end de formål, som er beskrevet i produktionsbetingelserne. Ved vurderingen af produktionsbetingelserne skal der tages højde for materialernes type, beskaffenhed og alder/levetid, ligesom nye forsøg bør iværksættes, hvis materialer og/eller produktionsbetingelserne i øvrigt på nogen måde ændres, herunder eventuel ny materialeleverandør.



Coatings	Designation EN 10326 – EN 10327	Coating weight – Double sided (g/m ²)	Coating thickness (µm per side)
	AZ100	100	13
	AZ150	150	20
	AZ165	165	23
	AZ185	185	25
	AZ200	200	26

Coating thickness for indication.

Steel grades	Steel for bending and deep drawing applications		
Designation EN 10327	R _e (N/mm ²)	R _m (N/mm ²)	A ₈₀ (%)
DX51D+AZ	≥ 140	270 – 500	≥ 22
DX52D+AZ	140 – 300	270 – 420	≥ 26
DX53D+AZ	140 – 260	270 – 380	≥ 30
DX54D+AZ	140 – 220	270 – 350	≥ 34
DX56D+AZ (HFX)*	120 – 180	260 – 330	≥ 39

Measurements transverse to rolling direction. When thickness $t < 0.7$ mm, A₈₀ should be decreased with 2%.

* Steel grade not mentioned in the standard.

Structural steel			
Designation EN 10326	R _e (N/mm ²)	R _m (N/mm ²)	A ₈₀ (%)
S220GD+AZ	≥ 220	≥ 300	≥ 20
S250GD+AZ	≥ 250	≥ 330	≥ 19
S280GD+AZ	≥ 280	≥ 360	≥ 18
S320GD+AZ	≥ 320	≥ 390	≥ 17
S350GD+AZ	≥ 350	≥ 420	≥ 16
S380GD+AZ*	≥ 380	≥ 450	≥ 22
S420GD+AZ*	≥ 420	≥ 500	≥ 21
S550GD+AZ	≥ 550	≥ 560	-

Measurements in rolling direction. When thickness $t < 0.7$ mm, A₈₀ should be decreased with 2%.

* Steel grade not mentioned in the standard.

Dimensions	Thickness (mm)	Width (mm)
	0.25 – 2.00	700 – 1500

Surface aspect	Designation EN 10326 – EN 10327	Definition
	A	Standard finish (normal skinpass)
	B	Improved finish (skinpass)



Protection – surface treatments	Designation	Definition
	E-Passivation®	Chromium-free chemical passivation
	O	Oiling
		Passivation and oiling
	Easyfilm® E	Environment-friendly thin organic coating (chromium-free, complying with European directives)



The technical informations above respond to the extreme feasibilities of ArcelorMittal's installations. Some extreme combinations may not be available. It is therefore recommended to consult us in these cases or when specific dimensions, packaging, finishing etc are requested.

Aluzinc®

Type	Continuous hot dip coating		
	Double-sided coating		
Properties	Excellent corrosion resistance Very attractive appearance Excellent thermal and light reflectivity Good abrasion resistance		
Applications	Construction	Roofing, cladding, profiling, tiles etc	
	General industry	Housings, cabinets and cases for air conditioning, computers, pipes, electrical equipment etc	
	Appliances	Washing machines, tumble dryers, refrigerators, ovens, toasters etc	
Description	Composition	Aluminium (55%) Zinc (43.4%) Silicon (1.6%)	
	Structure	Bi-phase structure, with grains of aluminium and zinc	
	Bulk density	3750 kg/m ³	
	Aspect	Bright silvery metallic spangle	
	Aspect durability	Good Excellent with Easyfilm®	
	Performances	Edge protection	Very good
Surface protection			
• Salt spray test, corrosion resistance (ISO 7253 / DIN 50021)		50 hours/μm	
• Outdoor exposure, corrosion resistance		Marine Industrial	0.6 μm/year 0.3 μm/year
Adhesion (Resistance to cracking on bending for DX51D+AZ reference) ¹ (EN 10327)		0 T (AZ100, AZ150) 1 T (AZ185)	
Hardness on cross section (Vickers, 5g)		140 HV 100 HV for HFX grade	
Reflection of solar heat		New Aged	81% 39%
Heat transmission		65 Watts/m ²	
Temperature resistance T _{max}		315°C	
Fire resistance		European standard EN 13501-2 French standard (NF P92-507) British standard BS 5822-1:2003	DBI PGA 11340A
Remarks	The performances indicated are averages and may vary in particular according to the type of support used. These data are not contractual and may be amended in line with technological progress related to the product.		