

Test Report

Penetration seal

Name of sponsor:	Wood:UpHigh		
Test specimen:	Penetration seals in different walls		
File no.:	PGA12248A	Revision no.:	0
Test date:	2023-04-27	Date:	05-02-2024
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Ref:	RKP / KTO		

Client information

Client: Wood:UpHigh
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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.

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1 Date of test

The test was conducted on 2023-04-27

2 Purpose of test

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

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

in conjunction with

EN 1366-3:2022 Fire resistance tests – Penetration seals

Electrical installation boxes were included and was tested based on the principles of EN 1364-1:2015 – Fire resistance tests for non-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 the sponsor.

4 Drawings and description

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

Type	Drawing No.	Subject
Drawing	1.0	Comparison test – pipe penetrations
Drawing	1.1	Comparison test – pipe penetrations
Drawing	1.2	Comparison test
Drawing	1.3	Comparison test
Drawing	1.4	Comparison test
Drawing	1.5	Comparison test
Drawing	1.6	Comparison test
Drawing	1.7	Comparison test
Drawing	1.8	Comparison test

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.

In the test 2 walls were included with the same penetration seals. The difference between the two supporting constructions were the insulation type. One was insulated with stone wool and the other with wood fiber insulation batts.

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

Test specimen

External measures for each wall:

Height: 3100 mm

Width: 2530 mm

Thickness: 145 mm

General description of the test specimen

Penetration seal system The penetration seal system consisted of an uninsulated various pipe penetrations individually sealed.

The different components of the system are described below.

Seal system An intumescent fire protection sleeve was fitted around the pipes in the total depth of the wall. The size of the sleeve was 15 mm thick with a total depth of 145 mm. The product used around the plastic based pipes were designated [REDACTED]. On the metal pipes [REDACTED] were used. All dimensions were fitted to the pipes.

Covering the sleeves a mastic designated [REDACTED] was applied.

Supporting construction The walls were not a standard supporting construction. The walls were with wooden studs and 2 layers of gypsum boards on either side and insulated with either stone wool or wood fiber insulation batts.

Pipe penetrations

Service support system: The pipes were held in place by brackets on a steel profile rig (Standard support system). The rig consisted of 41 x 41 x 2 mm (H x W x T) C-profiles, designated [REDACTED] and steel brackets mounted with nuts and bolts.
See photo no.4.

Two horizontal profiles were welded to the test frame on either side of the walls. The C-profiles were welded to the horizontal profiles with a distance of 400 mm and 700 mm from the wall. The support system was only mounted on the unexposed side.

Brackets for the pipes were added to the C-profiles. They were adjustable with threaded rods. Each pipe was secured with two steel brackets attached to the two C-profiles. The steel brackets for the pipes were selected based on their diameter.
See photo no. 6.

Service installations: The basic setup for the pipes was as follows:
The pipes were uninsulated.

Each pipe was approximately 1650 mm long and protruded approximately 500 mm on the exposed side and 1000 mm on the unexposed side.

Capping was done with 50 mm stone wool - Intumescent coated slabs and a mastic designated Envirograf Intumescent AM acrylic mastic. All pipes were capped on the exposed and unexposed side giving the pipes the pipe end configuration of C/C.

Further information about the pipes is given in table 1 below.

Electrical installations

Installation box Two installation boxes were included in both walls. One was located on the exposed side and the other on the unexposed side. The boxes were placed between two wooden studs in the height of 740 mm from the bottom of the wall.
The installation boxes were designated [REDACTED] forfrådåse and were a 1½ module box. The boxes included an intumescent pad.

The installation boxes were fitted with electrical sockets designated [REDACTED].

See drawing no 1.3-1.5 and photo no. 8 and 9.

Supporting construction

Wood studs 45 x 95 mm pine studs with the strength class C24 were used for the walls. The studs were placed per cc 450 mm. The studs were joint with a top and bottom rim. 2 screws of 5.0 x 120 mm were used in each end. See drawing 1.6 and photo no. 1.
To fix the wooden frame to the test frame 7.5 x 92 mm screws were used. Each frame had the outer dimensions of 2500 x 3000 mm (width x height)

At the bottom additionally two pine studs of 95 x 45 x 2530 mm were installed to raise the wooden frame 100 mm upwards.

Gypsum boards 2 layers of gypsum boards were fixed to either side of the wooden structure. The gypsum boards designated [REDACTED] had a thickness of 12.5 mm and maximum dimensions of 2700 x 900 mm. A horizontal joint was included 400 mm from the top.

The gypsum boards were fixed with 3.9 x 41 mm screws in the first and second layer. The distance between the fixations were approximately 200 mm with a range between 100 – 300 mm.

The gypsum boards were staggered with 450 mm.

Insulation

The insulation used for wall A was stone wool (SW), designated [REDACTED] with a nominal density of 30 kg/m³. The batts had a maximum dimension of 445 x 1000 x 95 mm. The stone wool was cut to size and fitted between the studs.

The insulation used for wall B was wood fiber (WF) batts designated [REDACTED] with a nominal density of 50 kg/m³. The batts had a maximum dimension of 100 x 565 x 1200 mm and were cut to fit between the wooden studs.

Finishing

Over the joints of the outer layer of the gypsum boards a self-adhesive mesh was applied and filler was applied on top.

Free edge

A free edge in each side of each wall was installed. The free edge consisted of one layer of 30 mm stone wool.

Table 1:

Test specimen system number	Pipe type/product name	Pipe outer diameter	Pipe wall thickness	Seal type	Seal thickness	Length of seal	Pipe end configuration
		[mm]	[mm]		[mm]	[mm]	
Pipe 1	[REDACTED] PE-HD pipe	110	5.0	[REDACTED]	15	145	C/C
Pipe 2	[REDACTED] steel pipe	28	1.5	[REDACTED]	15	145	C/C
Pipe 3	[REDACTED] pipe (Material: PE-RT II / aluminium)	20	2.5	[REDACTED]	15	145	C/C
Pipe 4	[REDACTED] pipe in pipe (Material: PE-X/EVOH)	15	2.5	[REDACTED]	15	145	C/C
	Outer pipe corrugated PE-X	25	5	[REDACTED]			

Measured by DBI

Product		Gypsum Boards	Wood fiber insulation	Stone Wool	Wood studs
Density	kg/m ³	691	48	32	543
Thickness	mm	12.5	100.0	95.0	95.0
Moisture content	%	0.45	3.11	1.17	11.07
Organic content	%			1.84	
Sampling method		Extra material	Extra material	Extra material	Extra material
Drying temperature	°C	55	105	105	105

* The wood studs are measured 20% higher in density than the stated nominal density of 450 kg/m³.

5 Test conditions

Conditioning

The test specimen was delivered on the 21-04-2023 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 in a test frame lined with high density concrete with a clear opening of 2600 x 3100 mm. Between the walls aerated concrete with a nominal density of 575 kg/m³ was installed with the dimensions 300 x 3100 x 150 mm (width x height x thickness)

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.

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. 1.0-1.8.

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.

6 Test results

Duration of the test was 91 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 4.0 and 4.1	Ambient temperature The ambient temperature in the laboratory during the test
Enclosures 5.0 and 5.1	SW Wall 1 - Average temperature rise Measured with 5 thermocouples.
Enclosures 6.0 and 6.1	SW wall 1 - Maximum temperature rise

	Maximum temperature rise on the unexposed side.
Enclosures 7.0 and 7.1	SW wall 1 - Pipe 1 Maximum temperature rise inside the construction.
Enclosures 8.0 and 8.1	SW wall 1 - Pipe 2 Maximum temperature rise inside the construction.
Enclosures 9.0 and 9.1	SW wall 1 - Pipe 3 Maximum temperature rise inside the construction.
Enclosures 10.0 and 10.1	SW wall 1 - Pipe 4 Maximum temperature rise inside the construction.
Enclosures 11.0 and 11.1	SW wall 1 - Installation box Maximum temperature rise inside the construction.
Enclosures 12.0 and 12.1	SW wall 1 - Internal measurements - stud B Measure on 3 sides of stud and between the gypsum board layers.
Enclosures 13.0 and 13.1	SW wall 1 - Internal measurements - stud C Measure on 3 sides of stud and between the gypsum board layers.
Enclosures 14.0 and 14.1	WF wall 2 - Average temperature rise Measured with 5 thermocouples.
Enclosures 15.0 and 15.1	WF wall 2 - Maximum temperature rise Maximum temperature rise on the unexposed side.
Enclosures 16.0 and 16.1	WF wall 2 - Pipe 1 Maximum temperature rise inside the construction.
Enclosures 17.0 and 17.1	WF wall 2 - Pipe 2 Maximum temperature rise inside the construction.
Enclosures 18.0 and 18.1	WF wall 2 - Pipe 3 Maximum temperature rise inside the construction.
Enclosures 19.0 and 19.1	WF wall 2 - Pipe 4 Maximum temperature rise inside the construction.
Enclosures 20.0 and 20.1	WF wall 2 - Installation box Maximum temperature rise inside the construction.
Enclosures 21.0 and 21.1	WF wall 2 - Internal measurements - stud B Measure one 3 sides of stud and between the gypsum board layers.
Enclosures 22.0 and 22.1	WF wall 2 - Internal measurements - stud C Measure one 3 sides of stud and between the gypsum board layers.
Enclosures 23.0 and 23.1	Deformation Negative values indicate movement towards the furnace. 1-3 on SW wall 1, 4-6 on WF wall 2

Enclosures 24.0 and 24.1 SW wall 1 - Internal measurements - stud B
Measure one 3 sides of stud and between the gypsum board layers

Enclosures 25.0 and 25.1 WF wall 2 - Internal measurements - stud B
Measure one 3 sides of stud and between the gypsum board layers

Visual observations:

Time / Minutes	Visual observations:	U = Unexposed side E = Exposed side
0	Test commences	
0	Smoke development from SW (Stone Wool) P1 end cap	U
1	Smoke from aerated concrete center between the two walls	U
1	Smoke development stopped from SW P1 end cap	U
2	Smoke development from free edge in both walls	U
3	Smoke stopped from free edge in both walls	U
8	Plastic pipe melted away	E
9	Alupex was melting	E
11	Smoke development from left edge of SW	U
13	Filler was falling from both walls	E
18	Gypsum board was cracking along the center line on both walls	E
18	Installation box intumescent had expanded on both walls	E
18	Alupex is melted away	E
20	Cracks in gypsum board between studs on WF (Wood Fibre) wall	E
22	Slight darkening around outlet on SW wall	U
25	Faint smoke development from installation box	U
33	Faint discoloration along free edge SW wall on the left side	U
34	Gypsum boards still in place, but with large cracks both vertically and horizontally.	E
42	Increase of smoke development from left side of SW wall	U
42	First board fell from the left side of SW wall	E
47	One more board has fallen from SW wall	E
48	Wood burning sounds	U
49	Gypsum boards had fallen down from the corner of the WF wall	E
50	More gypsum boards fell down from the SW side	E
53	Both layers of gypsum fell slightly from SW wall. The half part of the first layer of gypsum boards on WF was fallen	E
55	More gypsum fell from the WF wall	E
56	More gypsum fell from the SW wall – half of the insulation is exposed	E
57	Increased smoke development from installation box on SW wall and from the top of SW wall	U

63	Visible insulation on SW wall	E
64	30 – 40 % of the insulation was exposed on the WF wall and the insulation had visibly shrunk	E
67	Cotton pad test was done over SW wall installation box: no ignition, no discoloration	U
70	Heavy smoke development from installation box WF wall	U
70	Insulation fell from the WF wall	E
72	Installation box from the WF wall had sustained flaming + gap gauge of 25 mm diameter was able to pass through	U
80	Heavy smoke appeared from pipe 1 on the WF wall	U
84	Discoloration on Pipe from the WF wall. Discoloration was on the top part of the seal.	U
88	Cotton pad test pipe 1 on the WF wall: No ignition, no discoloration	U
91	Almost all insulation on WF wall had fallen.	E
91	Test stopped	
93	Discoloration began on the center of the boards placed on the WF wall	U

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 1366-3:2021 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:

Test specimen	Supporting construction:	Thermocouple group name:	On service installation (pipe):	On the supporting construction:	Integrity (E)	Insulation (I)
	wall	[min]	[min]	[min]	[min]	[min]
Pipe 1	SW	1.P1.X	91	91	91	91
Pipe 2	SW	1.P2.X	91	91	91	91
Pipe 3	SW	1.P3.X	91	91	91	91
Pipe 4	SW	1.P4.X	91	91	91	91
Pipe 1	WF	2.P1.X	91	91	91	91
Pipe 2	WF	2.P2.X	91	90	91	90
Pipe 3	WF	2.P3.X	91	91	91	91
Pipe 4	WF	2.P4.X	91	91	91	91

The cotton pad was not ignited, sustained flaming did not occur, and no through-going openings were created in the test specimen during the test.

Additionally, installation boxes were included in the test. The thermocouples were placed after the principles in EN 1364-1:2015. The results are as follows:

Test specimen	Supporting construction	On service installation (pipe):	On pipe closure device:	On the supporting construction:	Integrity (E)	Insulation (I)
Electrical socket 1 (exposed side)	Stone wool insulation	91	-	91	91	91
Electrical socket 2 (unexposed side)	Stone wool insulation	91	-	91	91	91
Electrical socket 1 (exposed side)	Wood fiber insulation	91	-	91	91	91
Electrical socket 2 (unexposed side)	Wood fiber insulation	91	-	91	72	91

The supporting construction had additional thermocouples placed on the unexposed side according to the principles in EN 1364-1:2015.

The results for the supporting construction with stone wool insulation based on the thermocouples on unexposed side was:

Integrity (E): 91 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): 91 minutes

- 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.

The results for the supporting construction with wood fiber insulation based on the thermocouples on unexposed side was:

Integrity (E): 91 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): 91 minutes

-
- Insulation failure occurred due to failure of integrity after 91 minutes.
 - 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.

In the graphs, enclosure 12.0-13.1 (stone wool insulation) and 21.0 – 22.1 (wood fiber insulation), information about the temperature rise inside the construction can be seen.

8 Remarks

The field of direct application of the test results appears from 1366-3:2021, 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.



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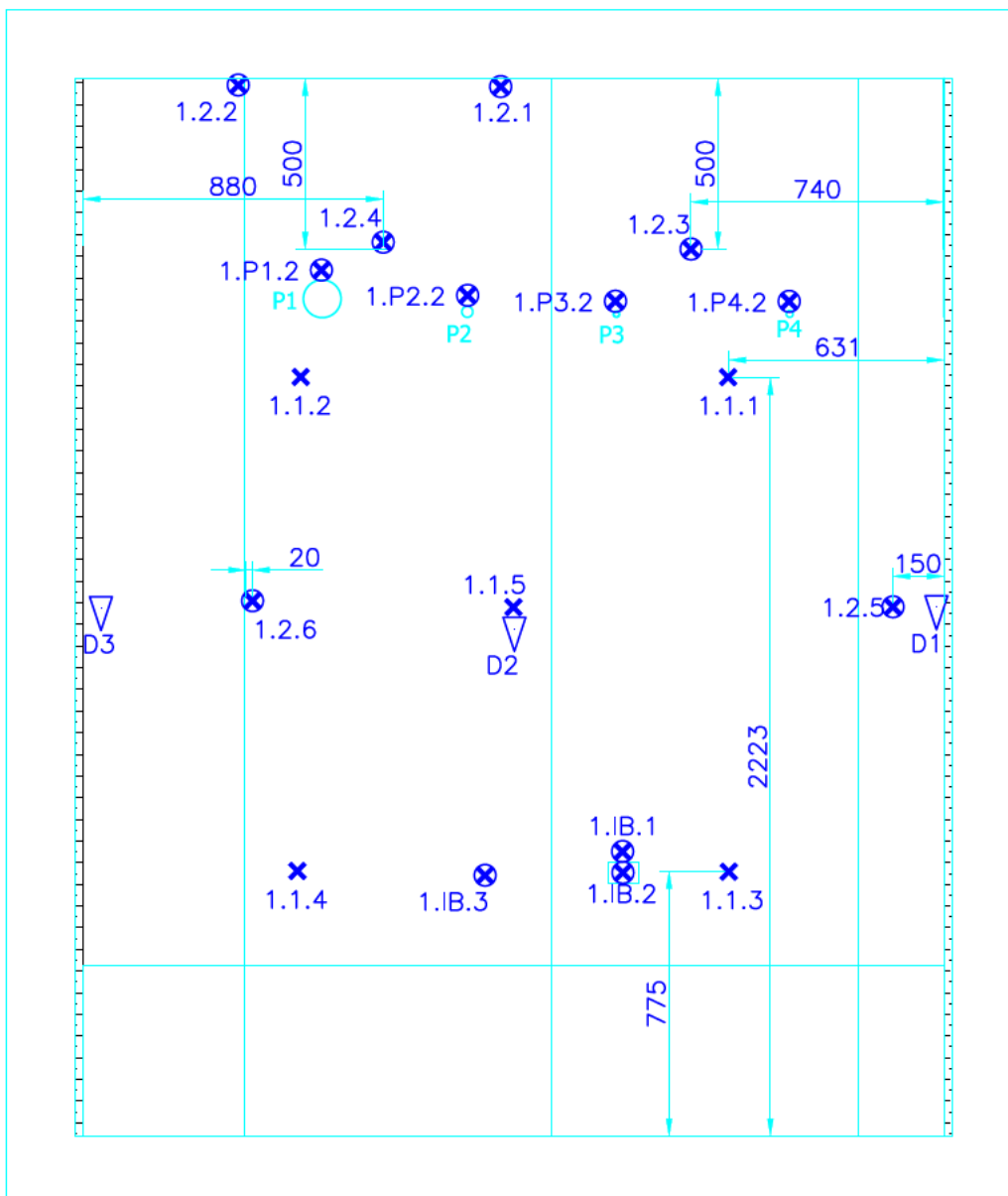
Wood:UpHigh

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Enclosures:

DBI drawings:	3
DBI graphs and tables:	46
Photo sheets:	10
Sponsors drawings:	6

65



All measurements are in mm

Danish Institute of Fire and security Technology

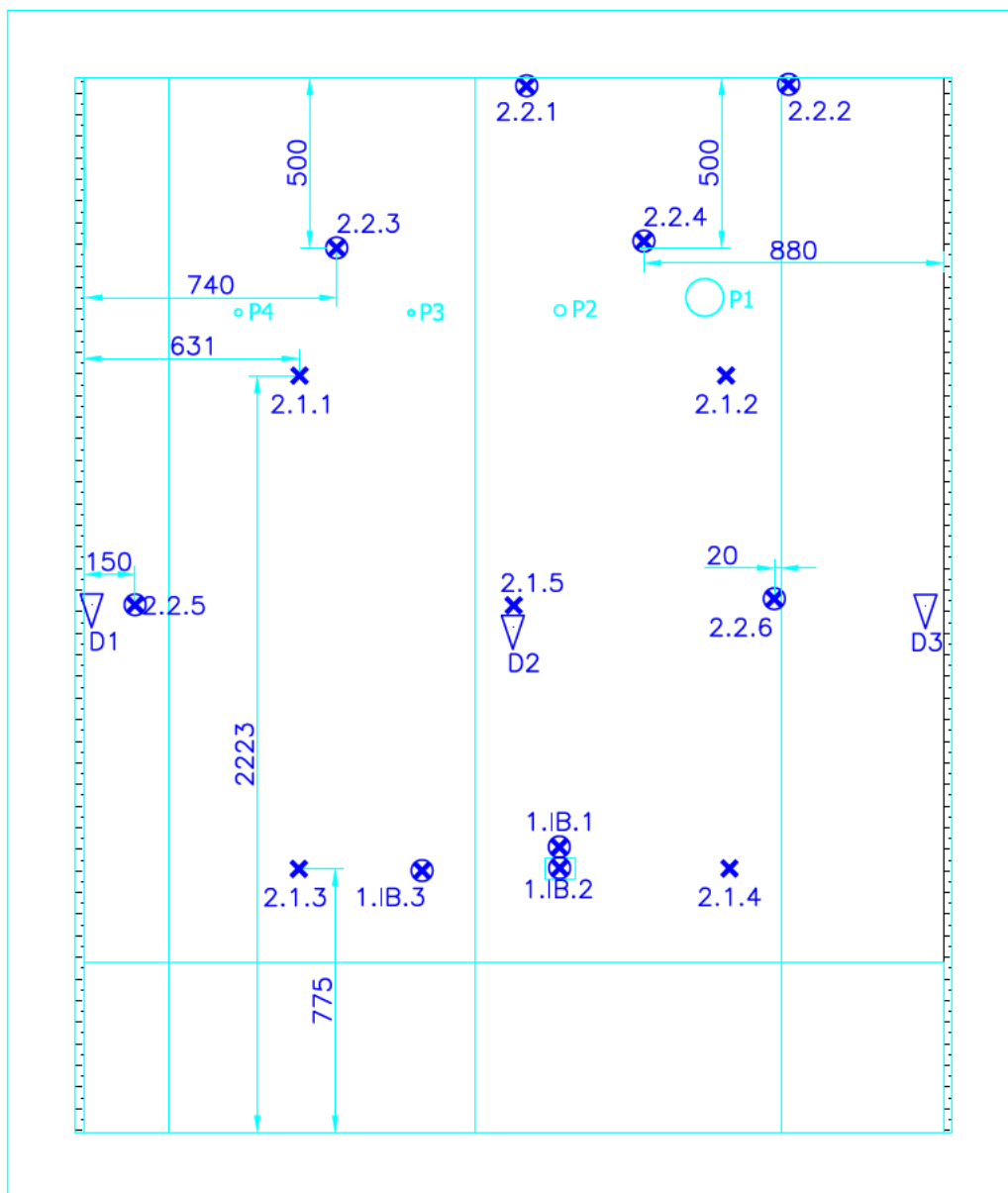
Sponsor: Wood:UpHigh

Subject: Comparison test - pipe penetrations - Stone wool insulation

File No.: PGA12248A

Test date: 27-04-2023

Enclosure: 1.0



All measurements are in mm

Danish Institute of Fire and security Technology

Sponsor: Wood:UpHigh

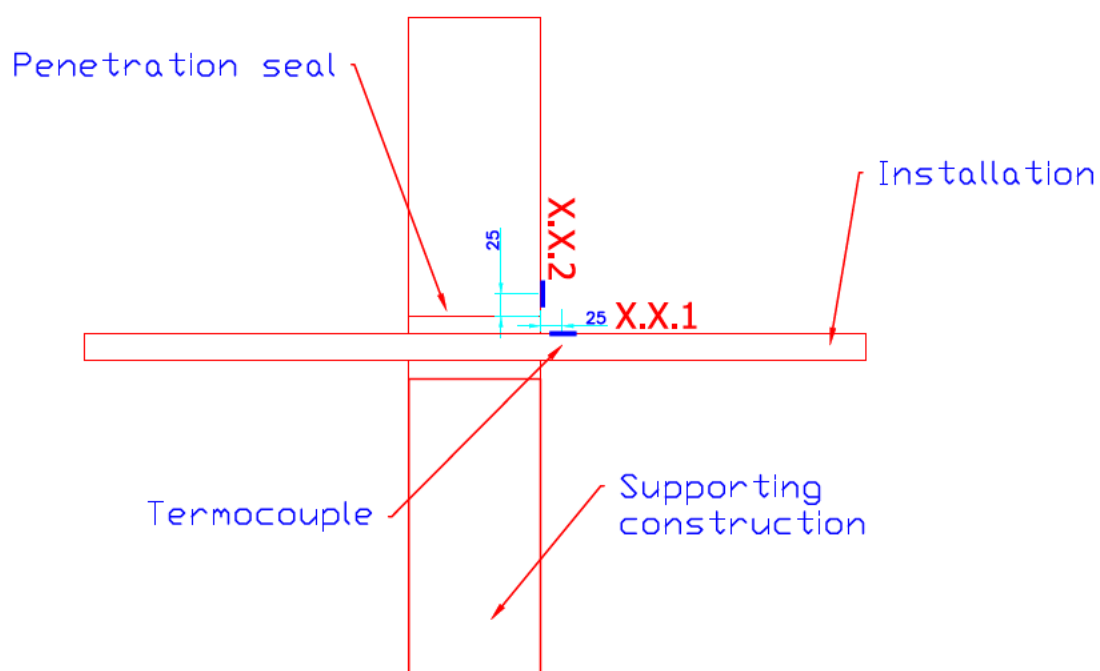
Subject: Comparison test - pipe penetrations - Wood fiber batt insulation

File No.: PGA12248A

Test date: 27-04-2023

Enclosure: 1.1

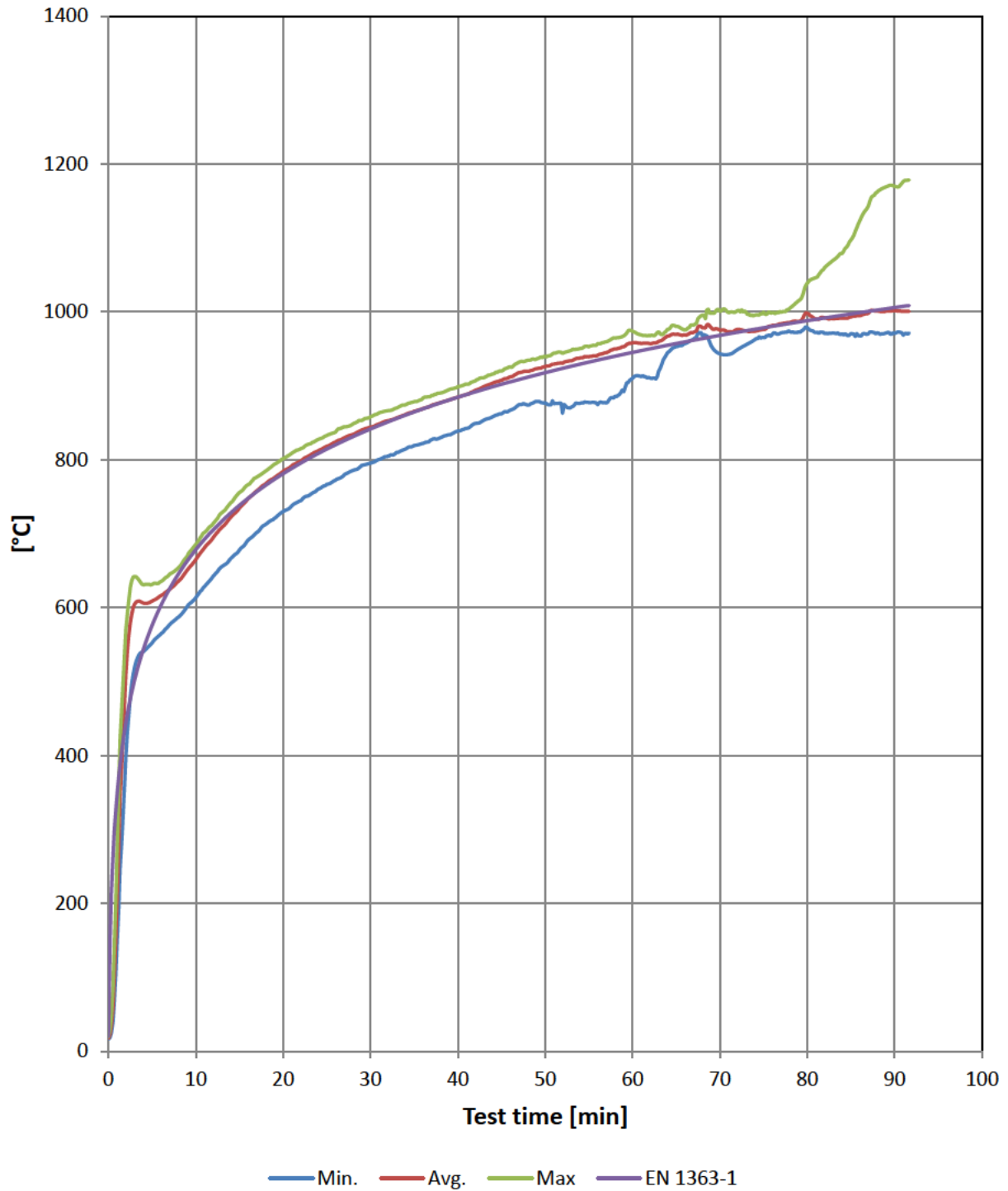
Type 1



Example:

1.P1.1 means that the TC is located on wall 1 (stone wool) on pipe 1 on the pipe.

Furnace temperature

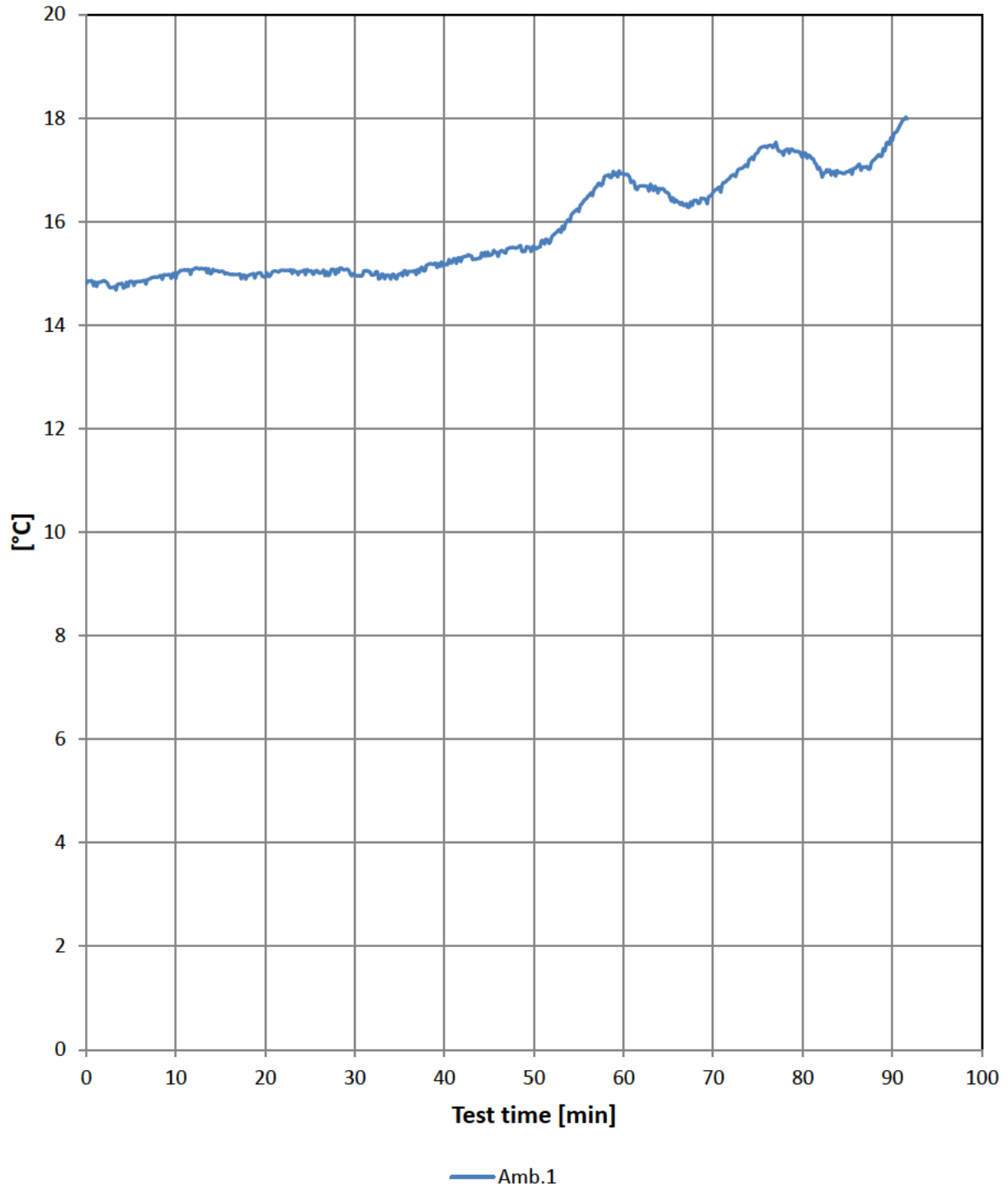


Furnace temperature

Time Minutes	Measured			Norm	Area under curve		Dev. [%]	Limit [%]
	Minimum	Average	Maximum	EN 1363-1	Measured	EN 1363-1		
0	16	17	19	20	0	0	0.0	
3	520	605	642	502	1027	1115	-7.9	
6	565	617	636	603	2854	2790	2.3	15
9	601	651	669	663	4747	4695	1.1	15
12	643	695	714	705	6766	6750	0.2	14
15	679	735	756	739	8912	8918	-0.1	13
18	713	768	785	766	11170	11176	-0.1	11
21	738	792	809	789	13510	13508	0.0	10
24	761	812	828	809	15917	15904	0.1	8
27	780	830	845	826	18380	18357	0.1	7
30	796	844	858	842	20892	20859	0.2	5
33	810	857	870	856	23445	23406	0.2	5
36	822	869	884	869	26034	25994	0.2	5
39	834	881	895	881	28661	28619	0.1	4
42	849	894	907	892	31322	31279	0.1	4
45	862	908	920	902	34025	33971	0.2	4
48	874	920	935	912	36769	36692	0.2	4
51	876	929	944	921	39543	39442	0.3	3
54	877	938	951	930	42343	42218	0.3	3
57	877	945	960	938	45166	45019	0.3	3
60	910	958	974	945	48022	47844	0.4	3
63	920	961	973	953	50896	50691	0.4	3
66	957	969	976	960	53798	53559	0.4	3
69	955	979	999	966	56727	56448	0.5	3
72	949	977	1002	973	59653	59356	0.5	3
75	966	977	1000	979	62578	62283	0.5	3
78	974	986	1005	985	65525	65228	0.5	3
81	972	991	1047	990	68499	68190	0.5	3
84	971	992	1079	996	71473	71169	0.4	3
87	971	998	1144	1001	74457	74164	0.4	3
90	971	1002	1170	1006	77460	77175	0.4	3
91	969	1001	1177	1008	78462	78181	0.4	3

Ambient temperature

The ambient temperature in the laboratory during the test



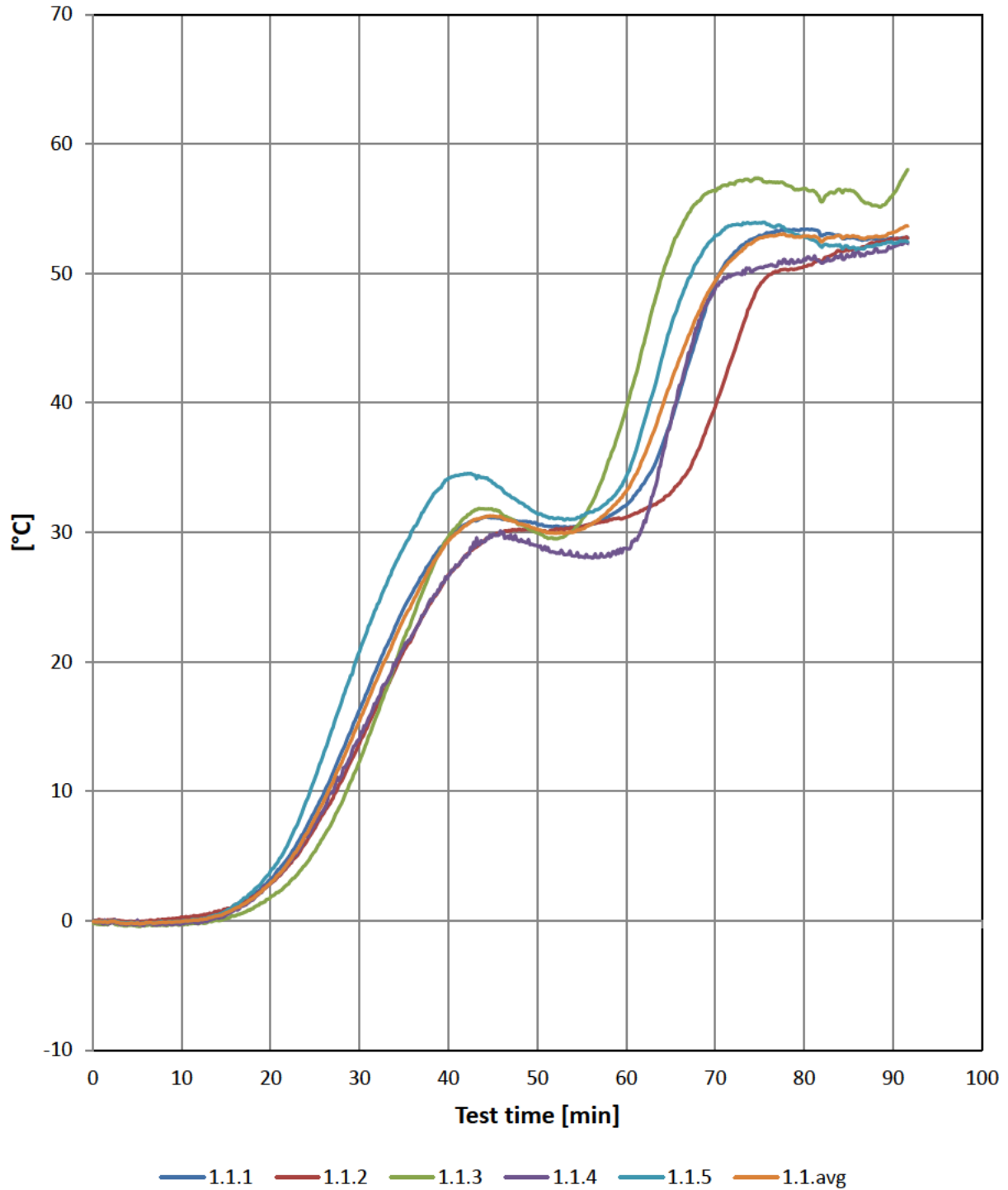
Ambient temperature

The ambient temperature in the laboratory during the test

Min. / °C	Amb.1
0	15
3	15
6	15
9	15
12	15
15	15
18	15
21	15
24	15
27	15
30	15
33	15
36	15
39	15
42	15
45	15
48	15
51	16
54	16
57	17
60	17
63	17
66	16
69	16
72	17
75	17
78	17
81	17
84	17
87	17
90	18
91	18

SW Wall 1 - Average temperature rise

Measured with 5 thermocouples



SW Wall 1 - Average temperature rise

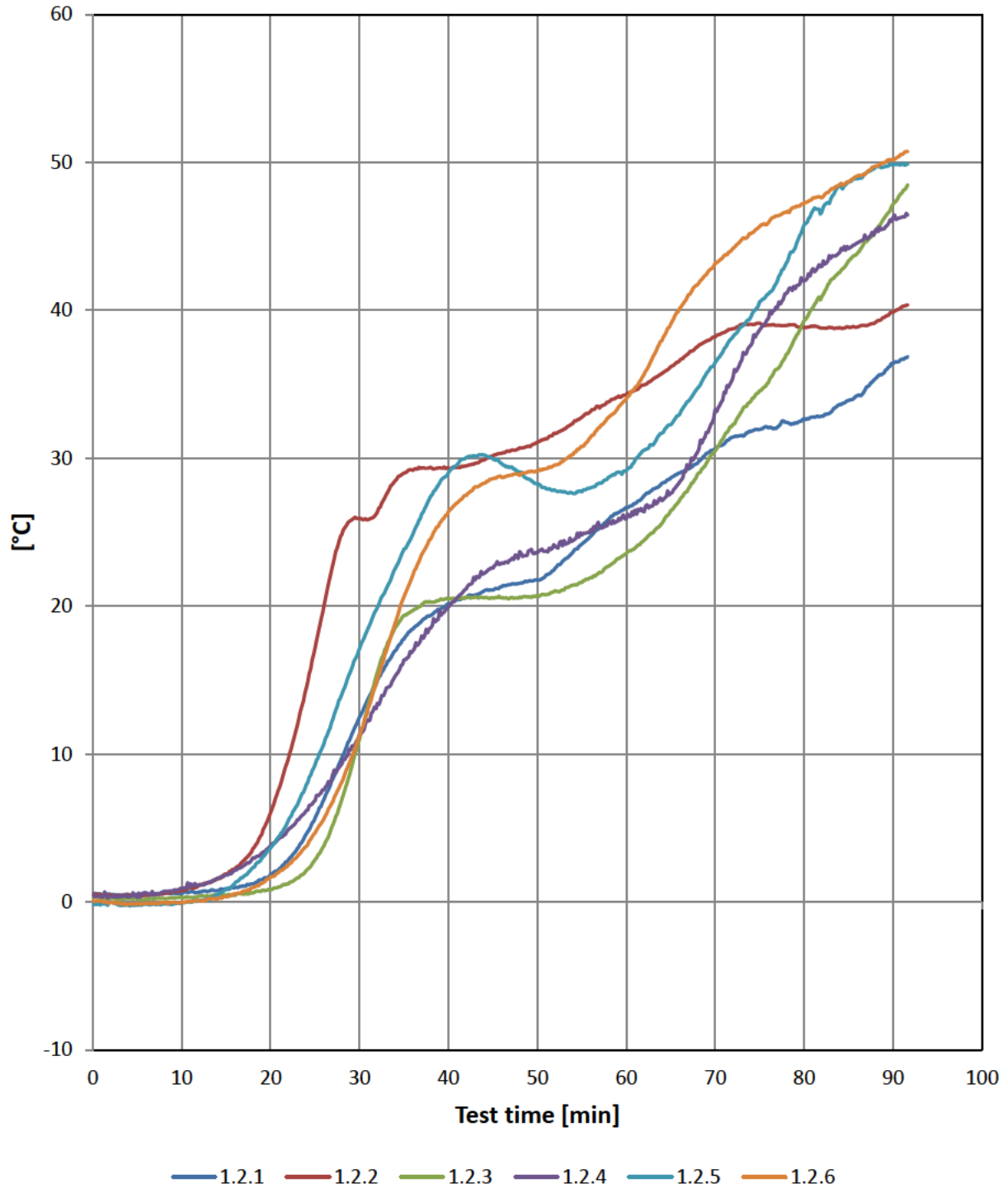
Measured with 5 thermocouples

Min. / °C	1.1.1	1.1.2	1.1.3	1.1.4	1.1.5	1.1.Avg	1.1.Max
0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
15	1	1	0	1	1	1	1
18	2	2	1	2	2	2	2
21	4	3	2	4	5	4	5
24	7	6	4	7	9	7	9
27	11	9	8	10	15	11	15
30	16	14	12	14	21	15	21
33	21	18	18	18	26	20	26
36	25	22	23	22	30	25	30
39	29	26	28	26	33	28	33
42	31	28	31	28	34	31	34
45	31	30	32	30	34	31	34
48	31	30	31	29	32	31	32
51	30	30	30	29	31	30	31
54	30	30	30	28	31	30	31
57	31	31	34	28	32	31	34
60	32	31	40	29	34	33	40
63	35	32	47	33	41	38	47
66	41	34	53	41	48	43	53
69	48	38	56	48	52	48	56
72	51	44	57	50	54	51	57
75	53	49	57	50	54	53	57
78	53	50	57	51	53	53	57
81	53	51	56	51	53	53	56
84	53	52	57	51	52	53	57
87	53	52	55	52	52	53	55
90	53	53	56	52	52	53	56
91	53	53	57	52	53	53	57

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

SW wall 1 - Maximum temperature rise

Maximum temperature rise on the unexposed side



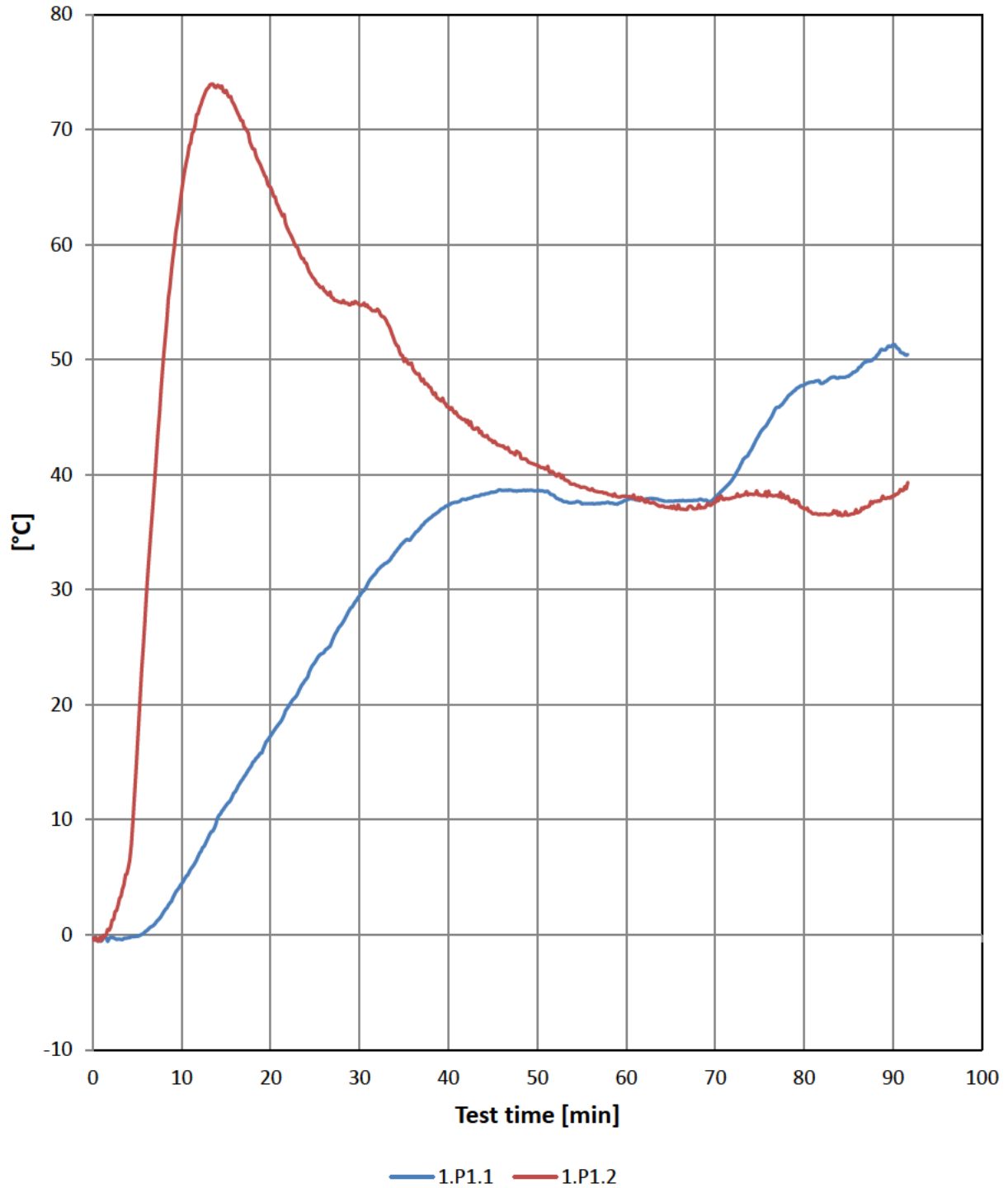
SW wall 1 - Maximum temperature rise*Maximum temperature rise on the unexposed side*

Min. / °C	1.2.1	1.2.2	1.2.3	1.2.4	1.2.5	1.2.6	1.2.Max
0	1	0	0	0	0	0	1
3	0	0	0	0	0	0	0
6	0	0	0	1	0	0	1
9	1	1	0	1	0	0	1
12	1	1	0	1	0	0	1
15	1	2	0	2	1	0	2
18	1	4	1	3	2	1	4
21	2	8	1	4	4	2	8
24	5	14	2	6	8	4	14
27	8	23	5	9	12	7	23
30	13	26	11	11	17	11	26
33	16	28	17	14	21	17	28
36	18	29	20	17	25	22	29
39	20	29	20	20	28	26	29
42	21	29	21	21	30	27	30
45	21	30	21	23	30	29	30
48	22	31	21	24	29	29	31
51	22	31	21	24	28	29	31
54	24	32	21	24	28	30	32
57	25	33	22	25	28	32	33
60	27	34	24	26	29	34	34
63	28	35	25	27	31	37	37
66	29	37	27	28	33	40	40
69	30	38	30	32	36	42	42
72	31	39	32	35	38	44	44
75	32	39	35	39	41	46	46
78	32	39	37	41	43	47	47
81	33	39	40	43	47	48	48
84	34	39	43	44	49	49	49
87	35	39	45	45	49	49	49
90	36	40	47	46	50	50	50
91	37	40	48	46	50	51	51

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

SW wall 1 - Pipe 1

Maximum temperature rise inside the construction



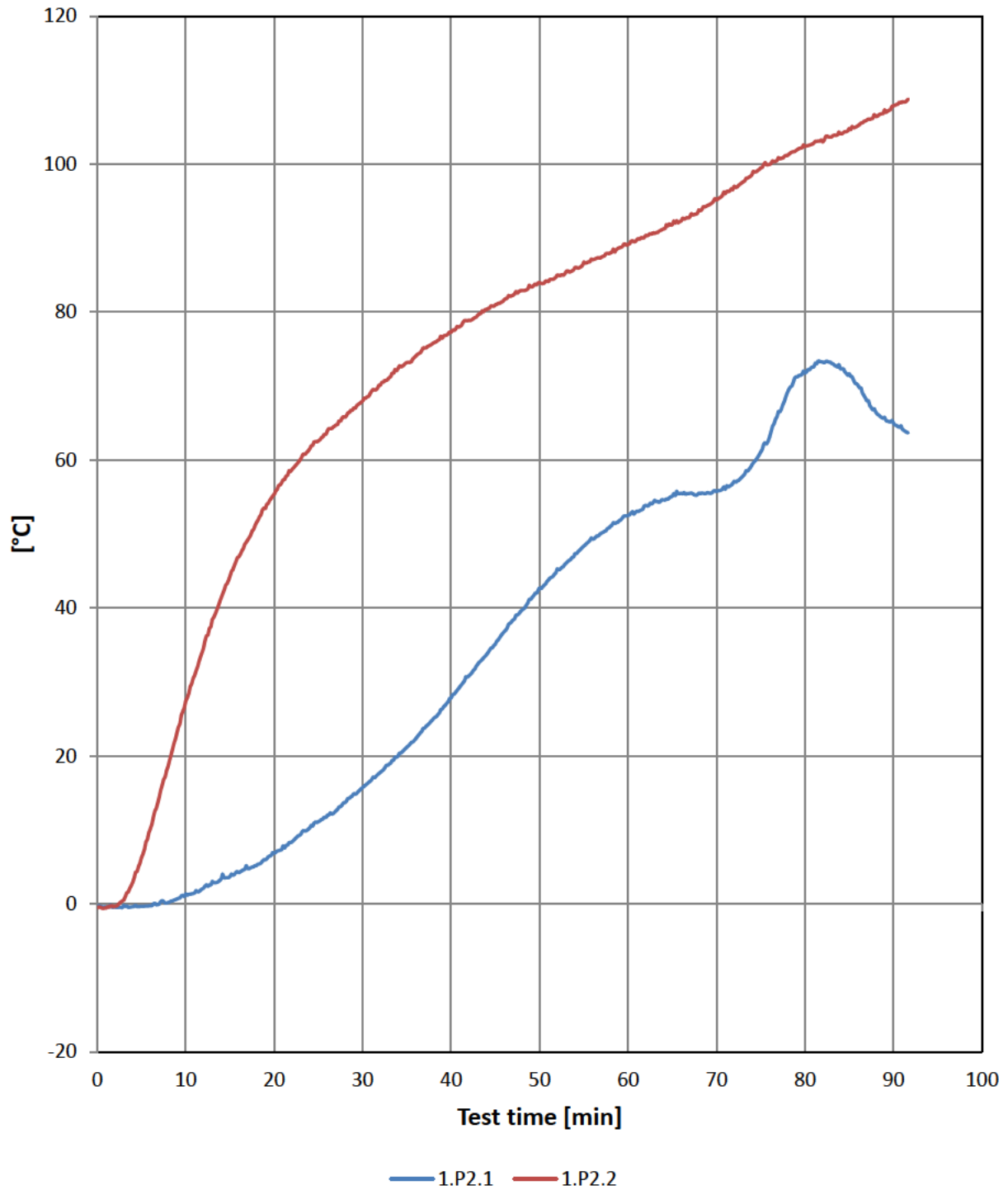
SW wall 1 - Pipe 1*Maximum temperature rise inside the construction*

Min. / °C	1.P1.1	1.P1.2	1.P1.Max
0	0	0	0
3	0	3	3
6	0	29	29
9	3	59	59
12	7	72	72
15	11	73	73
18	15	68	68
21	18	63	63
24	22	58	58
27	26	55	55
30	29	55	55
33	32	53	53
36	35	49	49
39	37	47	47
42	38	45	45
45	38	43	43
48	39	42	42
51	39	40	40
54	38	39	39
57	37	38	38
60	38	38	38
63	38	38	38
66	38	37	38
69	38	37	38
72	40	38	40
75	44	38	44
78	47	38	47
81	48	37	48
84	48	37	48
87	50	37	50
90	51	38	51
91	51	39	51

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

SW wall 1 - Pipe 2

Maximum temperature rise inside the construction



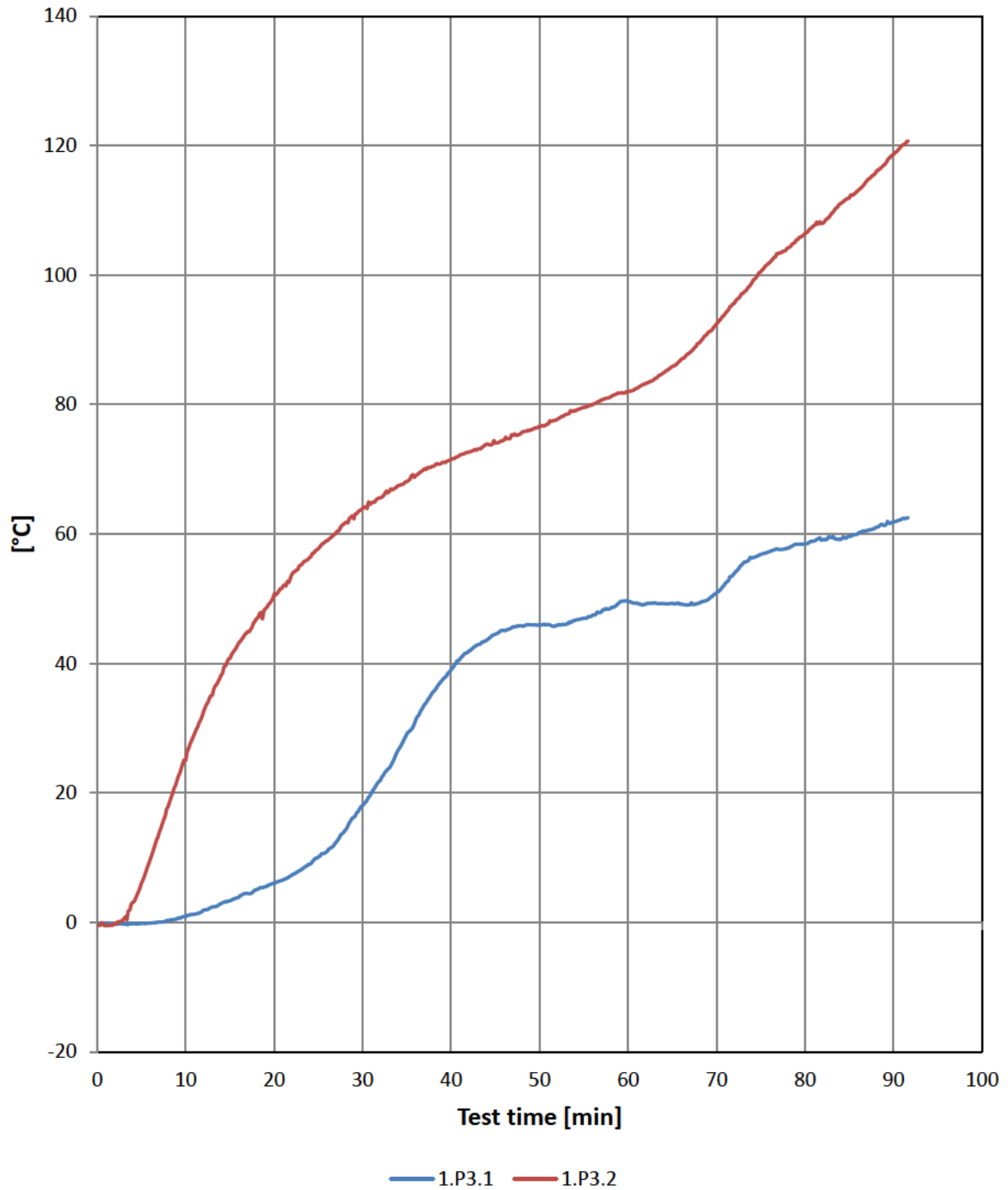
SW wall 1 - Pipe 2*Maximum temperature rise inside the construction*

Min. / °C	1.P2.1	1.P2.2	1.P2.Max
0	0	-1	0
3	0	1	1
6	0	10	10
9	1	23	23
12	2	35	35
15	4	44	44
18	5	52	52
21	8	57	57
24	10	61	61
27	13	65	65
30	16	68	68
33	19	71	71
36	22	74	74
39	26	76	76
42	31	79	79
45	35	81	81
48	40	83	83
51	44	84	84
54	47	86	86
57	50	87	87
60	53	89	89
63	55	91	91
66	56	92	92
69	56	94	94
72	57	97	97
75	61	100	100
78	69	101	101
81	73	103	103
84	72	104	104
87	68	106	106
90	65	108	108
91	64	108	108

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

SW wall 1 - Pipe 3

Maximum temperature rise inside the construction



SW wall 1 - Pipe 3

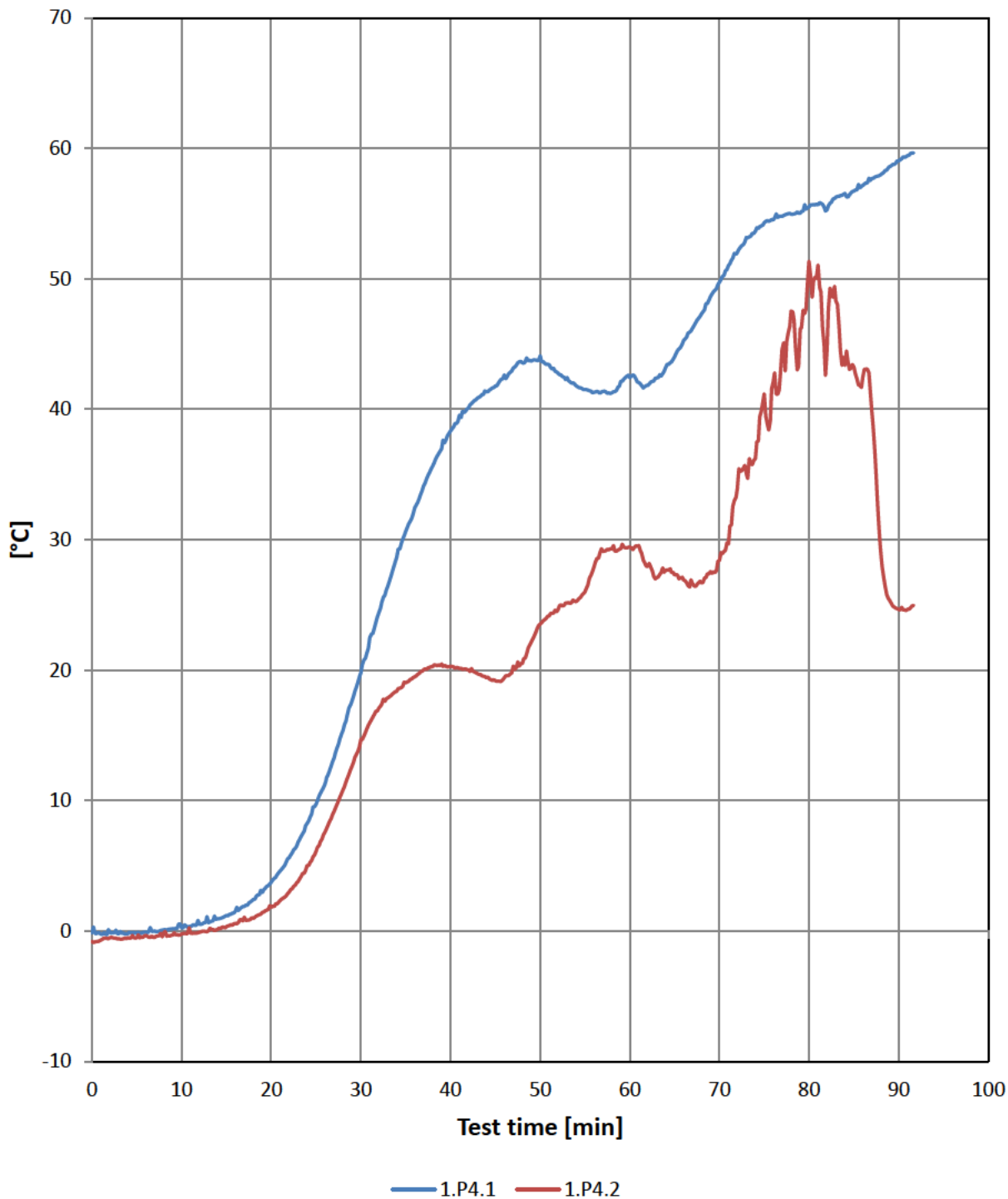
Maximum temperature rise inside the construction

Min. / °C	1.P3.1	1.P3.2	1.P3.Max
0	0	0	0
3	0	1	1
6	0	10	10
9	1	22	22
12	2	33	33
15	3	41	41
18	5	47	47
21	7	52	52
24	9	56	56
27	12	60	60
30	18	64	64
33	24	67	67
36	31	69	69
39	37	71	71
42	42	73	73
45	45	74	74
48	46	76	76
51	46	77	77
54	47	79	79
57	48	81	81
60	50	82	82
63	49	84	84
66	49	87	87
69	50	91	91
72	54	96	96
75	57	100	100
78	58	104	104
81	59	108	108
84	59	111	111
87	61	115	115
90	62	119	119
91	62	120	120

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

SW wall 1 - Pipe 4

Maximum temperature rise inside the construction



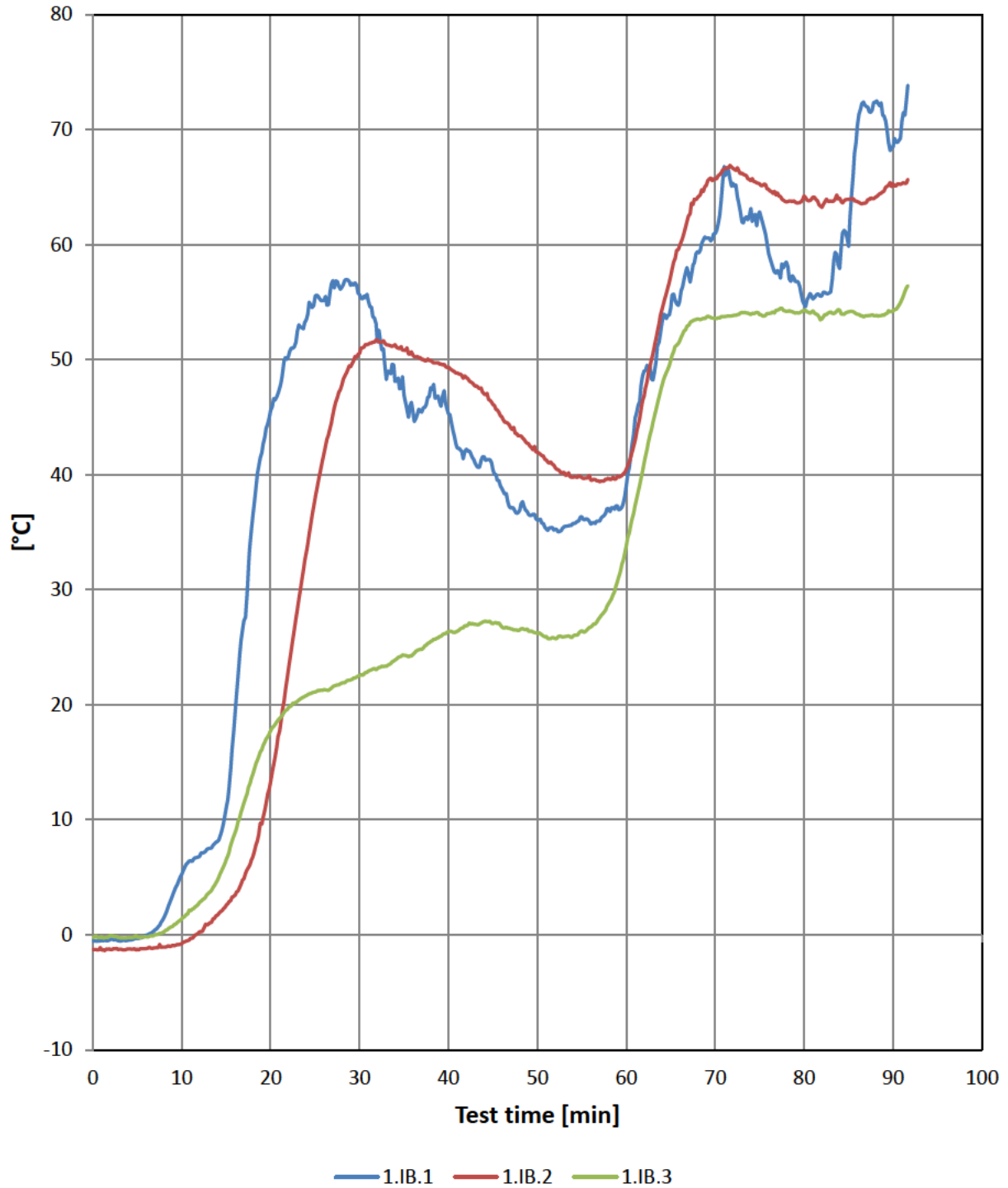
SW wall 1 - Pipe 4*Maximum temperature rise inside the construction*

Min. / °C	1.P4.1	1.P4.2	1.P4.Max
0	0	-1	0
3	0	-1	0
6	0	0	0
9	0	0	0
12	1	0	1
15	1	0	1
18	2	1	2
21	5	2	5
24	8	5	8
27	13	9	13
30	20	15	20
33	26	18	26
36	32	19	32
39	37	20	37
42	40	20	40
45	42	19	42
48	44	21	44
51	43	24	43
54	42	25	42
57	41	29	41
60	42	29	42
63	42	27	42
66	45	27	45
69	49	28	49
72	52	34	52
75	54	41	54
78	55	48	55
81	56	51	56
84	57	43	57
87	58	40	58
90	59	25	59
91	59	25	59

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

SW wall 1 - Installation box

Maximum temperature rise inside the construction



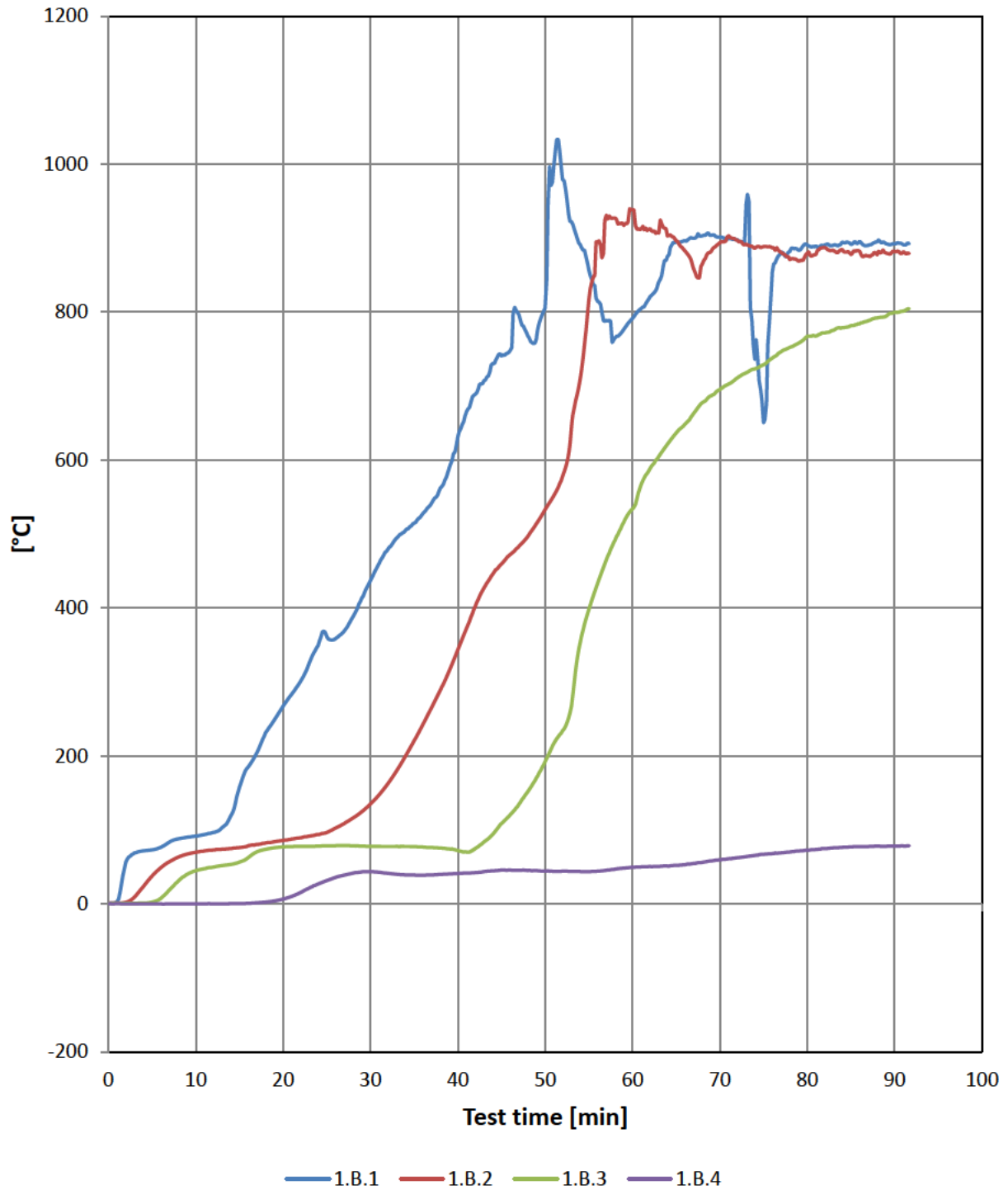
SW wall 1 - Installation box*Maximum temperature rise inside the construction*

Min. / °C	1.IB.1	1.IB.2	1.IB.3	1.IB.Max
0	-1	-1	0	0
3	-1	-1	0	0
6	0	-1	0	0
9	4	-1	1	4
12	7	0	3	7
15	11	3	7	11
18	37	7	14	37
21	48	18	19	48
24	53	33	21	53
27	57	45	22	57
30	56	51	23	56
33	48	51	23	51
36	45	50	24	50
39	46	50	26	50
42	42	48	27	48
45	40	46	27	46
48	37	43	27	43
51	35	41	26	41
54	36	40	26	40
57	36	39	28	39
60	39	40	34	40
63	48	51	45	51
66	55	60	52	60
69	61	65	54	65
72	65	67	54	67
75	63	65	54	65
78	58	64	54	64
81	55	64	54	64
84	58	64	54	64
87	72	64	54	72
90	68	65	54	68
91	71	65	55	71

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

SW wall 1 - Internal measurements - stud B

Measure on 3 sides of stud and between the gypsum board layers



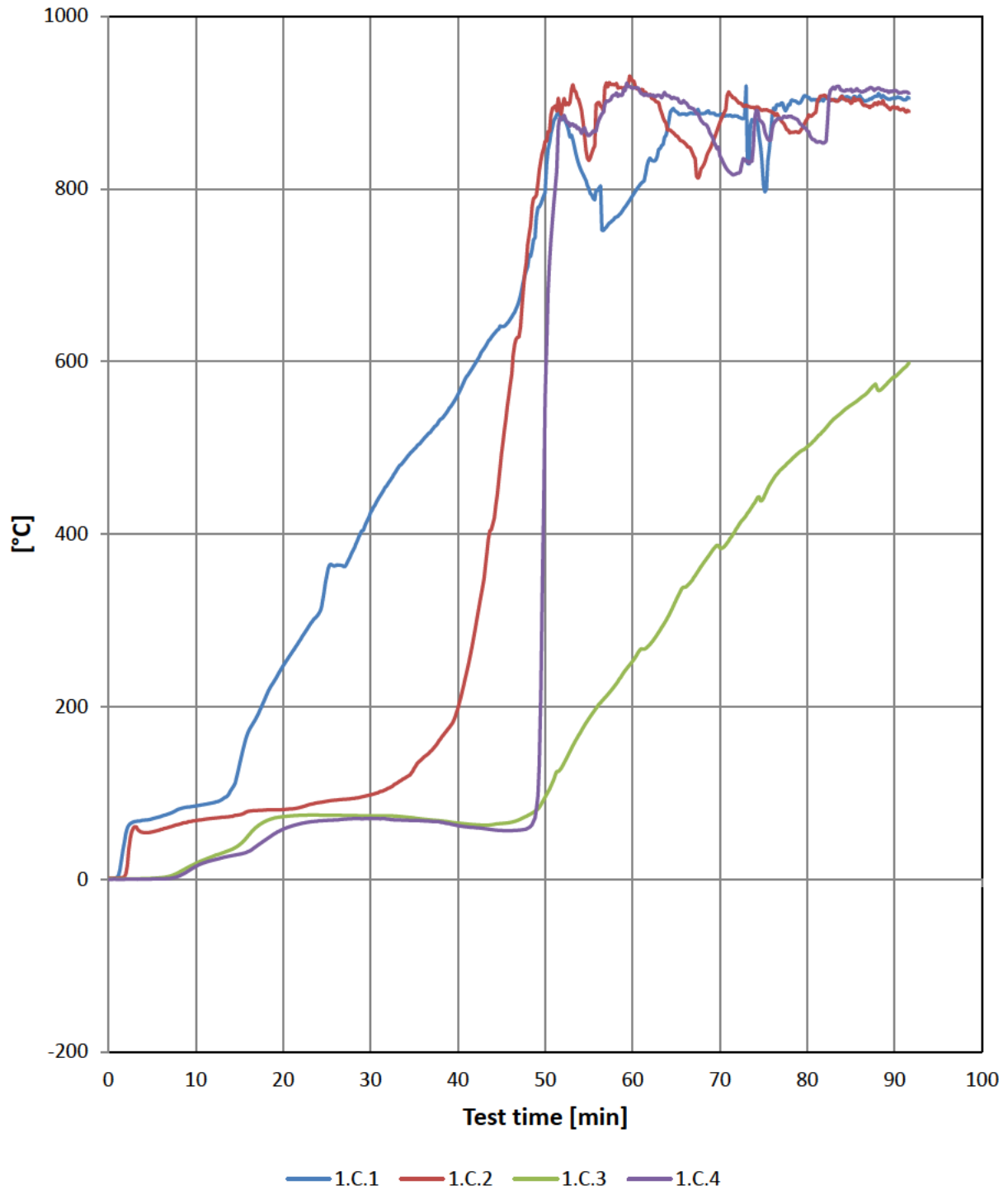
SW wall 1 - Internal measurements - stud B*Measure on 3 sides of stud and between the gypsum board layers*

Min. / °C	1.B.1	1.B.2	1.B.3	1.B.4	1.B.Max
0	1	1	1	0	1
3	69	9	1	0	69
6	77	49	8	0	77
9	90	67	40	0	90
12	97	73	50	0	97
15	158	76	56	1	158
18	232	82	74	2	232
21	284	88	78	10	284
24	349	94	78	27	349
27	369	109	79	39	369
30	438	135	78	44	438
33	495	180	78	40	495
36	528	243	77	39	528
39	589	315	74	40	589
42	689	402	75	42	689
45	741	460	109	46	741
48	768	497	152	45	768
51	998	552	217	44	998
54	891	710	353	44	891
57	789	931	466	45	931
60	792	939	534	50	939
63	841	907	605	51	907
66	897	883	648	53	897
69	904	882	687	58	904
72	898	897	711	62	898
75	651	889	729	67	889
78	882	871	752	70	882
81	890	878	768	74	890
84	895	885	779	76	895
87	890	876	789	78	890
90	893	882	800	78	893
91	891	882	801	78	891

Failure [min]	20.17	37.17	53.00	-	20.17
Failure °C	270	270	270	270	270

SW wall 1 - Internal measurements - stud C

Measure on 3 sides of stud and between the gypsum board layers



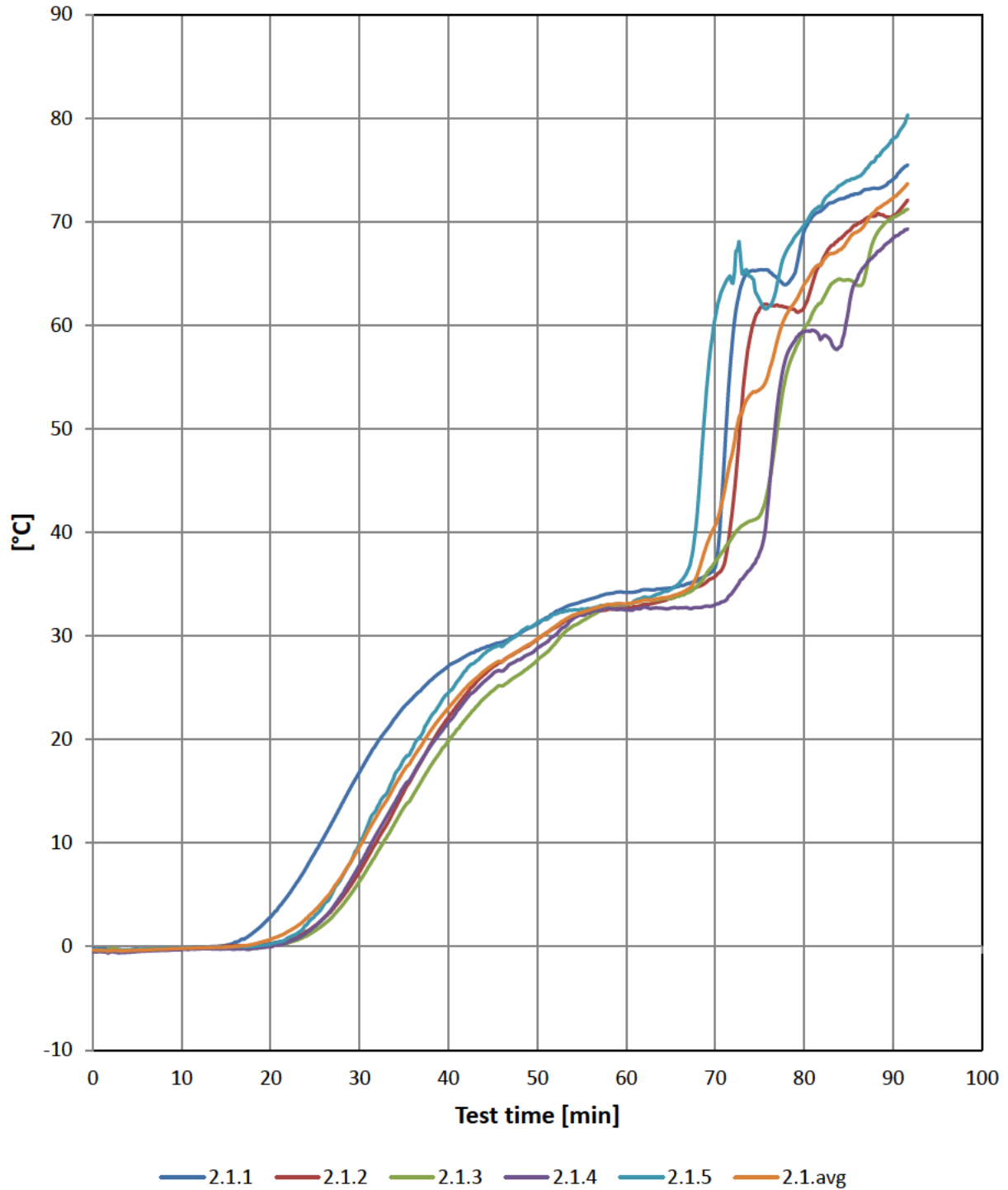
SW wall 1 - Internal measurements - stud C*Measure on 3 sides of stud and between the gypsum board layers*

Min. / °C	1.C.1	1.C.2	1.C.3	1.C.4	1.C.Max
0	1	1	1	0	1
3	67	61	1	0	67
6	73	58	2	1	73
9	83	66	13	9	83
12	89	71	27	22	89
15	133	75	40	29	133
18	211	80	67	46	211
21	263	82	73	62	263
24	306	89	74	68	306
27	362	93	74	70	362
30	425	98	74	71	425
33	474	111	73	69	474
36	509	140	70	68	509
39	546	176	66	64	546
42	598	291	63	60	598
45	640	493	65	57	640
48	710	735	74	59	735
51	879	895	116	783	895
54	824	897	170	868	897
57	756	923	212	902	923
60	792	925	253	916	925
63	846	900	286	909	909
66	887	853	338	900	900
69	887	849	379	862	887
72	885	902	408	818	902
75	804	892	442	874	892
78	897	865	485	884	897
81	904	889	511	855	904
84	908	907	541	915	915
87	903	896	566	915	915
90	905	895	582	914	914
91	903	893	591	913	913

Failure [min]	21.50	41.50	61.83	49.50	21.50
Failure °C	270	270	270	270	270

WF wall 2 - Average temperature rise

Measured with 5 thermocouples



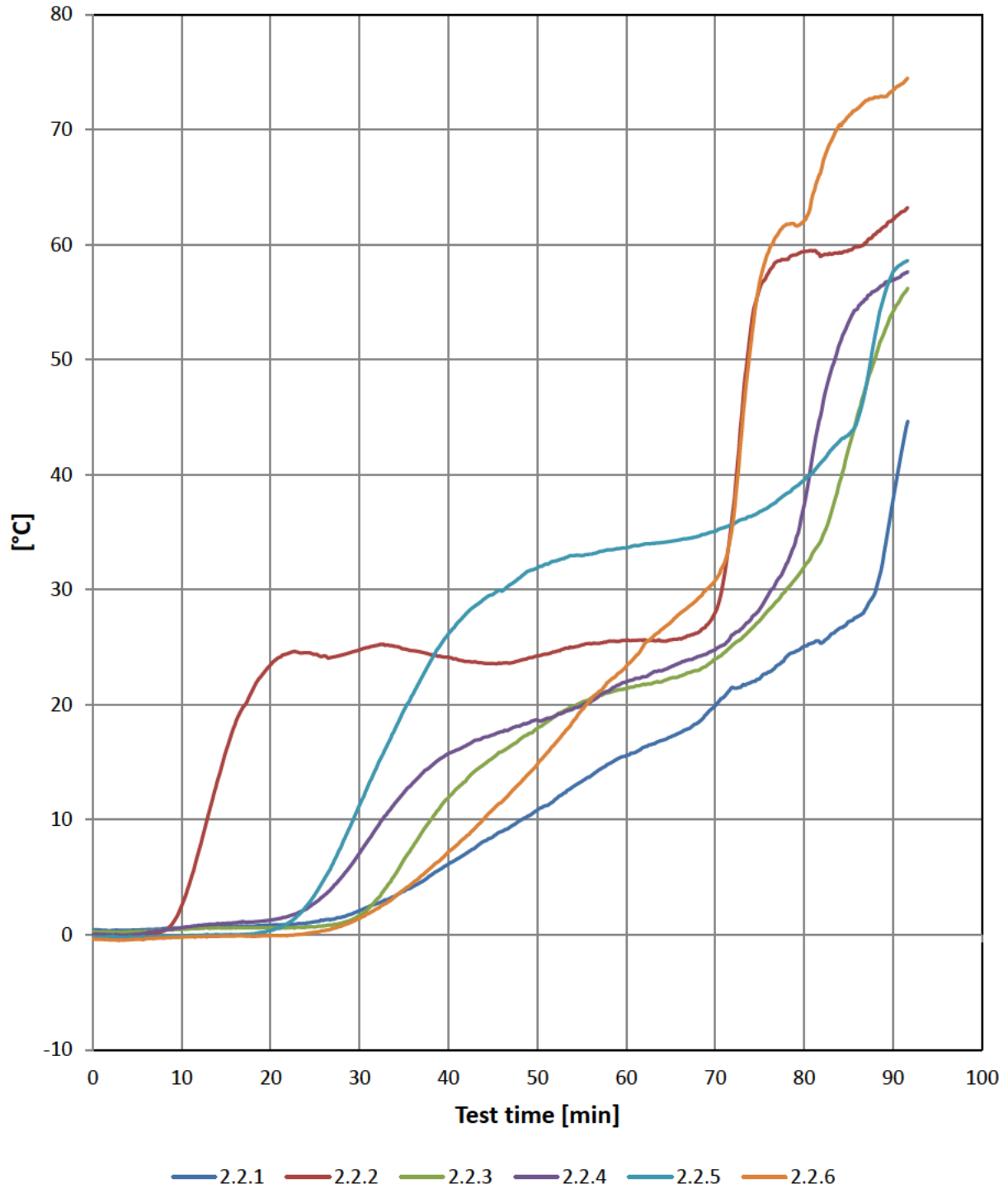
WF wall 2 - Average temperature rise*Measured with 5 thermocouples*

Min. / °C	2.1.1	2.1.2	2.1.3	2.1.4	2.1.5	2.1.Avg	2.1.Max
0	0	0	0	0	0	0	0
3	0	0	0	-1	0	0	0
6	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
18	1	0	0	0	0	0	1
21	4	0	0	0	0	1	4
24	8	1	1	1	2	3	8
27	12	4	3	4	5	6	12
30	17	7	6	8	10	10	17
33	21	12	10	12	15	14	21
36	24	16	15	17	19	18	24
39	26	21	19	21	23	22	26
42	28	24	22	24	27	25	28
45	29	27	25	26	29	27	29
48	30	29	26	28	30	29	30
51	32	30	28	29	32	30	32
54	33	32	31	32	33	32	33
57	34	32	32	32	33	33	34
60	34	33	33	33	33	33	34
63	34	33	33	33	34	34	34
66	35	34	34	33	35	34	35
69	36	35	36	33	53	39	53
72	59	43	40	34	64	48	64
75	65	62	42	38	62	54	65
78	64	62	55	57	67	61	67
81	71	64	61	60	71	65	71
84	72	68	65	58	74	67	74
87	73	70	65	66	75	70	75
90	74	71	70	68	78	72	78
91	75	71	71	69	79	73	79

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

WF wall 2 - Maximum temperature rise

Maximum temperature rise on the unexposed side



WF wall 2 - Maximum temperature rise

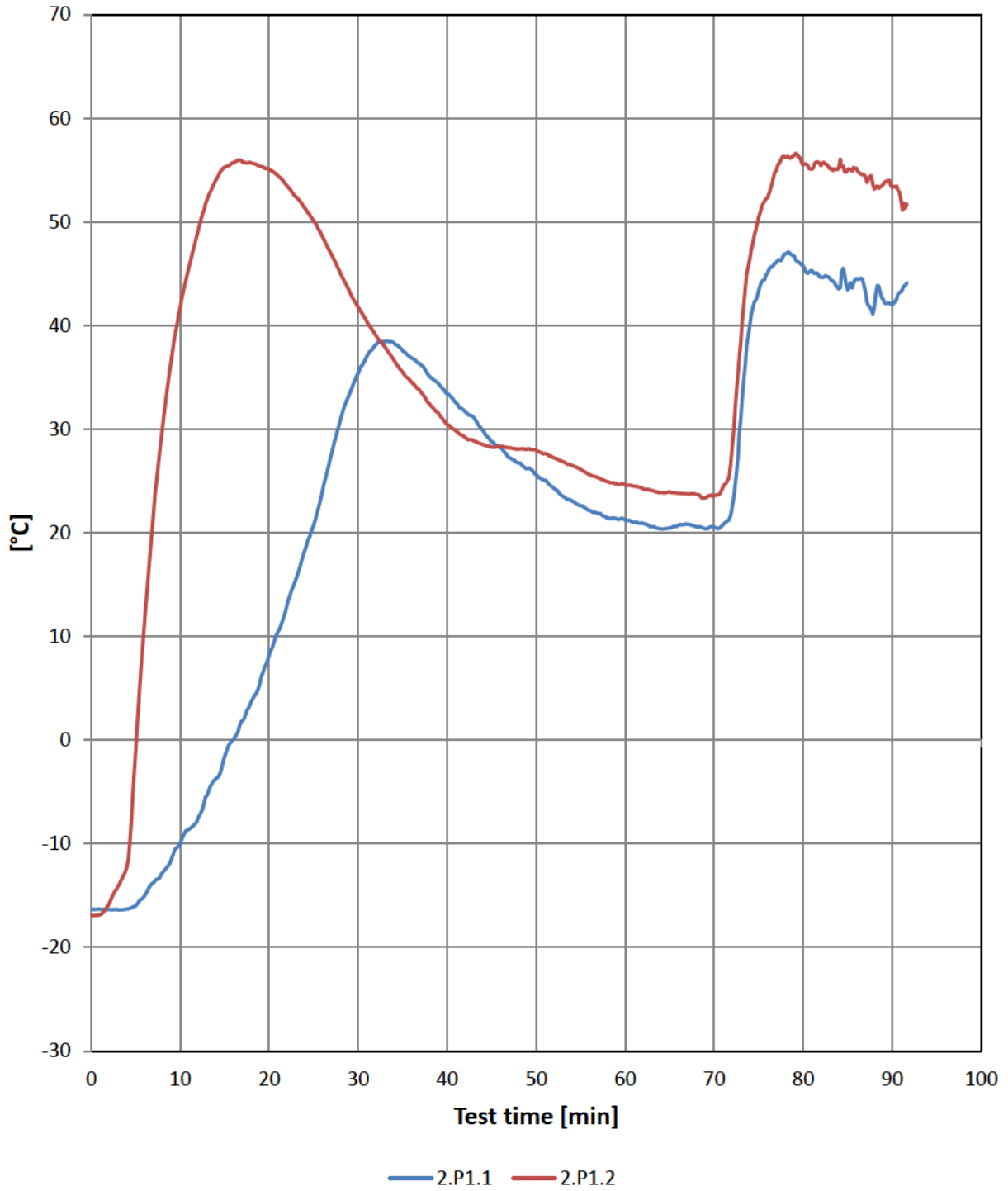
Maximum temperature rise on the unexposed side

Min. / °C	2.2.1	2.2.2	2.2.3	2.2.4	2.2.5	2.2.6	2.2.Max
0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
9	1	1	0	1	0	0	1
12	1	8	1	1	0	0	8
15	1	16	1	1	0	0	16
18	1	21	1	1	0	0	21
21	1	24	1	1	1	0	24
24	1	25	1	2	2	0	25
27	1	24	1	4	6	1	24
30	2	25	2	7	11	1	25
33	3	25	4	10	16	3	25
36	4	25	8	13	21	5	25
39	6	24	11	15	25	6	25
42	7	24	13	16	28	9	28
45	9	24	15	17	30	11	30
48	10	24	17	18	31	13	31
51	11	24	18	19	32	16	32
54	13	25	20	20	33	19	33
57	14	25	21	21	33	21	33
60	16	26	21	22	34	23	34
63	17	26	22	23	34	26	34
66	18	26	22	24	34	28	34
69	19	27	23	24	35	30	35
72	22	37	25	26	36	36	37
75	22	56	27	28	37	57	57
78	24	59	30	32	38	62	62
81	25	59	33	42	40	64	64
84	27	59	39	51	43	70	70
87	28	60	48	55	48	73	73
90	38	62	54	57	58	73	73
91	42	63	56	57	58	74	74

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

WF wall 2 - Pipe 1

Maximum temperature rise inside the construction



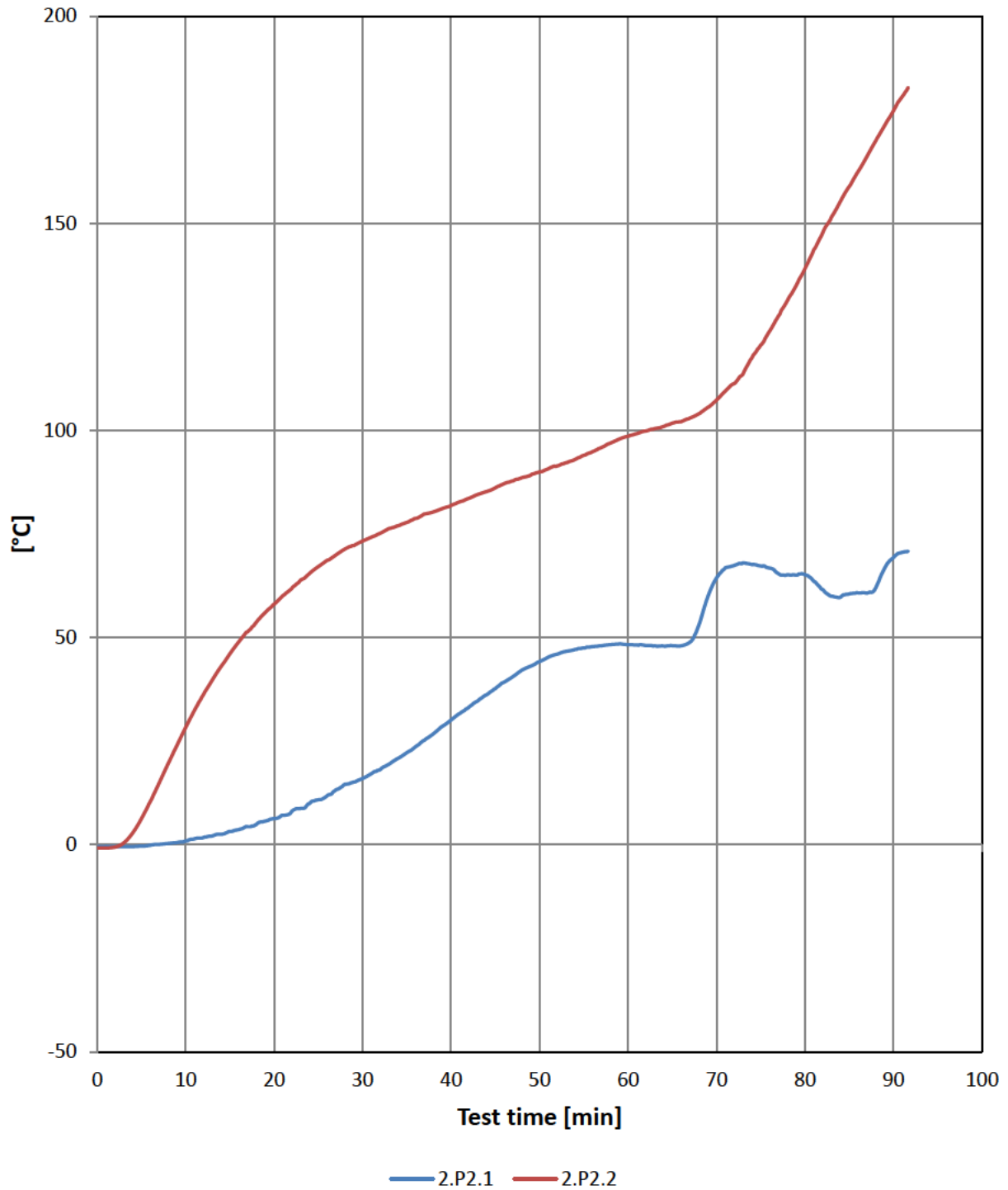
WF wall 2 - Pipe 1*Maximum temperature rise inside the construction*

Min. / °C	2.P1.1	2.P1.2	2.P1.Max
0	-16	-17	-16
3	-16	-14	-14
6	-15	12	12
9	-11	37	37
12	-8	49	49
15	-2	55	55
18	4	56	56
21	10	54	54
24	18	51	51
27	28	47	47
30	35	42	42
33	38	38	38
36	37	35	37
39	34	32	34
42	32	29	32
45	29	28	29
48	27	28	28
51	25	28	28
54	23	27	27
57	22	25	25
60	21	25	25
63	21	24	24
66	21	24	24
69	20	23	23
72	22	28	28
75	43	50	50
78	47	56	56
81	45	55	55
84	44	55	55
87	43	54	54
90	42	53	53
91	43	52	52

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

WF wall 2 - Pipe 2

Maximum temperature rise inside the construction



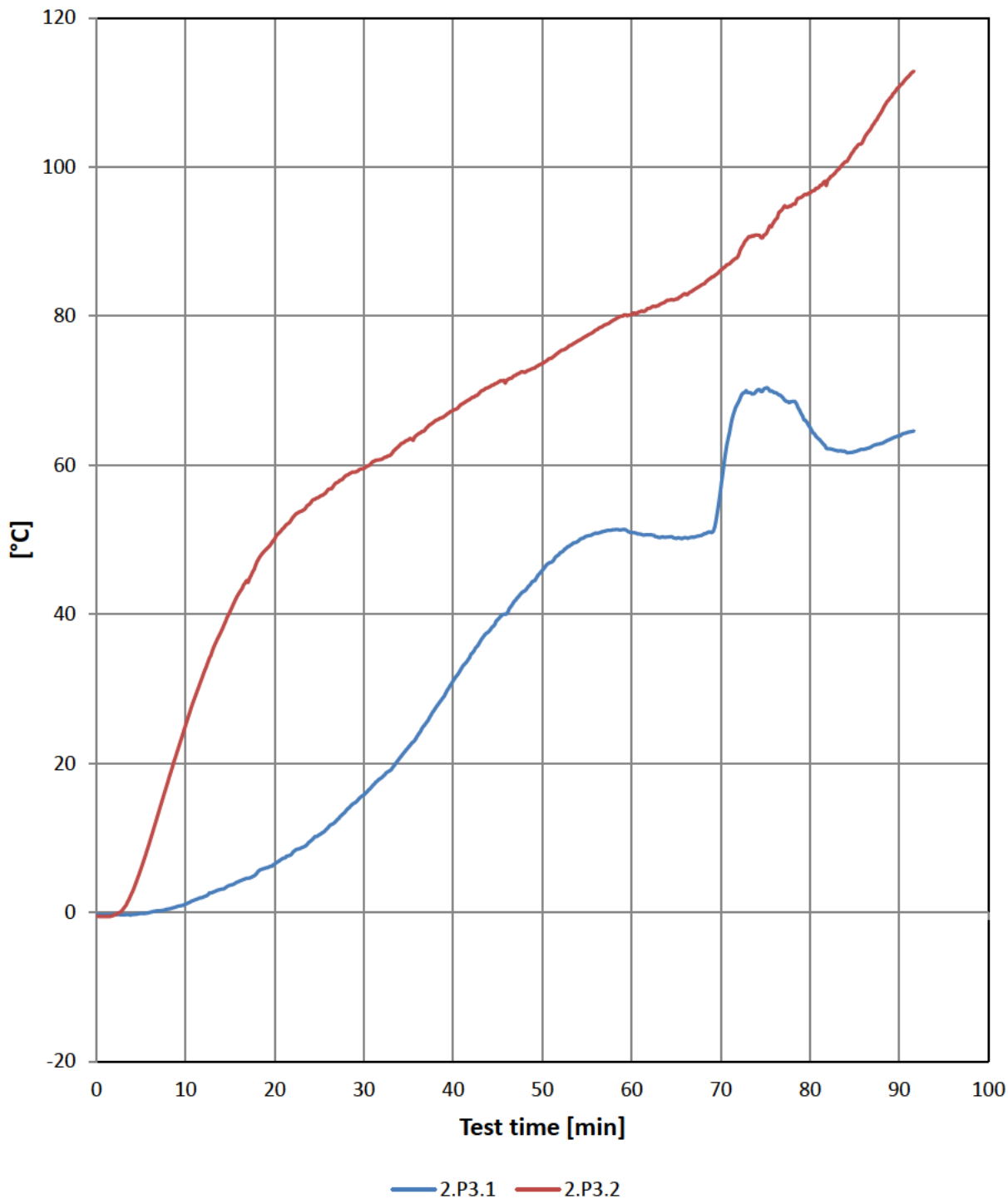
WF wall 2 - Pipe 2*Maximum temperature rise inside the construction*

Min. / °C	2.P2.1	2.P2.2	2.P2.Max
0	0	-1	0
3	0	0	0
6	0	10	10
9	1	24	24
12	2	36	36
15	3	46	46
18	5	54	54
21	7	60	60
24	10	66	66
27	13	70	70
30	16	73	73
33	19	76	76
36	24	79	79
39	29	81	81
42	33	84	84
45	38	86	86
48	42	89	89
51	45	91	91
54	47	93	93
57	48	96	96
60	48	99	99
63	48	100	100
66	48	102	102
69	60	106	106
72	67	111	111
75	67	121	121
78	65	131	131
81	64	144	144
84	60	155	155
87	61	166	166
90	69	177	177
91	71	181	181

Failure [min]	-	90.83	90.83
Failure °C	180	180	180

WF wall 2 - Pipe 3

Maximum temperature rise inside the construction



WF wall 2 - Pipe 3

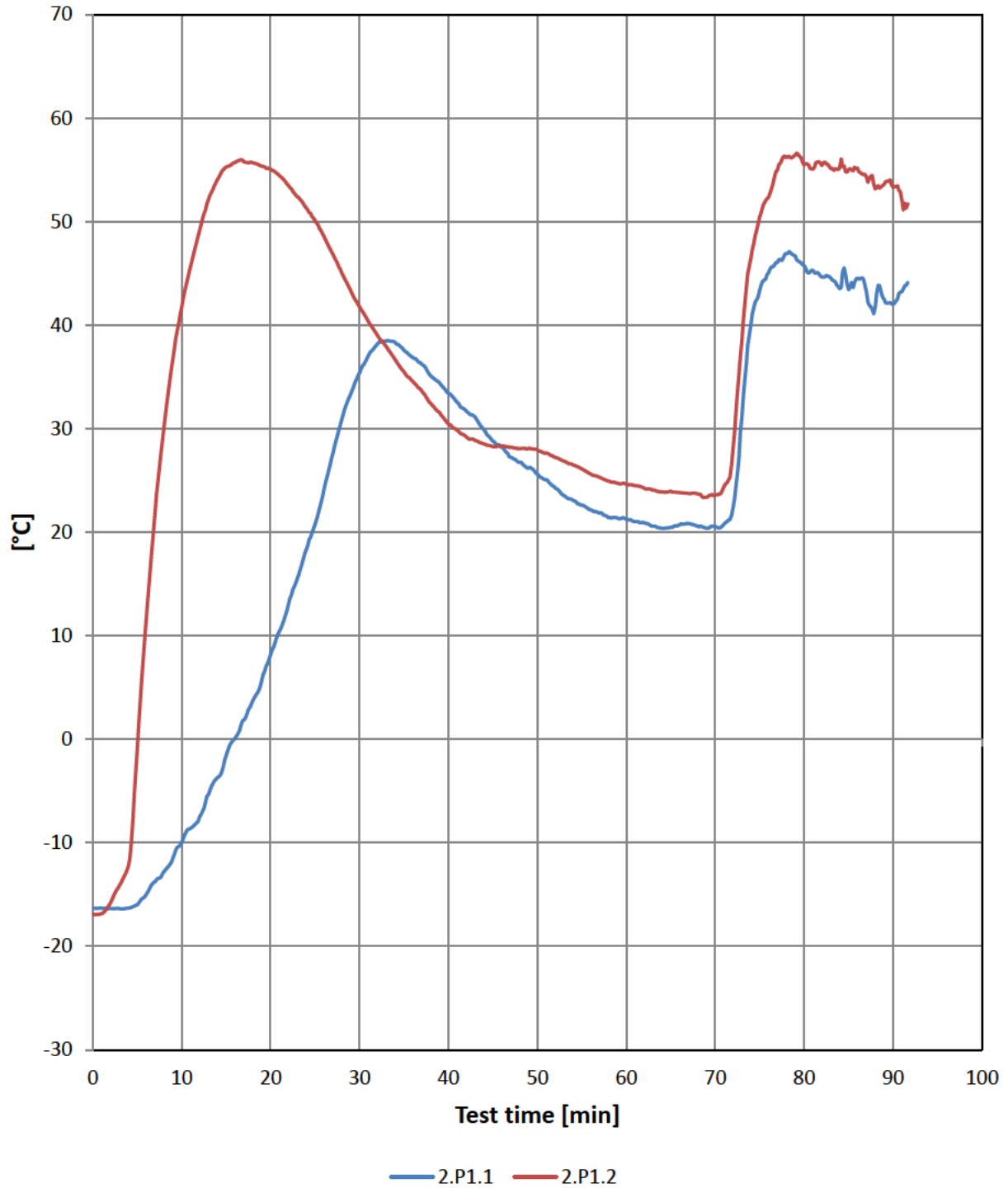
Maximum temperature rise inside the construction

Min. / °C	2.P3.1	2.P3.2	2.P3.Max
0	0	-1	0
3	0	0	0
6	0	10	10
9	1	21	21
12	2	32	32
15	4	40	40
18	5	47	47
21	7	52	52
24	10	55	55
27	12	58	58
30	16	60	60
33	19	61	61
36	24	64	64
39	29	67	67
42	35	69	69
45	39	71	71
48	43	72	72
51	47	74	74
54	50	77	77
57	51	79	79
60	51	80	80
63	50	81	81
66	50	83	83
69	51	85	85
72	69	88	88
75	70	91	91
78	69	95	95
81	64	97	97
84	62	101	101
87	63	106	106
90	64	111	111
91	64	112	112

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

WF wall 2 - Pipe 4

Maximum temperature rise inside the construction



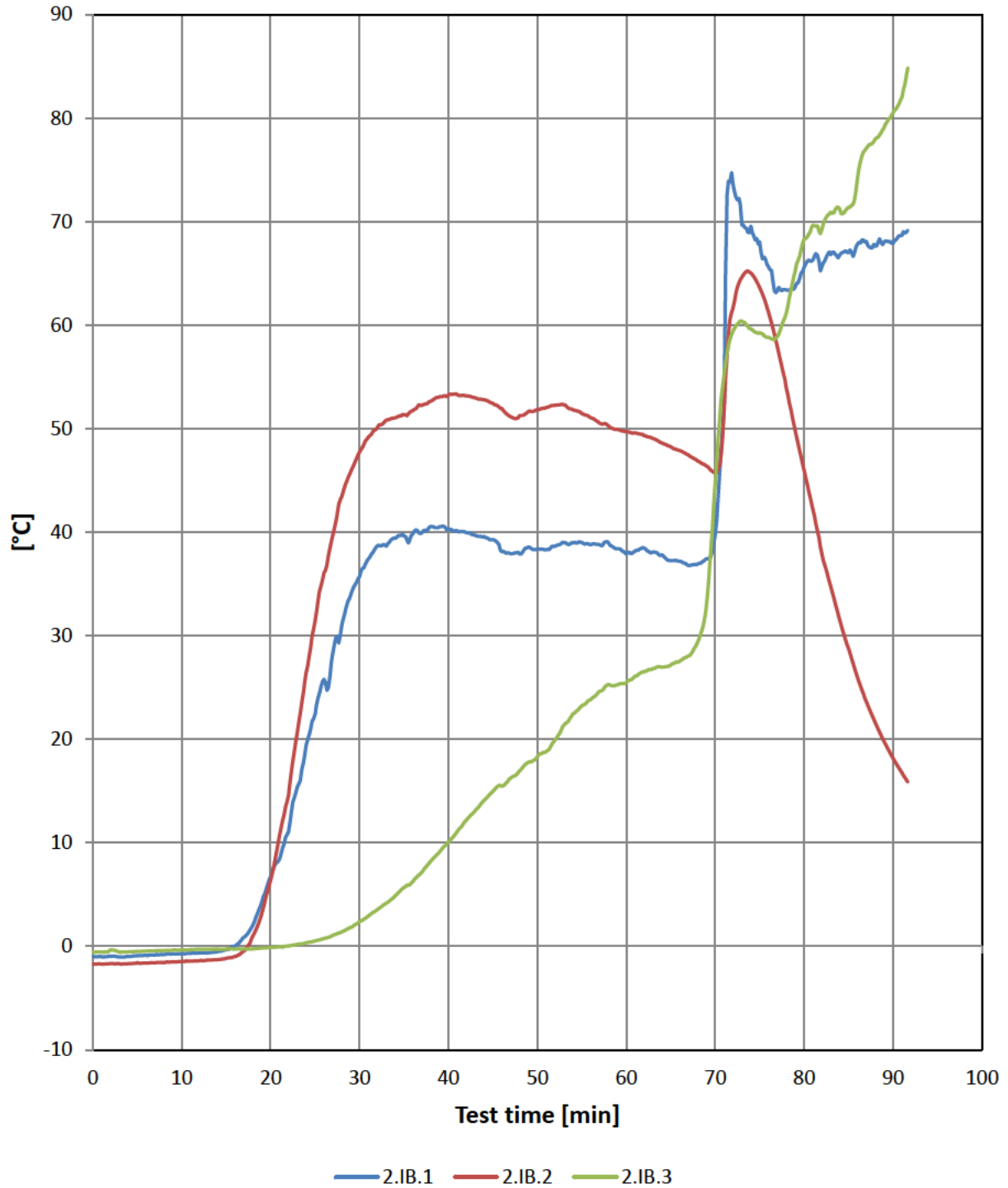
WF wall 2 - Pipe 4*Maximum temperature rise inside the construction*

Min. / °C	2.P1.1	2.P1.2	2.P1.Max
0	-16	-17	-16
3	-16	-14	-14
6	-15	12	12
9	-11	37	37
12	-8	49	49
15	-2	55	55
18	4	56	56
21	10	54	54
24	18	51	51
27	28	47	47
30	35	42	42
33	38	38	38
36	37	35	37
39	34	32	34
42	32	29	32
45	29	28	29
48	27	28	28
51	25	28	28
54	23	27	27
57	22	25	25
60	21	25	25
63	21	24	24
66	21	24	24
69	20	23	23
72	22	28	28
75	43	50	50
78	47	56	56
81	45	55	55
84	44	55	55
87	43	54	54
90	42	53	53
91	43	52	52

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

WF wall 2 - Installation box

Maximum temperature rise inside the construction



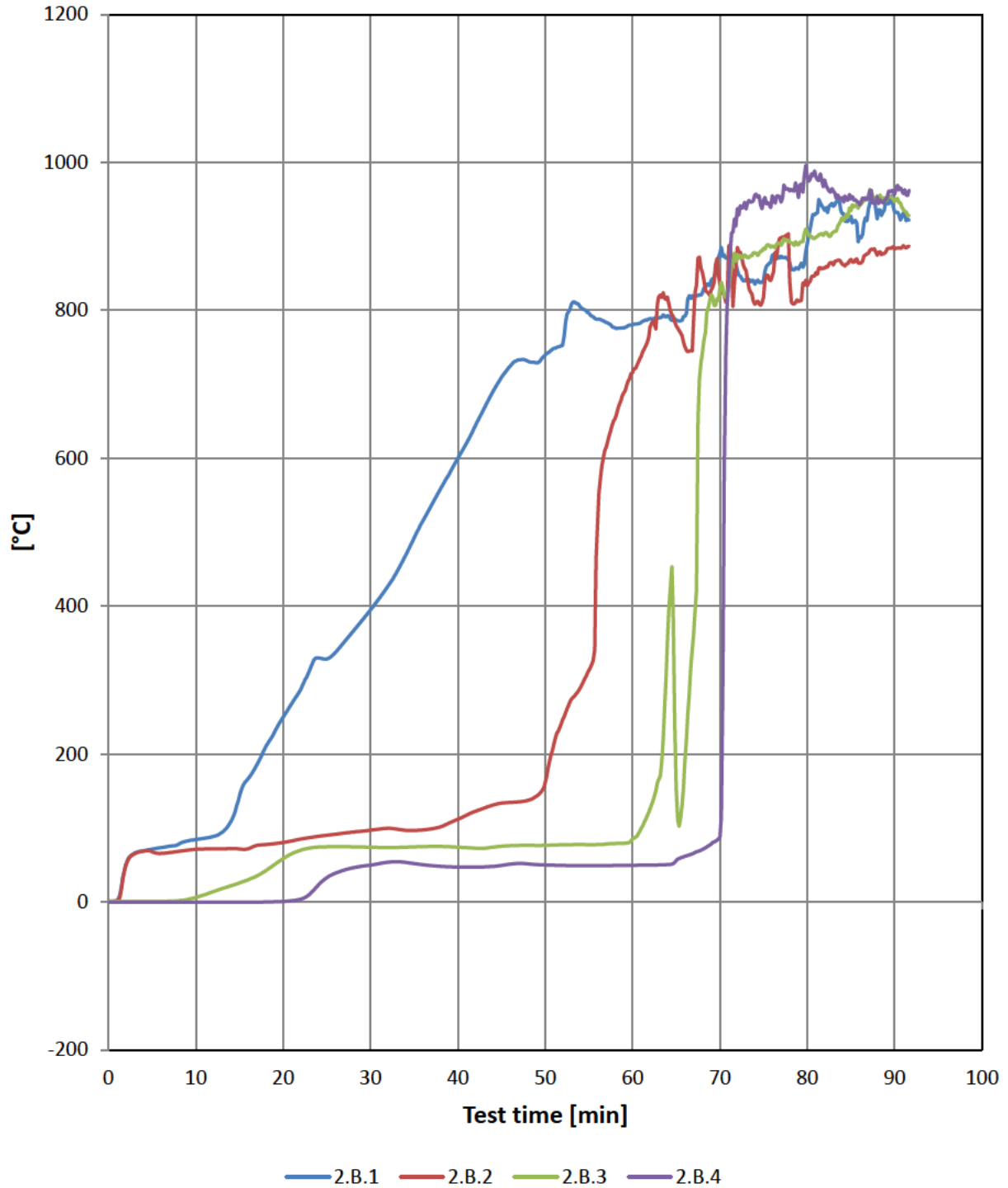
WF wall 2 - Installation box*Maximum temperature rise inside the construction*

Min. / °C	2.IB.1	2.IB.2	2.IB.3	2.IB.Max
0	-1	-2	-1	-1
3	-1	-2	-1	-1
6	-1	-2	0	0
9	-1	-2	0	0
12	-1	-1	0	0
15	0	-1	0	0
18	2	1	0	2
21	8	11	0	11
24	19	26	0	26
27	28	40	1	40
30	36	48	2	48
33	39	51	4	51
36	40	52	6	52
39	41	53	9	53
42	40	53	12	53
45	39	52	15	52
48	38	51	17	51
51	38	52	19	52
54	39	52	22	52
57	39	51	25	51
60	38	50	25	50
63	38	49	27	49
66	37	48	28	48
69	37	46	33	46
72	74	62	59	74
75	68	64	59	68
78	63	54	61	63
81	66	42	70	70
84	67	32	71	71
87	68	24	77	77
90	68	18	81	81
91	69	17	82	82

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

WF wall 2 - Internal measurements - stud B

Measure one 3 sides of stud and between the gypsum board layers



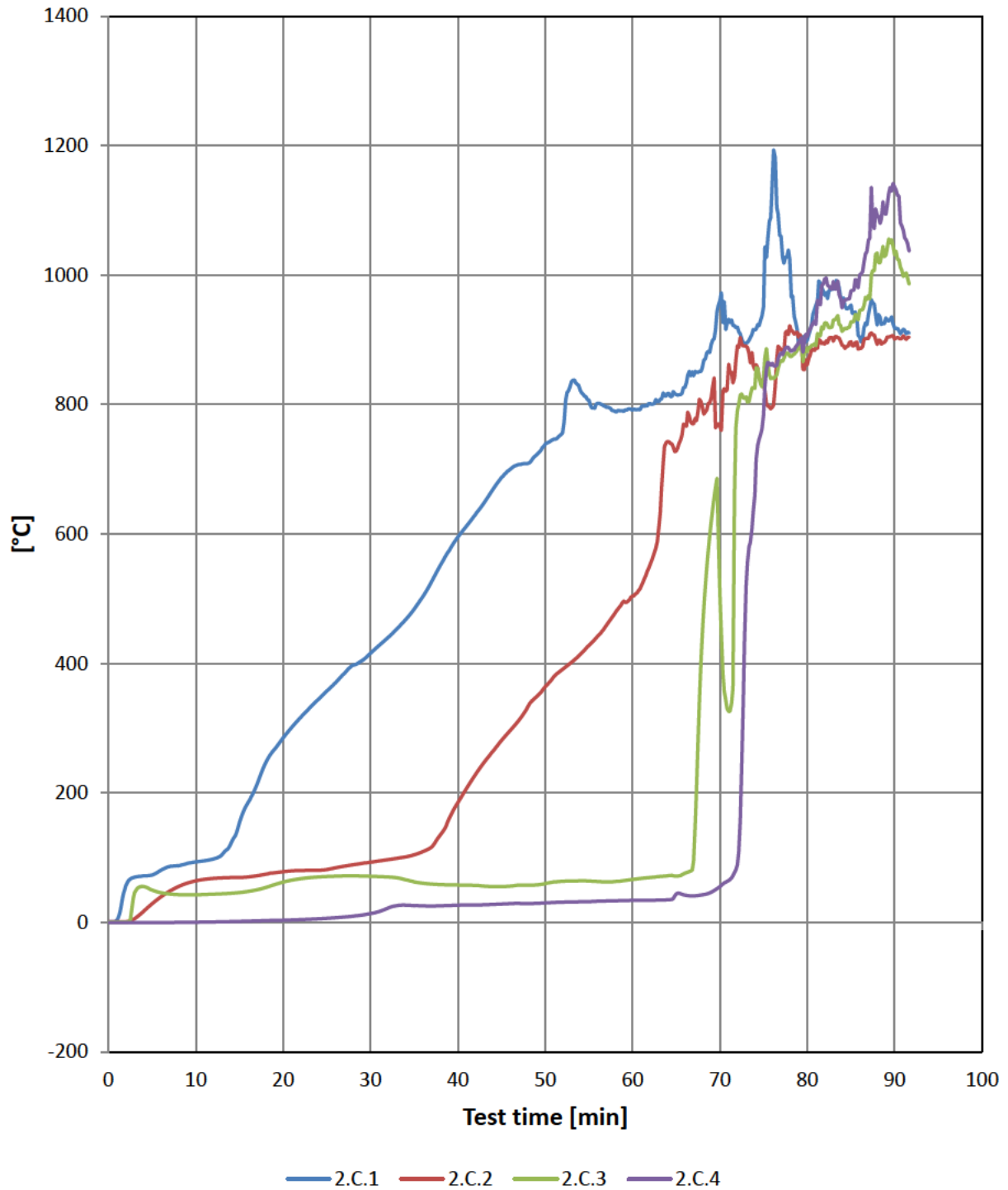
WF wall 2 - Internal measurements - stud B*Measure one 3 sides of stud and between the gypsum board layers*

Min. / °C	2.B.1	2.B.2	2.B.3	2.B.4	2.B.Max
0	1	1	1	0	1
3	66	65	1	0	66
6	74	66	1	0	74
9	82	70	3	0	82
12	89	72	14	0	89
15	143	72	26	0	143
18	210	78	42	0	210
21	269	83	65	2	269
24	330	89	74	23	330
27	352	93	75	43	352
30	395	97	74	50	395
33	446	98	74	55	446
36	515	97	75	51	515
39	579	107	75	47	579
42	644	123	73	47	644
45	710	134	75	50	710
48	732	138	76	52	732
51	749	213	77	50	749
54	805	289	78	49	805
57	784	616	78	49	784
60	780	716	85	50	780
63	789	818	165	50	818
66	792	751	190	62	792
69	841	828	821	79	841
72	854	885	876	938	938
75	841	818	884	949	949
78	865	840	892	961	961
81	931	851	899	981	981
84	931	863	926	953	953
87	937	877	953	952	953
90	933	883	947	957	957
91	932	887	936	958	958

Failure [min]	21.00	52.67	63.67	70.17	21.00
Failure °C	270	270	270	270	270

WF wall 2 - Internal measurements - stud C

Measure one 3 sides of stud and between the gypsum board layers



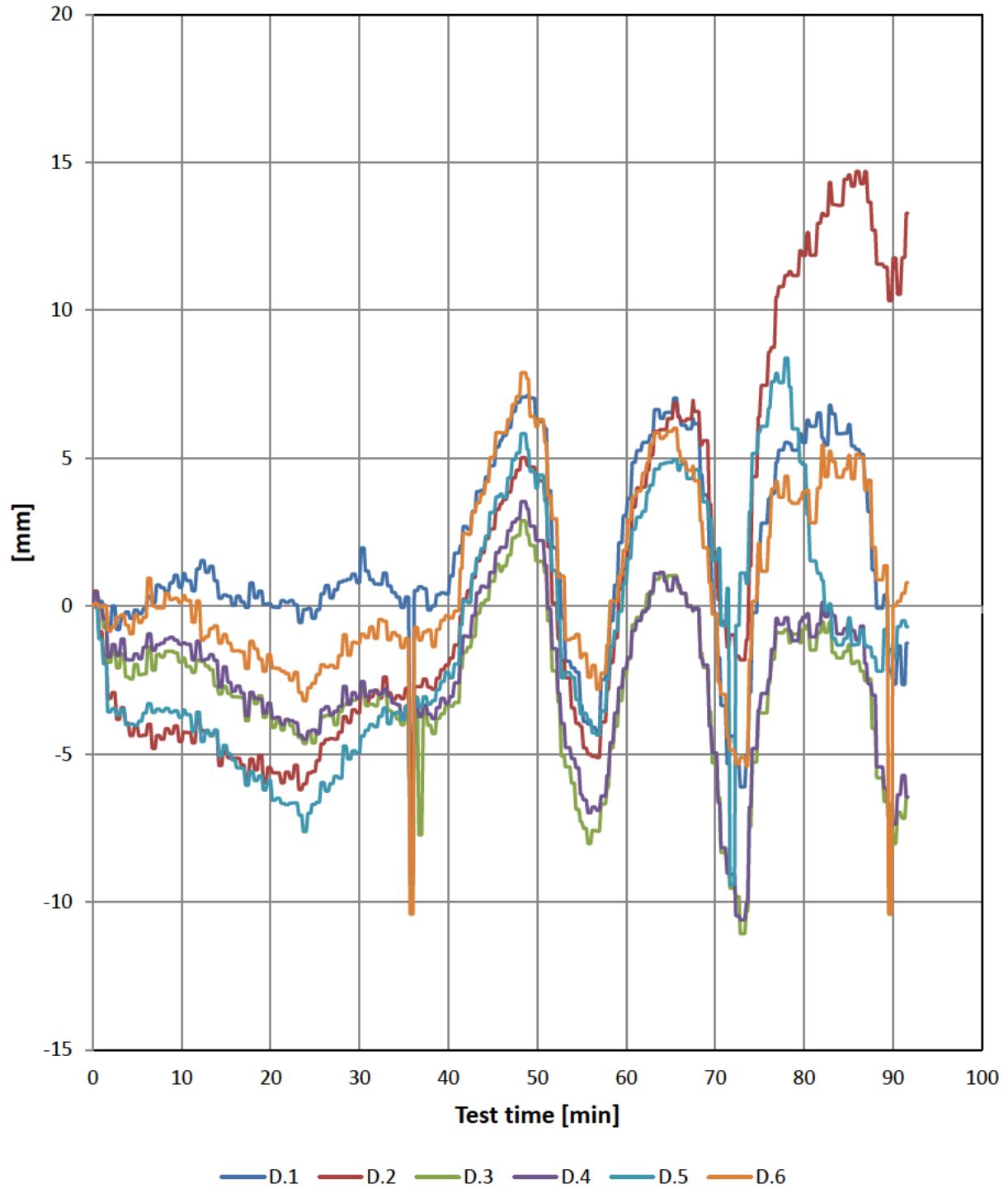
WF wall 2 - Internal measurements - stud C*Measure one 3 sides of stud and between the gypsum board layers*

Min. / °C	2.C.1	2.C.2	2.C.3	2.C.4	2.C.Max
0	1	1	0	0	1
3	70	6	46	0	70
6	80	39	46	0	80
9	91	61	43	0	91
12	98	68	43	1	98
15	154	69	46	2	154
18	246	74	54	3	246
21	302	80	65	4	302
24	344	80	70	6	344
27	385	87	72	8	385
30	416	93	71	13	416
33	453	99	69	26	453
36	504	110	61	26	504
39	575	160	58	26	575
42	630	228	57	27	630
45	687	281	55	28	687
48	709	333	57	29	709
51	747	380	63	31	747
54	822	414	64	32	822
57	796	459	63	33	796
60	792	504	66	34	792
63	805	609	71	34	805
66	826	769	76	42	826
69	893	811	622	47	893
72	920	891	791	89	920
75	951	836	841	784	951
78	1025	922	875	884	1025
81	953	888	891	924	953
84	963	892	913	949	963
87	939	902	969	1054	1054
90	919	901	1032	1136	1136
91	917	906	998	1070	1070

Failure [min]	19.17	44.33	67.33	72.50	19.17
Failure °C	270	270	270	270	270

Deformation

Negative values indicate movement towards the furnace. 1-3 on SW wall 1, 4-6 on WF wall 2



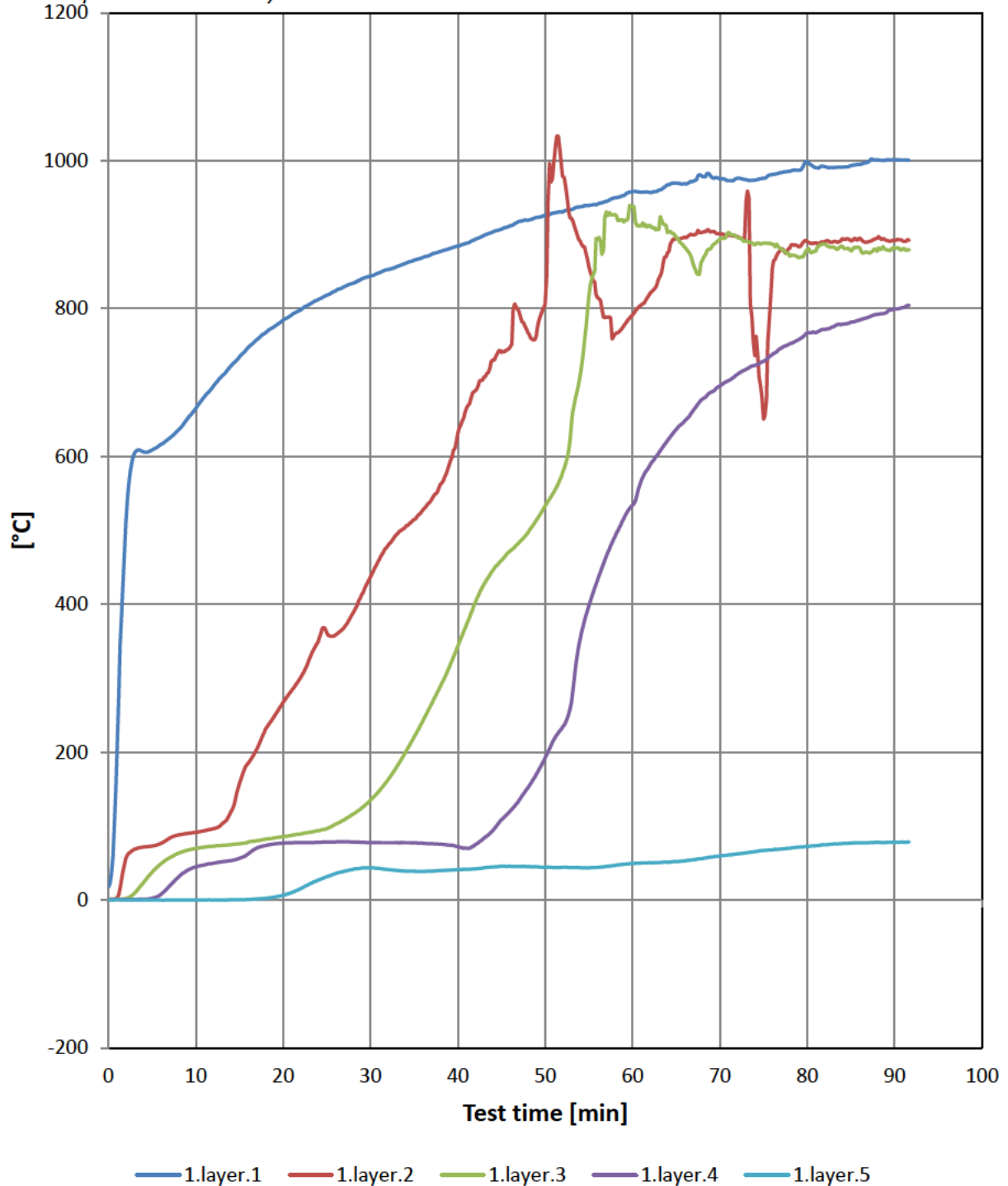
Deformation

Negative values indicate movement towards the furnace. 1-3 on SW wall 1, 4-6 on WF wall 2

Min. / mm	D.1	D.2	D.3	D.4	D.5	D.6
0	0	0	0	0	0	0
3	-1	-4	-2	-2	-4	0
6	0	-4	-2	-1	-4	0
9	1	-4	-2	-1	-4	0
12	1	-4	-2	-1	-4	0
15	0	-5	-3	-2	-5	-1
18	1	-5	-3	-3	-6	-1
21	0	-6	-4	-4	-6	-2
24	0	-6	-5	-5	-8	-3
27	0	-4	-4	-4	-6	-2
30	1	-4	-3	-3	-5	-1
33	1	-2	-3	-3	-3	-1
36	-6	-7	-8	-8	-9	-10
39	0	-2	-4	-3	-3	-1
42	3	0	-2	-1	0	2
45	5	3	1	1	3	5
48	7	5	2	3	5	7
51	6	4	1	1	4	6
54	-2	-3	-6	-5	-2	-1
57	-4	-5	-8	-7	-4	-3
60	3	1	-2	-2	1	2
63	6	5	0	0	4	5
66	6	6	1	1	5	5
69	4	6	-2	-2	4	2
72	-4	-1	-10	-9	-9	-5
75	2	6	-4	-3	6	2
78	6	11	-1	0	8	4
81	6	12	-1	-1	2	3
84	6	14	-2	-1	-1	4
87	4	15	-3	-2	-1	4
90	-3	12	-8	-7	-2	0
91	-3	12	-7	-6	0	0

SW wall 1 - temperature rise through the layers

From furnace temperatures to unexposed surface temperatures. Each line shows the maximum temperature in each layer



SW wall 1 - temperature rise through the layers

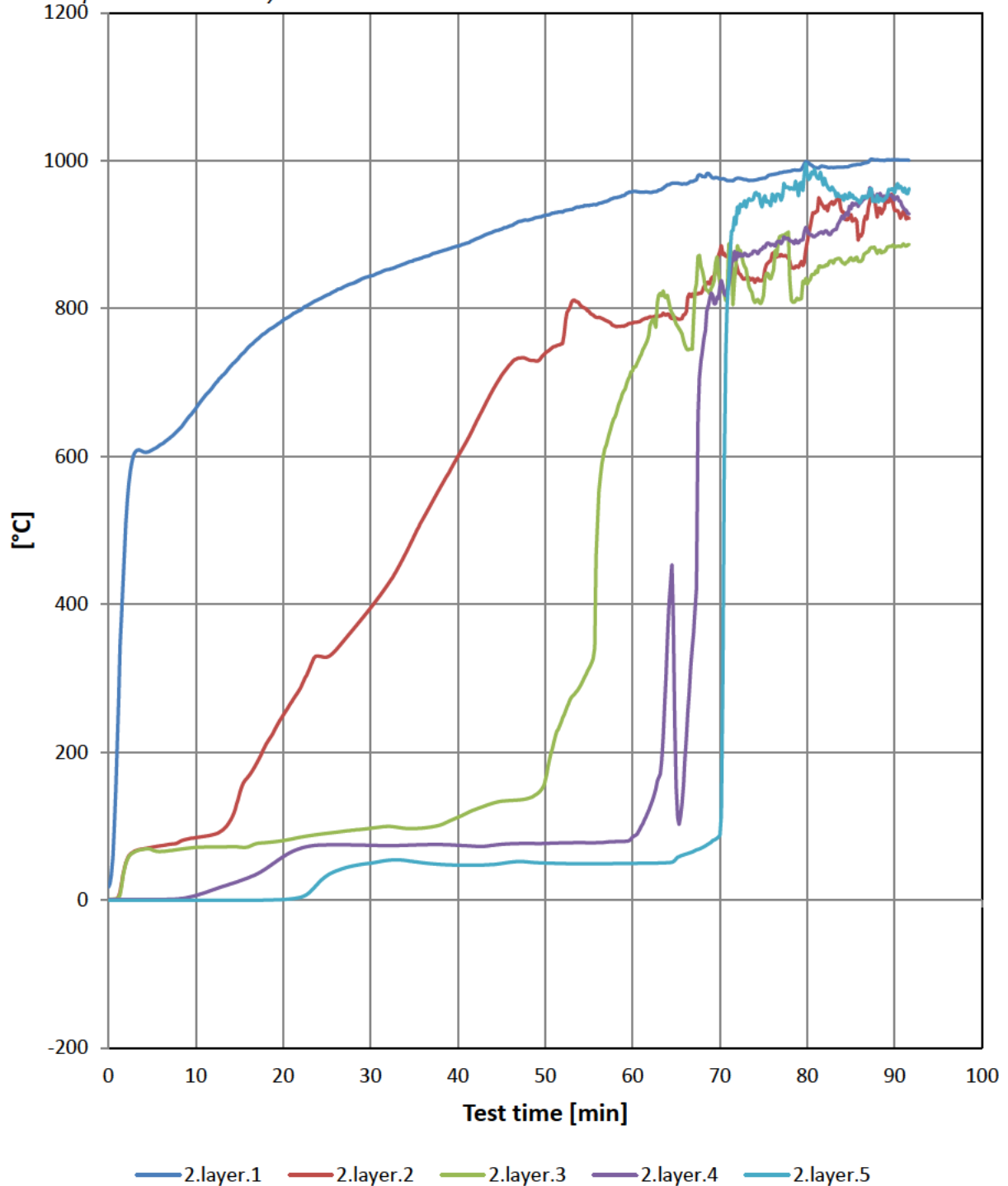
From furnace temperatures to unexposed surface temperatures. Each line shows the maximum temperature in each layer

Min. / °C	1.layer.1	1.layer.2	1.layer.3	1.layer.4	1.layer.5	1.layer.Max
0	17	1	1	1	0	1
3	605	69	9	1	0	69
6	617	77	49	8	0	77
9	651	90	67	40	0	90
12	695	97	73	50	0	97
15	735	158	76	56	1	158
18	768	232	82	74	2	232
21	792	284	88	78	10	284
24	812	349	94	78	27	349
27	830	369	109	79	39	369
30	844	438	135	78	44	438
33	857	495	180	78	40	495
36	869	528	243	77	39	528
39	881	589	315	74	40	589
42	894	689	402	75	42	689
45	908	741	460	109	46	741
48	920	768	497	152	45	768
51	929	998	552	217	44	998
54	938	891	710	353	44	891
57	945	789	931	466	45	931
60	958	792	939	534	50	939
63	961	841	907	605	51	907
66	969	897	883	648	53	897
69	979	904	882	687	58	904
72	977	898	897	711	62	898
75	977	651	889	729	67	889
78	986	882	871	752	70	882
81	991	890	878	768	74	890
84	992	895	885	779	76	895
87	998	890	876	789	78	890
90	1002	893	882	800	78	893
91	1001	891	882	801	78	891

Failure [min]	1.00	20.17	37.17	53.00	-	20.17
Failure °C	270	270	270	270	270	270

WF wall 2 - temperature rise through the layers

From furnace temperatures to unexposed surface temperatures. Each line shows the maximum temperature in each layer



WF wall 2 - temperature rise through the layers

From furnace temperatures to unexposed surface temperatures. Each line shows the maximum temperature in each layer

Min. / °C	2.layer.1	2.layer.2	2.layer.3	2.layer.4	2.layer.5	2.layer.Max
0	17	1	1	1	0	1
3	605	66	65	1	0	66
6	617	74	66	1	0	74
9	651	82	70	3	0	82
12	695	89	72	14	0	89
15	735	143	72	26	0	143
18	768	210	78	42	0	210
21	792	269	83	65	2	269
24	812	330	89	74	23	330
27	830	352	93	75	43	352
30	844	395	97	74	50	395
33	857	446	98	74	55	446
36	869	515	97	75	51	515
39	881	579	107	75	47	579
42	894	644	123	73	47	644
45	908	710	134	75	50	710
48	920	732	138	76	52	732
51	929	749	213	77	50	749
54	938	805	289	78	49	805
57	945	784	616	78	49	784
60	958	780	716	85	50	780
63	961	789	818	165	50	818
66	969	792	751	190	62	792
69	979	841	828	821	79	841
72	977	854	885	876	938	938
75	977	841	818	884	949	949
78	986	865	840	892	961	961
81	991	931	851	899	981	981
84	992	931	863	926	953	953
87	998	937	877	953	952	953
90	1002	933	883	947	957	957
91	1001	932	887	936	958	958

Failure [min]	1.00	21.00	52.67	63.67	70.17	21.00
Failure °C	270	270	270	270	270	270



Photo No. 1 Supporting construction wooden frame during mounting



Photo No. 2 Supporting construction seen from exposed side during mounting



Photo No. 3 Supporting construction seen from exposed side during mounting



Photo No. 4 Test specimen seen from unexposed side during mounting



Photo No. 5 Test specimen seen from exposed side



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



Photo No. 7 Test specimen seen from exposed side before test start



Photo No. 8 Installation box during mounting



Photo No. 9 Socket before test start



Photo No. 10 Test specimen seen from unexposed side before test start



Photo No. 11 Test specimen seen from unexposed side at test start



Photo No. 12 Test specimen seen from unexposed side after 17 minutes of testing



Photo No. 13 Test specimen seen from unexposed side after 30 minutes of testing



Photo No. 14 Test specimen seen from unexposed side after 45 minutes of testing



Photo No. 15 Test specimen seen from unexposed side after 60 minutes of testing



Photo No. 16 Test specimen seen from unexposed side after 72 minutes of testing



Photo No. 17 Test specimen seen from unexposed side after 75 minutes of testing



Photo No. 18 Test specimen seen from unexposed side after 88 minutes of testing



Photo No. 19 Test specimen seen from unexposed side after the test



Photo No. 20 Test specimen seen from exposed side after the test

Comparison test

Stone wool left side

Biobased material right side

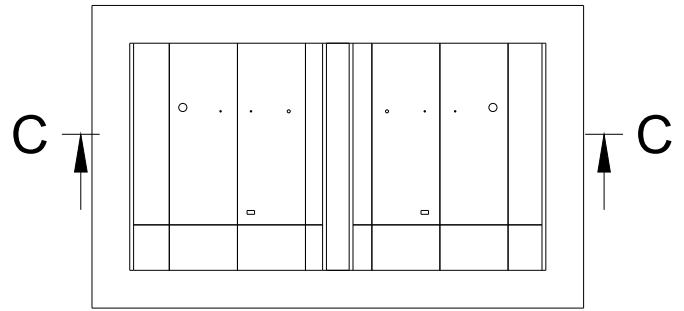
4 different pipe penetrations

Ø110 mm PP HD

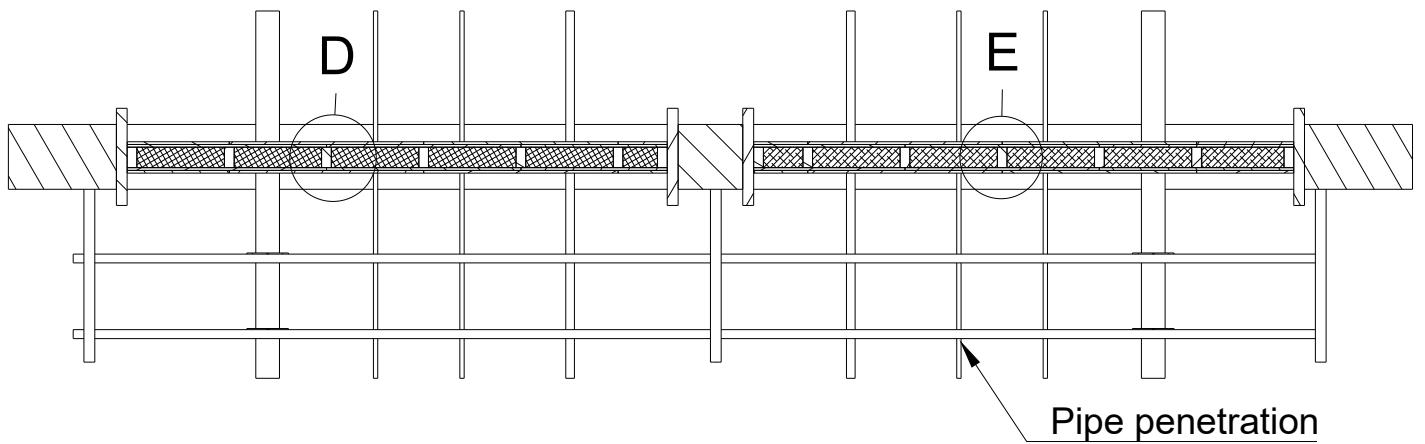
Ø20 mm Pex

Ø20 mm Alupex

Ø40 mm PE

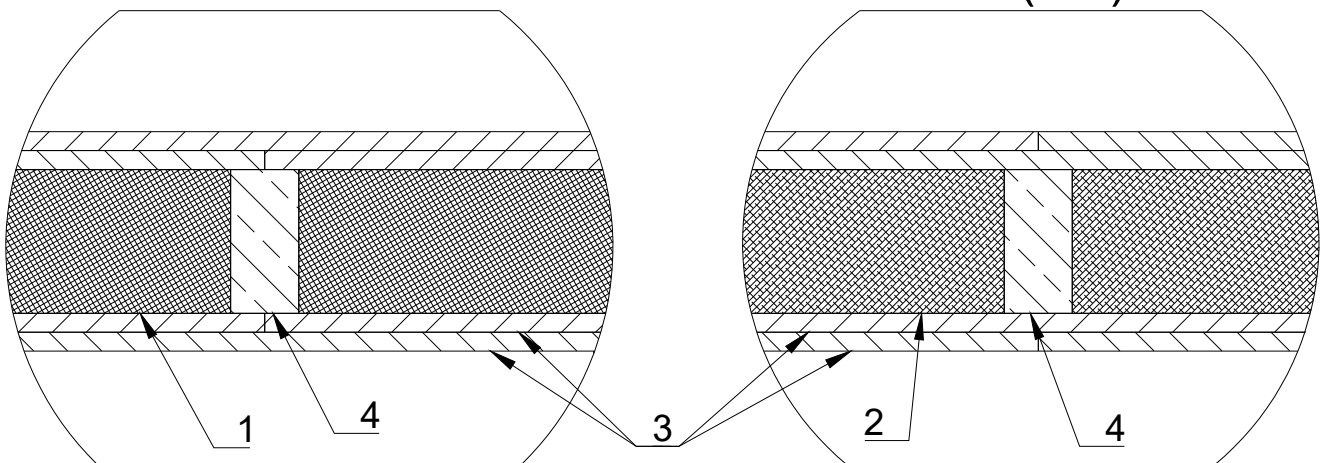


C-C (1:35)



D (1:5)

E (1:5)



1: Stone wool insulation

2: Woodfiber batt insulation

3: 12.5 mm gypsum board

4: Wooden studs 45 x 95 mm

All measurements are in mm



Danish Institute of Fire and Security Technology

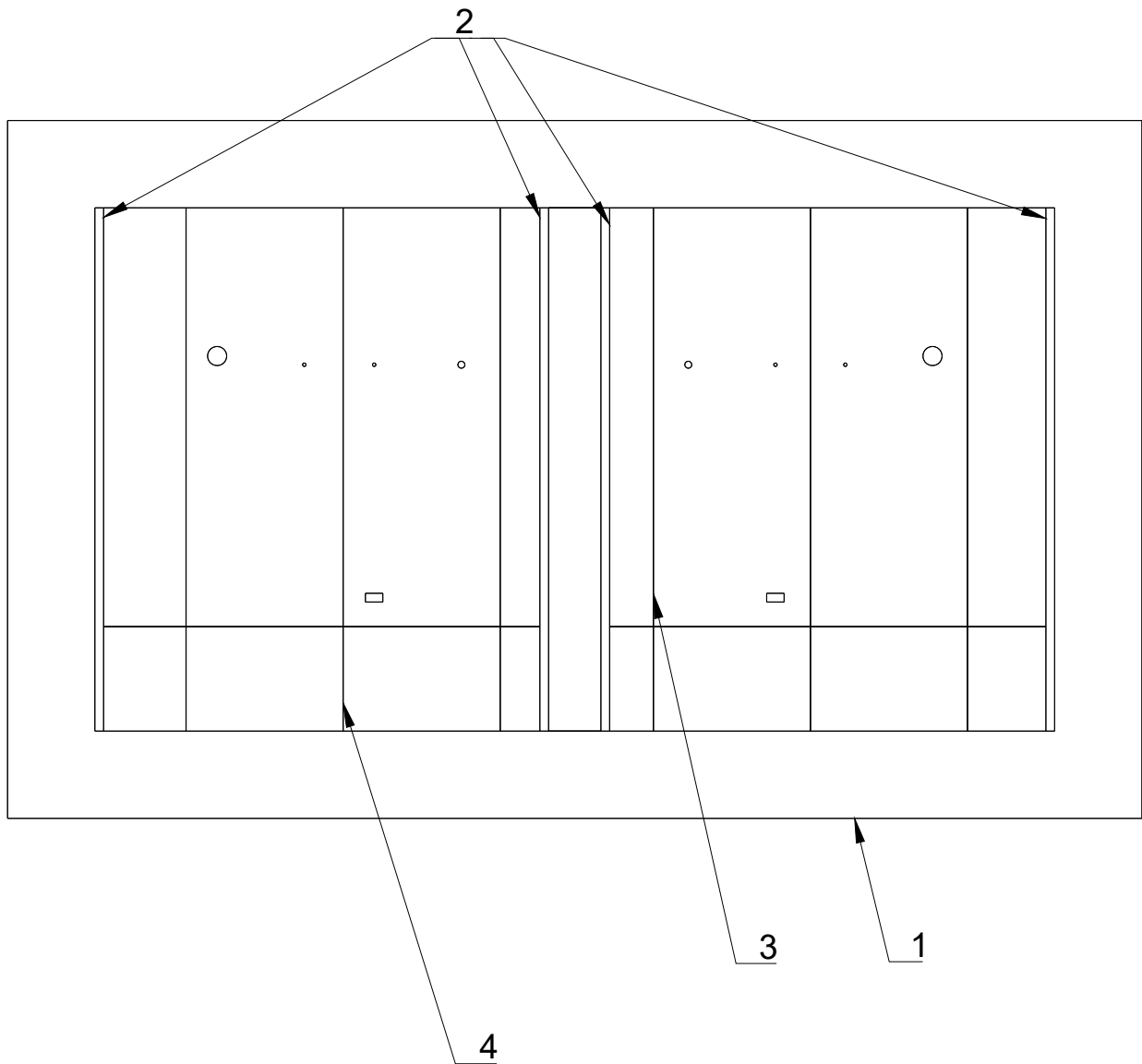
Sponsor: Wood:UpHigh

Subject: Comparison test

File No.: PGA12248A

Test date: 27-04-2023

Enclosure: 1.3



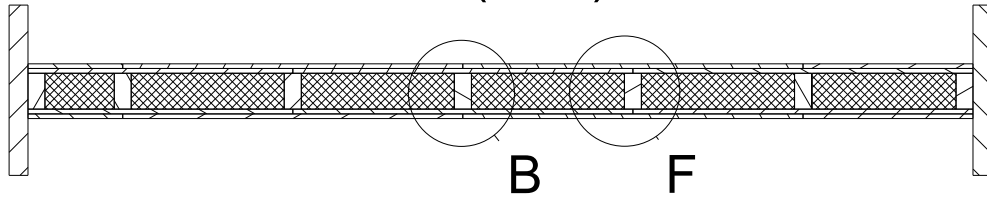
- 1: Test frame
- 2: Free edge
- 3: Wall (biobased insulation)
- 4: Wall (mineral-based insulation)

All measurements are in mm

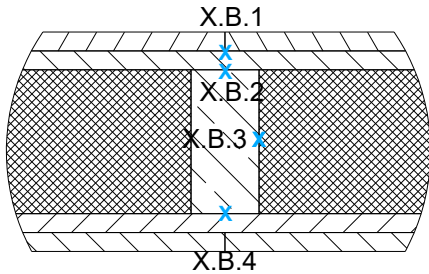


Exposed side

A-A (1:20)

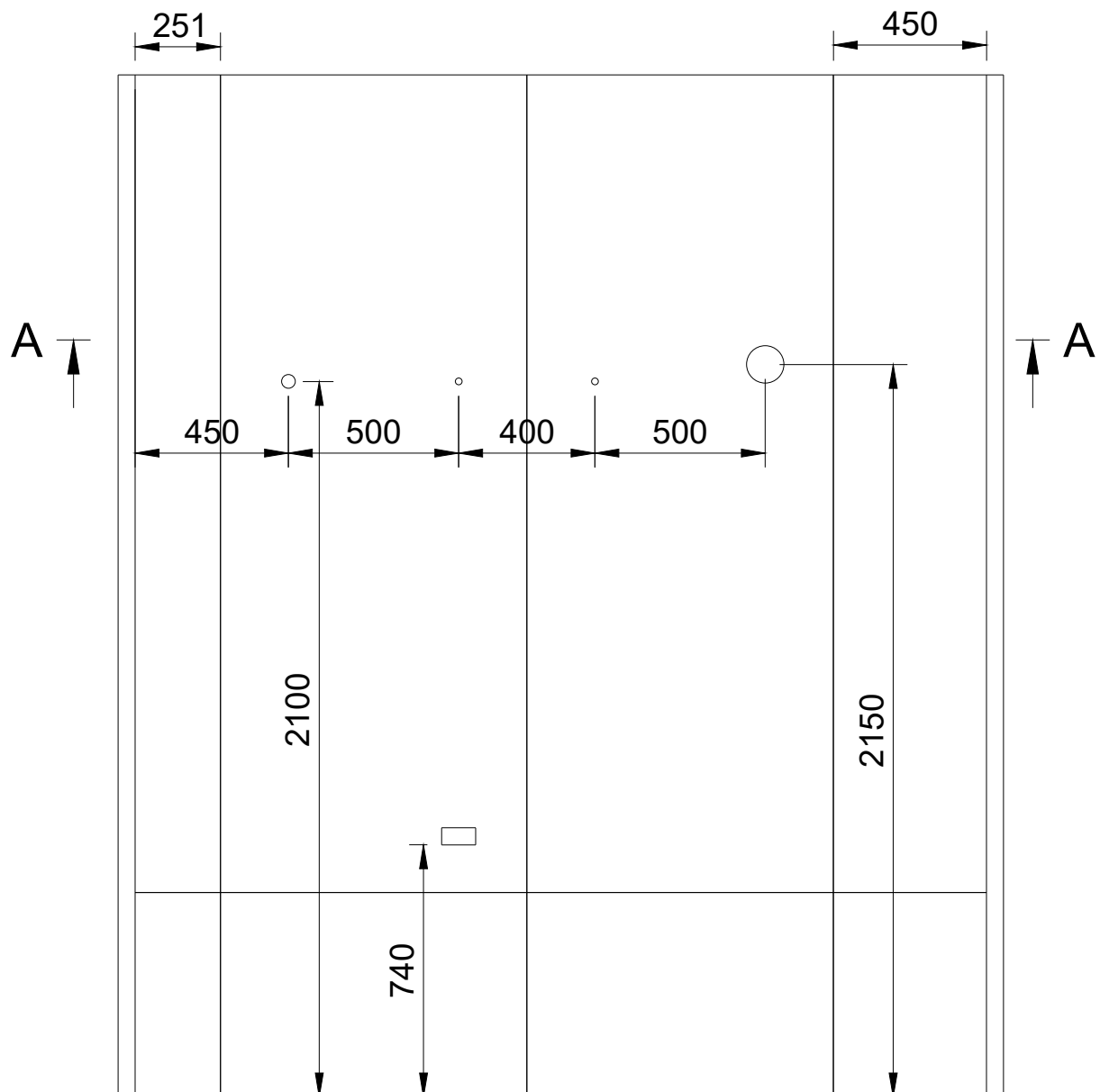
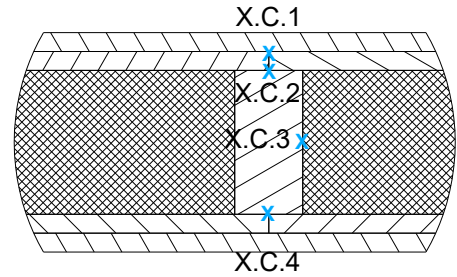


B (1:5)



TC placed
mid height of
construction.
X can either
be wall 1 or 2

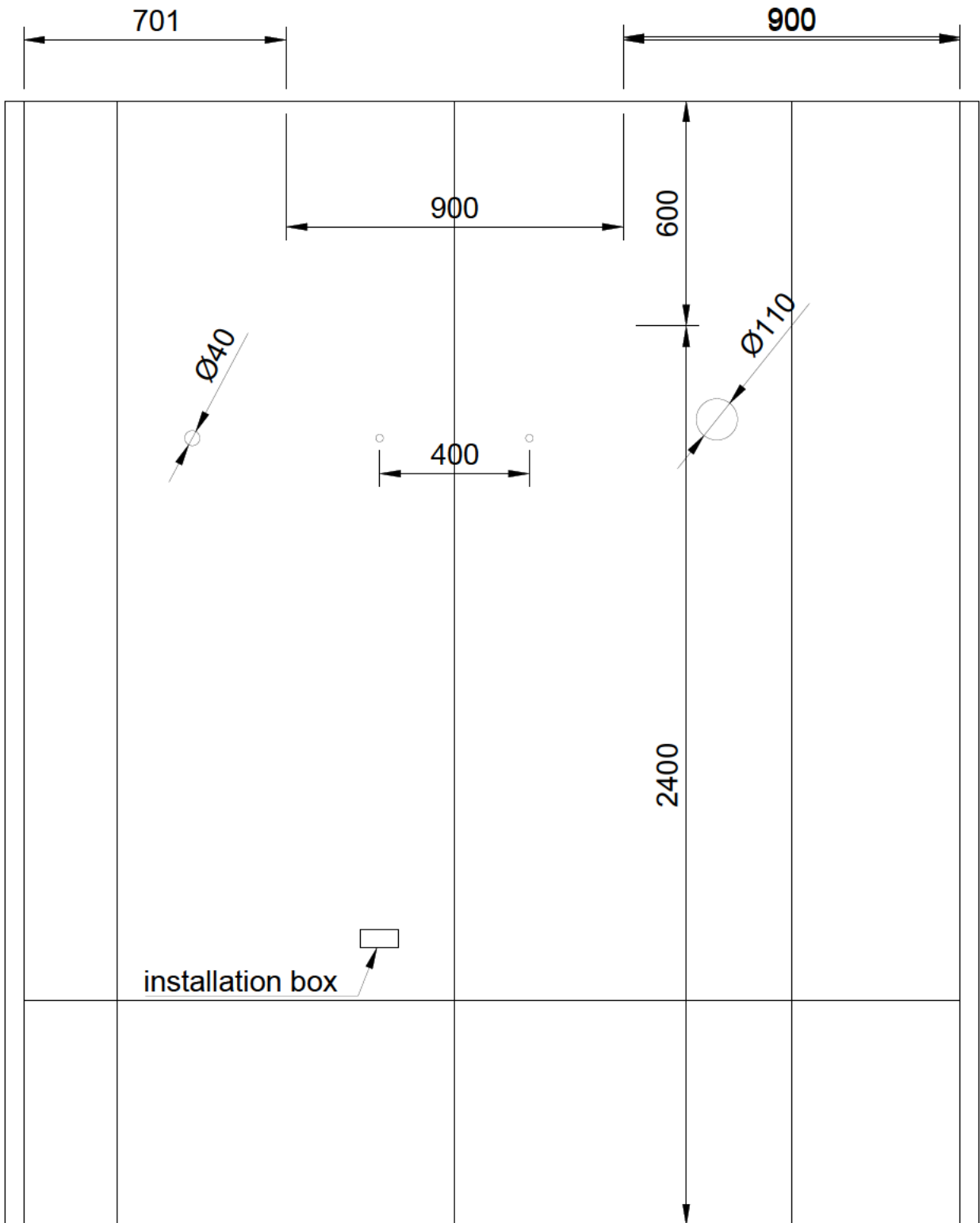
F (1:5)



Outer layer gypsum, exposed and unexposed side

All measurements are in mm

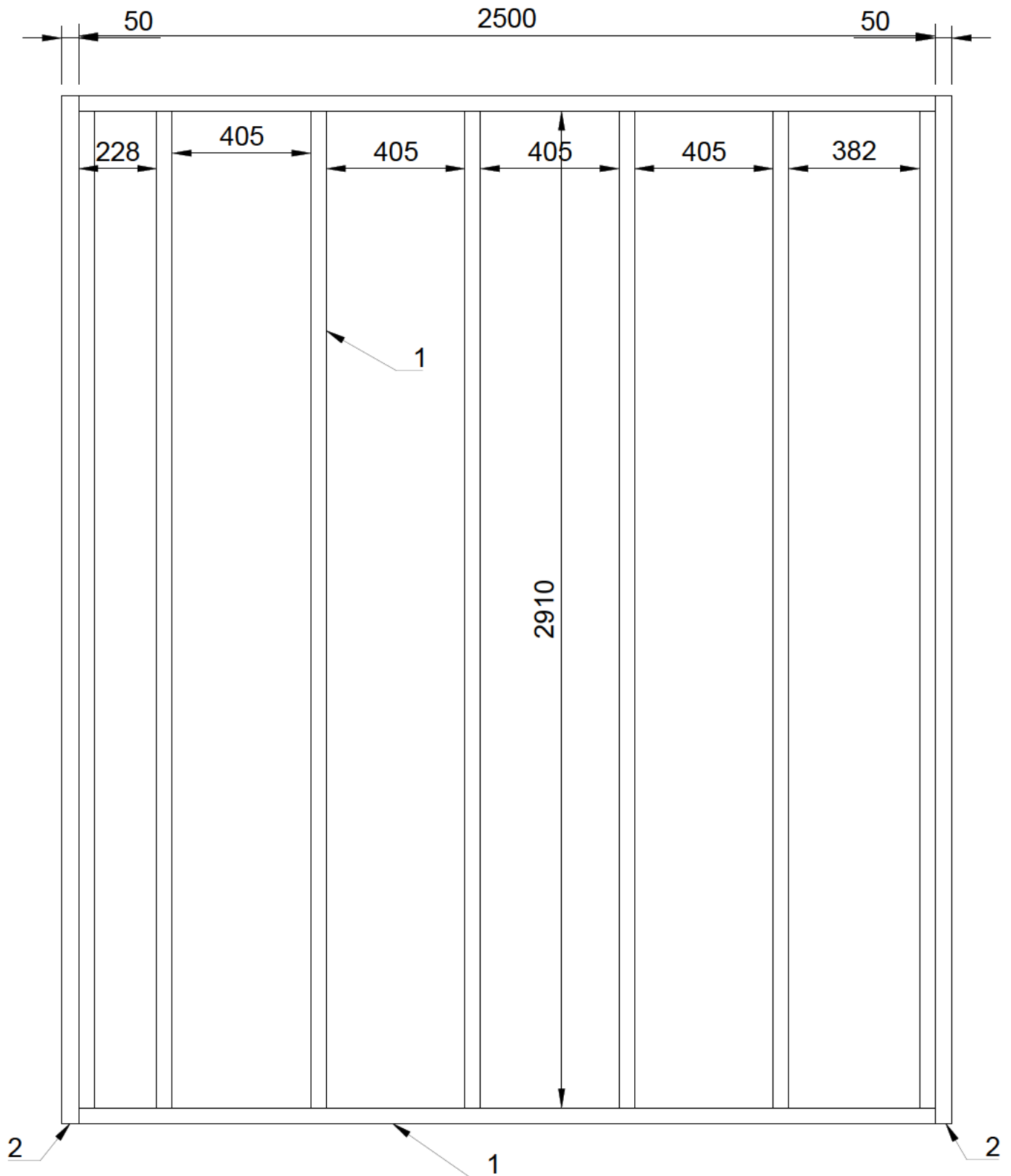




Inner layer gypsum, exposed and unexposed side

All measurements are in mm





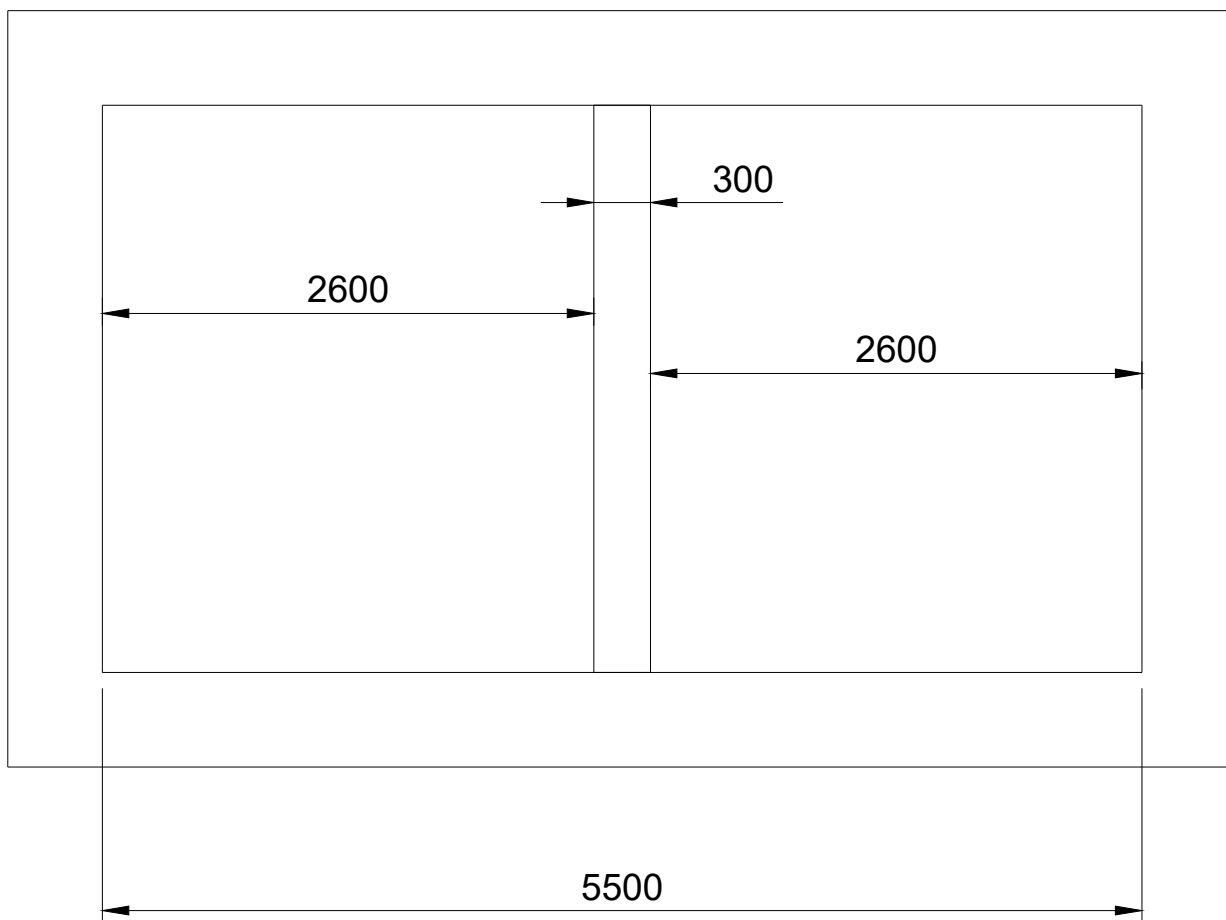
1: Wooden studs
 2: Free edge

All measurements are in mm



Danish Institute of Fire and Security Technology
 Sponsor: Wood:UpHigh
 Subject: Comparison test

File No.: PGA12248A
 Test date: 27-04-2023
 Enclosure: 1.7



Der skal sættes et 150 x 300 x 3100 mm gasbeton element ind i midten af rammen.

All measurements are in mm

