



Test report

InnoBYG small scale demonstration tests - Part 1

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Test date: 2013-12-11
Date: 2014-01-20

1 NAME OF SPONSOR



2 DATE OF TEST

2013-12-11

3 PURPOSE OF TEST

Two small scale tests based on test standard EN 14135 were performed, each with four different test samples, 8 samples in total.

The tests were performed as part of the sub-project "Fire and building materials" in relation to the Danish innovation cluster InnoBYG. The purposes were to

- investigate the difference between different types of covering systems and the general behaviour of EPS insulation behind a covering system *and*
- show the general principles of the covering test and the evaluation of the test criteria *and*
- inspire manufacturers and consultants in their innovation process.

4 TEST SPECIMENS

The test specimens were eight different types of coverings, all mounted on a substrate of 100 mm thick EPS insulation. The EPS insulation was mounted on a backing board of chip-board

The exposed area was 500 x 500 mm for all test specimens.

5 DRAWINGS AND DESCRIPTION OF THE TEST SPECIMENS

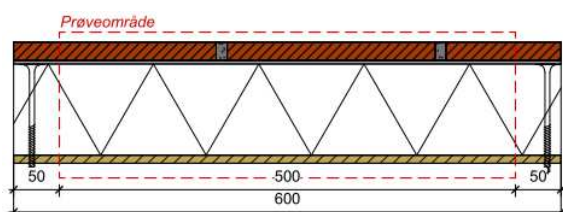
The details of the construction and the measures for the test specimens are described in the enclosed documentation:

Type:	Enclosure:	Description:
Drawing	A1.1	Test specimens no 1, 2, 3 and 4
Drawing	A1.2	Test specimens no 5, 6, 7 and 8

The test specimens were made by DBI. The test specimens consisted of the components described in the following.

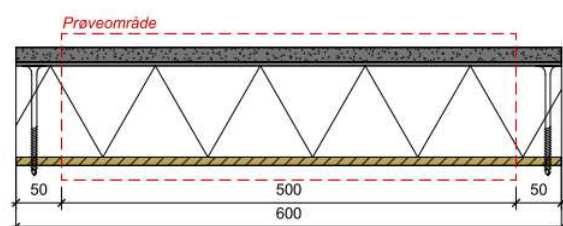
Test specimen 1

External measures:	600 x 600 mm
Covering:	20 mm bricks jointed with mortar
Fixation:	4 mm general purpose glue
Substrate:	100 mm EPS insulation
Backing board:	9 mm chipboard



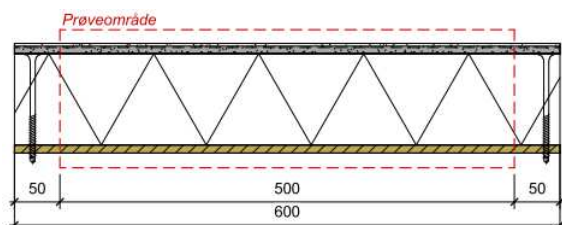
Test specimen 2

External measures:	600 x 600 mm
Covering:	16 mm concrete rendering
Fixation:	4 mm general purpose glue
Substrate:	100 mm EPS insulation
Backing board:	9 mm chipboard



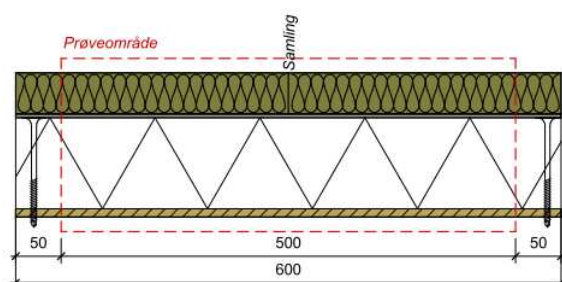
Test specimen 3

External measures:	600 x 600 mm
Covering:	12 mm plaster system consisting of a plaster base, reinforcement mesh and a plaster finish
Substrate:	100 mm EPS insulation
Backing board:	9 mm chipboard



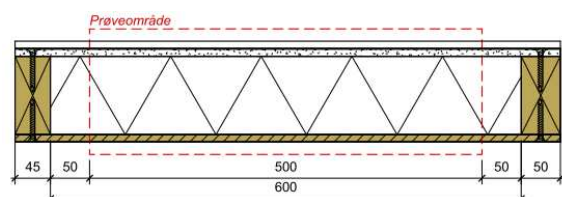
Test specimen 4

External measures:	600 x 600 mm
Covering:	45 mm stone wool insulation with nominal density 30 kg/m ³ with butt joint in the middle of the specimen
Fixation:	4 mm general purpose glue
Substrate:	100 mm EPS insulation
Backing board:	9 mm chipboard



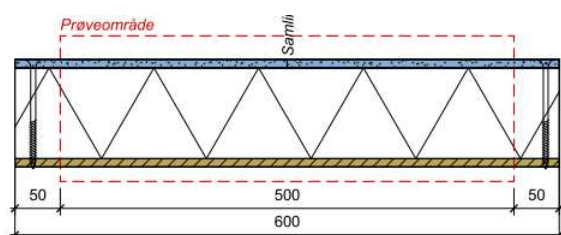
Test specimen 5

External measures:	600 x 695 mm
Covering:	10 mm fibre cement boards mounted with an overlap, nominal density of 1640 kg/m ³
Fixation:	Screws through a 45 x 100 mm wooden joist placed outside of the exposed area.
Substrate:	100 mm EPS insulation
Backing board:	9 mm chipboard



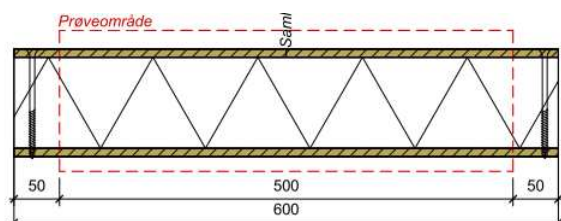
Test specimen 6

External measures:	600 x 600 mm
Covering:	9,5 mm wind stopping gypsum board
Fixation:	Screws through the EPS insulation outside of the exposed area
Substrate:	100 mm EPS insulation
Backing board:	9 mm chipboard



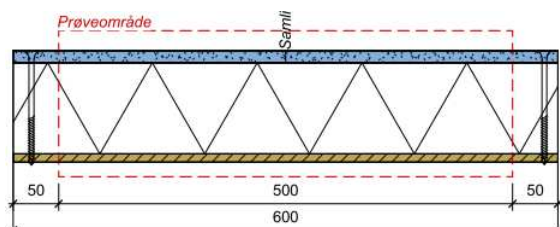
Test specimen 7

External measures:	600 x 600 mm
Covering:	9 mm water proof plywood
Fixation:	Screws through the EPS insulation outside of the exposed area
Substrate:	100 mm EPS insulation
Backing board:	9 mm chipboard



Test specimen 8

External measures:	600 x 600 mm
Covering:	12,5 mm gypsum plasterboard type A according to EN 520
Fixation:	Screws through the EPS insulation outside of the exposed area
Substrate:	100 mm EPS insulation
Backing board:	9 mm chipboard



6 TEST CONDITIONS

Conditioning

The test specimens were made by DBI during 2013-11-13 and were stored under laboratory conditions until the tests.

Mounting

The test specimens were placed on top of a horizontal concrete frame with four openings of 500 x 500 mm.

The area between the test specimens as well as the outer perimeter on the unexposed side was insulated with ceramic wool insulation in order to prevent any influence between each test specimen.

Fire test

Two fire tests were performed, each with four test specimens. The concrete frame with four test specimens was placed horizontally on the DBI small scale furnace.

Each fire test lasted 10 minutes.

The first fire test was performed at approx. 10 AM and the second fire test was performed at 13 PM. The furnace was ventilated between the two tests.

In order to prevent preheating of the test specimens for the second fire test, the test specimens were not placed on the test frame until just before the start of the second fire test.

DBI enclosure 1.0 and 1.1 show the position of the thermocouples for measuring the temperature rise on the unexposed surface of the test specimens.

7 TEST RESULTS

The enclosed graphs and tables describe:

Enclosures 1.0 and 1.1 Temperature rise on test specimen 1.

- Enclosures 2.0 and 2.1 Temperature rise on test specimen 2.
- Enclosures 3.0 and 3.1 Temperature rise on test specimen 3.
- Enclosures 4.0 and 4.1 Temperature rise on test specimen 4.
- Enclosures 5.0 and 5.1 Temperature rise on test specimen 5.
- Enclosures 6.0 and 6.1 Temperature rise on test specimen 6.
- Enclosures 7.0 and 7.1 Temperature rise on test specimen 7.
- Enclosures 8.0 and 8.1 Temperature rise on test specimen 8.
- Enclosures 9.0 and 9.1 Test 1: Actual minimum-, average- and maximum furnace temperature in relation to the standard temperature.
- Enclosures 10.0 and 10.1 Test 1: Ambient temperature in the laboratory during the test.
- Enclosures 11.0 and 11.1 Test 1: Furnace pressure measured 100 mm below the test frame.
- Enclosures 12.0 and 12.1 Test 2: Actual minimum-, average- and maximum furnace temperature in relation to the standard temperature.
- Enclosures 13.0 and 13.1 Test 2: Ambient temperature in the laboratory during the test.
- Enclosures 14.0 and 14.1 Test 2: Furnace pressure measured 100 mm below the test frame.

Observations during the tests

During the test the test specimens were constantly observed, and the relevant observations are stated in the following:

Test 1:

Time minutes	Test specimen	Observations
0		Test start
3	2,3,4	Light smoke development
6	2, 3	Increasing smoke development, particularly from test specimen 2
10		Test stopped

Test 2:

Time minutes	Test specimen	Observations
0		Test start
2	5,6,7,8	Light smoke development in general
4	5,6,7,8	Increased smoke development in general

7	7	Significant smoke development
9	7	Spurts of flames from test specimen 7
10		Test stopped

Photographs

General photographs from both tests are shown on the enclosed photo sheets.

Observations after the tests

Each test specimen was examined after the test and relevant observations and photos are stated in the following:

Test specimen	Observation
1	<p>The glue has detached and some of the bricks had fallen down. This could have happened just before the end of the test, as indicated by the temperature measurements.</p> <p>The EPS insulation has shrunk and melted in a large area in the middle of the test specimen. The insulation has melted and has formed stalactites.</p> <p>Light brown discolouration of the remaining insulation.</p> <p>The backing board is otherwise unaffected, which suggest that the insulation has not burned.</p>



-
- 2 Parts of the rendering had fallen down during the test (after approx. 5 minutes), as indicated by the temperature measurements.

The EPS insulation had burned and is completely gone in a large area. Remains of melted insulation on the back side of the remaining part of the rendering.

The backing board (chipboard) is charred due to direct exposure (flames in the cavity behind the covering).



-
- 3 The plaster is intact as a solid board, held together by the reinforcement mesh.

The EPS insulation has melted in a large area, except along the outer edges of the test specimen. Melted remains of the insulation on the back side of the plaster.

The backing board is otherwise unaffected, which suggest that the insulation has not burned.



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- 4 The glue has detached on one part of the stone wool insulation, but the other part is still attached to the EPS insulation.

The EPS insulation has melted and shrunk. Lumps of melted EPS insulation on the back side of the glue layer.

The backing board is otherwise unaffected, which suggest that the insulation has not burned.



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- 5 The fibre cement planks are still in place, but some transverse cracks have evolved. The planks bend outwards. One of the joints between the planks had opened.

The EPS insulation has almost completely melted away, but there are remains of melted insulation that looks like melted caramel.

The insulation has also melted in an area at the edge of the test specimen and small discolouration of the backing board suggests some influence by a neighbouring test specimen.

The backing board is otherwise unaffected, which suggest that the insulation has not burned.



-
- 6 The joint between the gypsum boards have opened. The EPS insulation has almost completely burned away in most of the test specimen. Remains of melted insulation that looks like caramel.

Significant discolouration and some charring of the backing board (chipboard) suggest direct exposure of the backing board (flames in the cavity behind the covering), but probably only for a short time.



-
- 7 The plywood has burned through and only small parts of the plywood remains.

The EPS insulation has completely burned away and only very small remains of melted insulation remains along the edges of the test specimen.

The backing board (chipboard) has significant charring which suggest direct exposure of the backing board.



- 8 The gypsum plasterboards were still in place, but the joint between the boards had opened a bit. One of the boards was removed after the test in order to examine the insulation.

The EPS insulation had melted in an area along the joint. In the area away from the joint, only shrinking of the insulation had occurred.

The EPS insulation had melted away in an area at the edge of the test specimen and there was significant discolouration of the backing board at that edge. This suggests influence from a neighbouring test specimen.

The backing board is otherwise only weakly discoloured.



8 REMARK

The tests described in this test report were small scale demonstration tests made for a general informative purpose. The test results are not meant to be used for classification or approval by authorities.

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.

Anders Dragsted
M.Sc. (Eng.)

/

Trine Dalsgaard Jensen
M.Sc. (Eng.)

Enclosures:	29
Photo sheets:	6
DBI drawings:	2
DBI graphs and tables:	28



Photo No. 1 Test specimens no 1, 2, 3 and 4 from exposed side before test (test 1)



Photo No. 2 Test specimens no 1, 2, 3 and 4 seen from unexposed side before test



Photo No. 3 Test specimens no 1,2,3 and 4 after 6 minutes of testing



Photo No. 4 Test specimens no 1,2,3 and 4 after 7 minutes of testing



Photo No. 5 Test specimens no 1,2,3 and 4 from exposed side after the test



Photo No. 6 Test specimens no 1,2,3 and 4 from exposed side after the test



Photo No. 7 Test specimens no 5,6,7 and 8 from exposed side before the test (test 2)



Photo No. 8 Test specimens no 5,6,7 and 8 from unexposed side before the test



Photo No. 9 Test specimens no 5,6,7 and 8 after 3 minutes of testing



Photo No. 10 Test specimens no 5,6,7 and 8 after 7 minutes of testing

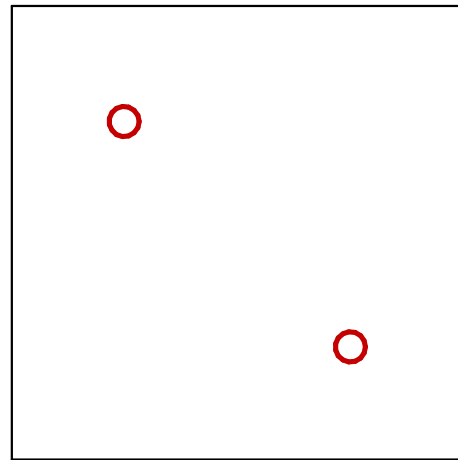


Photo No. 11 Test specimens no 5,6,7 and 8 after 9 minutes of testing



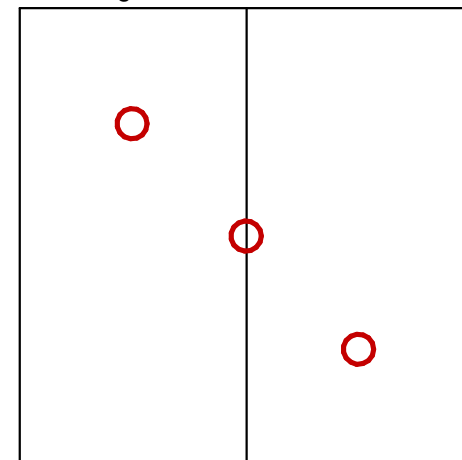
Photo No. 12 Test specimens no 5,6,7 and 8 after the test

Placering af thermoelementer



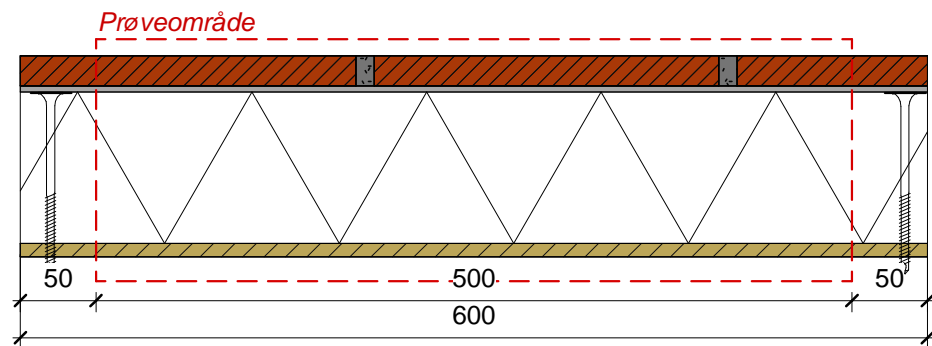
Prøveemner uden samling

Placering af thermoelementer



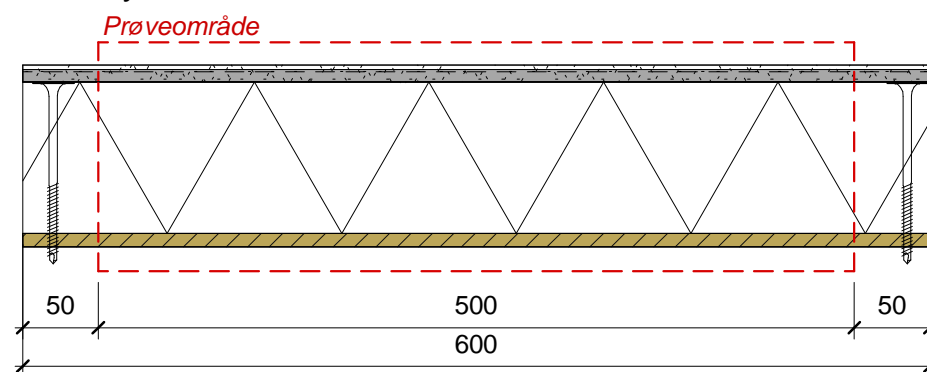
Prøveemner med samling

Skærmtegl



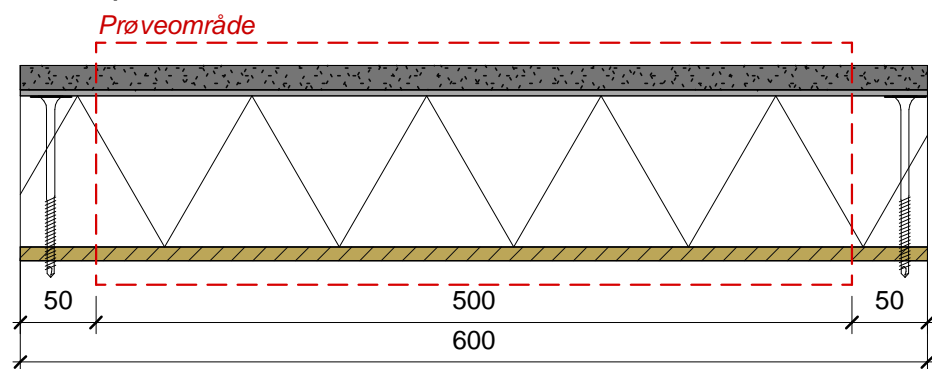
- 20 mm Tegl skaller fuget m. KC 35/65/650 mørtel
- 4 mm Universal klæb
- 100 mm EPS isolering
- 9 mm Spånplade

Pudssystem



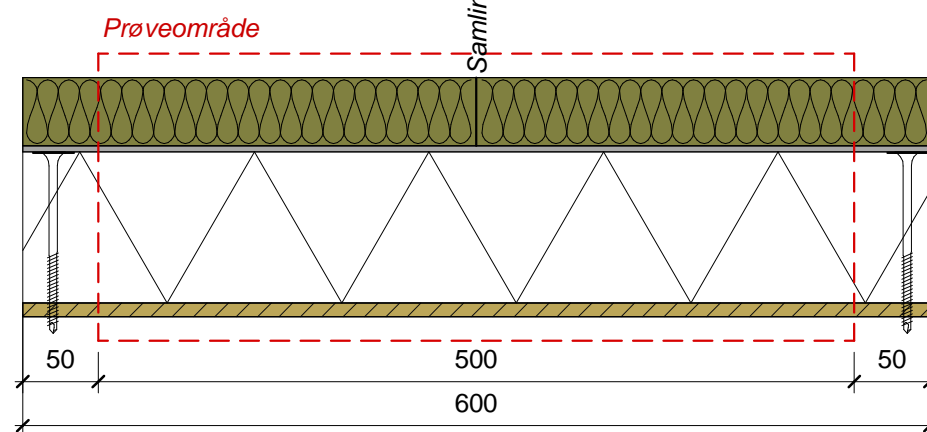
- 12 mm Pudssystemt med grundpuds, armeringsvæv goslutbelægning
- 100 mm EPS isolering
- 9 mm Spånplade

Betonpuds



- 16 mm Beton puds, C 100/400 mørtel
- 4 mm Universal klæb
- 100 mm EPS isolering
- 9 mm Spånplade

Stenuld



- 45 mm Stenuld 30 kg/m²
- 4 mm Universal klæb
- 100 mm EPS isolering
- 9 mm Spånplade



Note:

Alle synlige EPS sider afdækkes under prøvning med fx stenuld. Plus underside af klink
Prøveemner monteres vandret på "4 Huls" ramme

Bygherre: InnoBYG

Sag: Brandtekniske eksperimenter

Emne: Prøveemner med klæb

Int.: MJO | Kontr.: BVJ | Dato: 01/16/13

Sags nr.: FUN0001

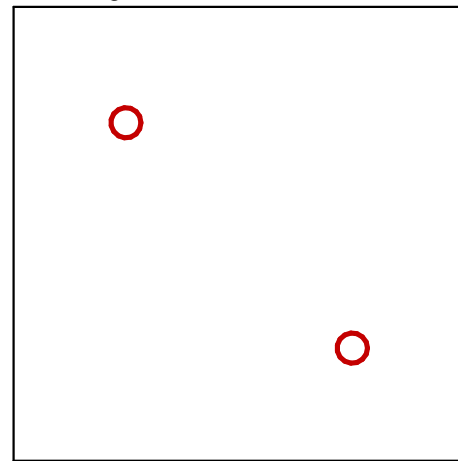
Tegn. nr.:

A1.1

Rev. dato:

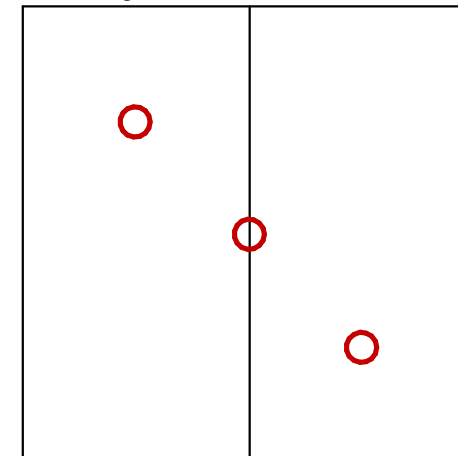
Mål: 1 : 5

Placering af thermoelementer



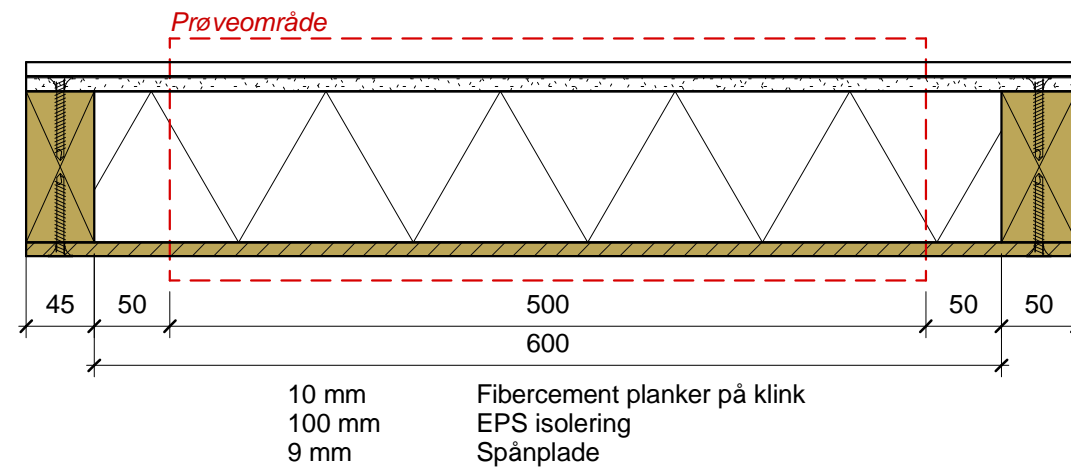
Prøvemner uden samling

Placering af thermoelementer

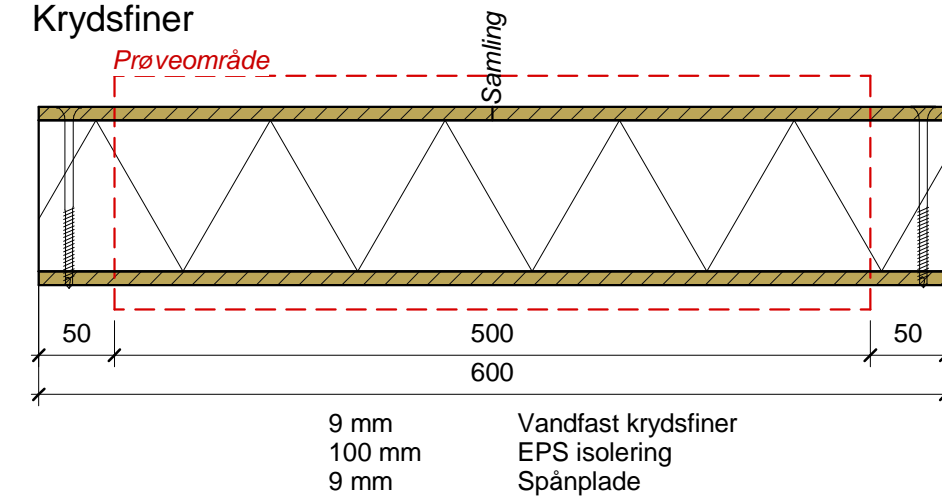


Prøvemner med samling

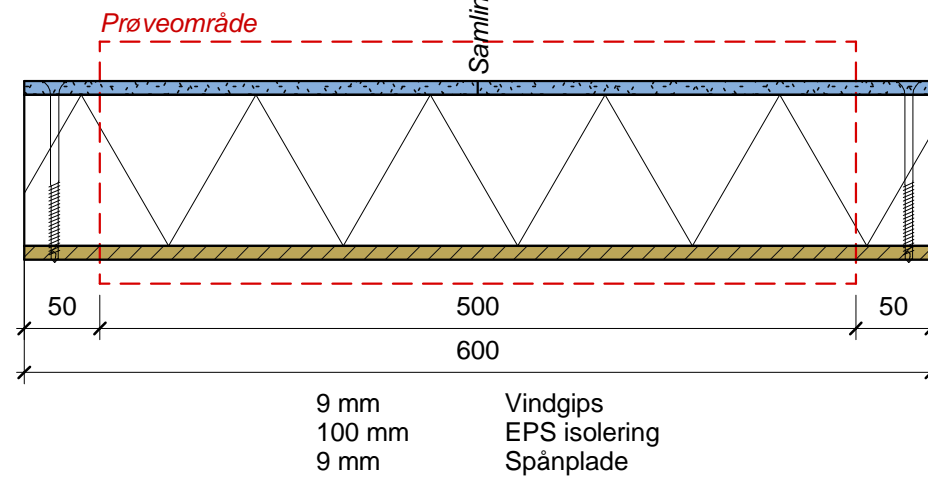
Fibercement planker på klink



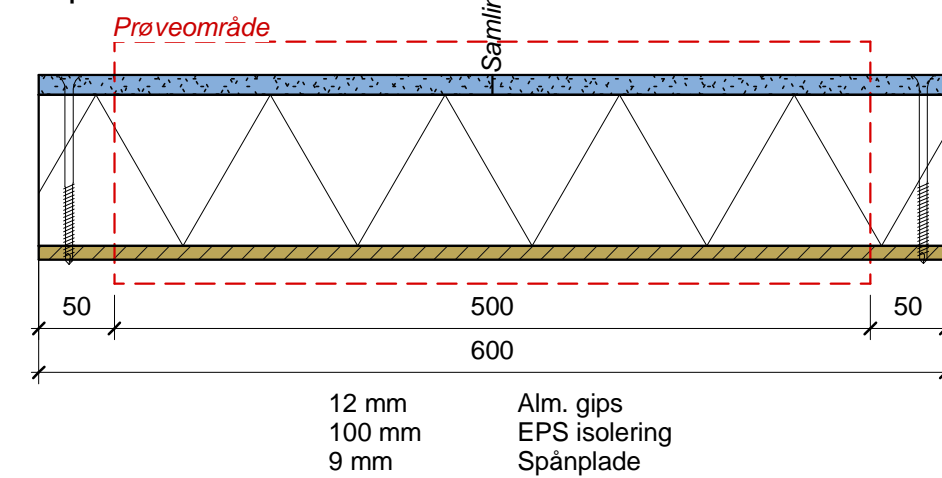
Krydsfiner



Vindgips



Gips



Note:

Alle synlige EPS sider afdækkes under prøvning med fx stenuld. Plus underside af klink
Prøvemner monteres vandret på "4 Huls" ramme

Bygherre: InnoBYG

Sag: Brandtekniske eksperimenter

Emne: Prøvemner, tørre

Int.: MJO | Kontr.: BVJ | Dato: 12/06/13

Sags nr.: FUN0001

Tegn. nr.:

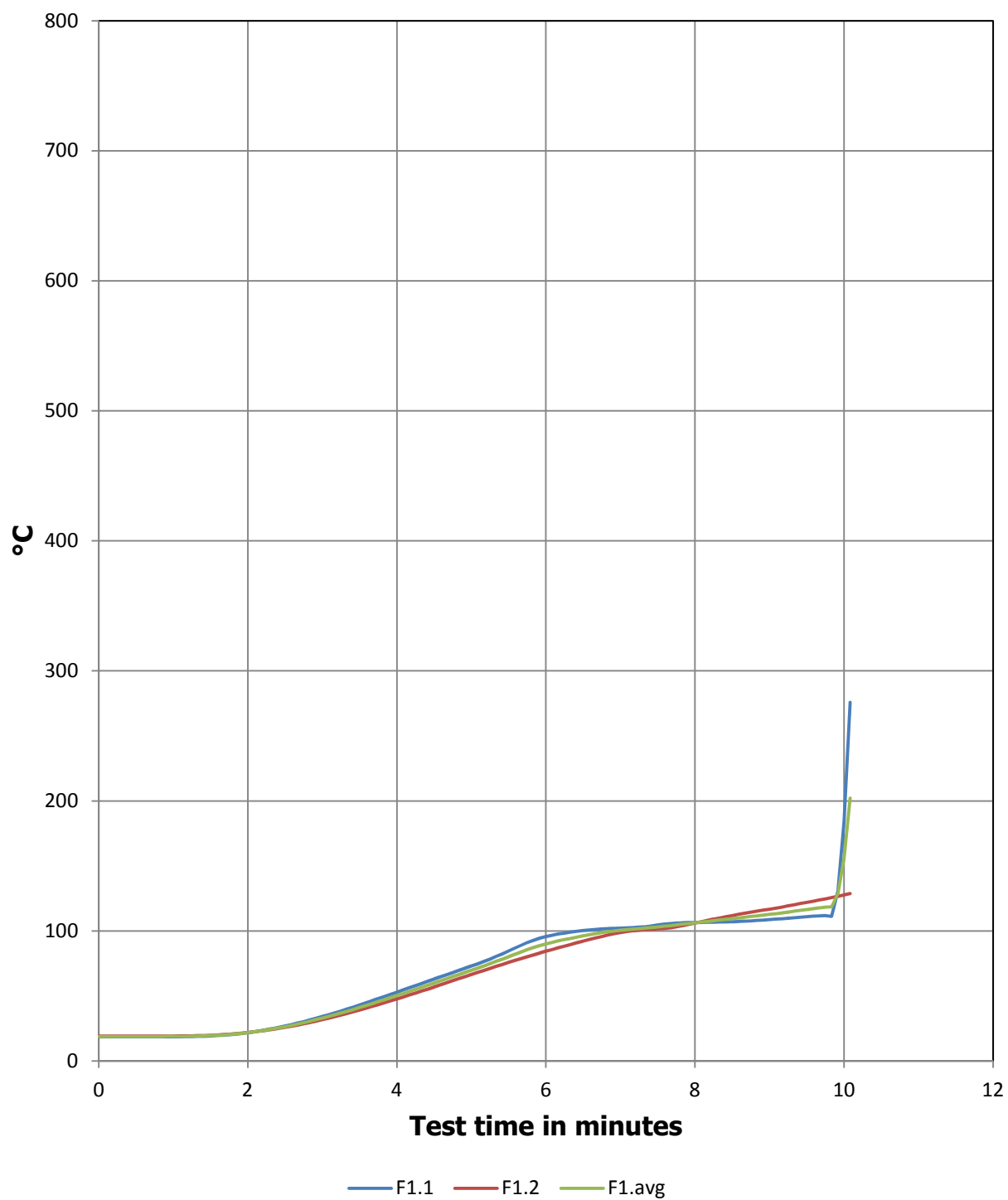
A1.2

Rev. dato:

Mål: 1 : 5



Temperature in area 1

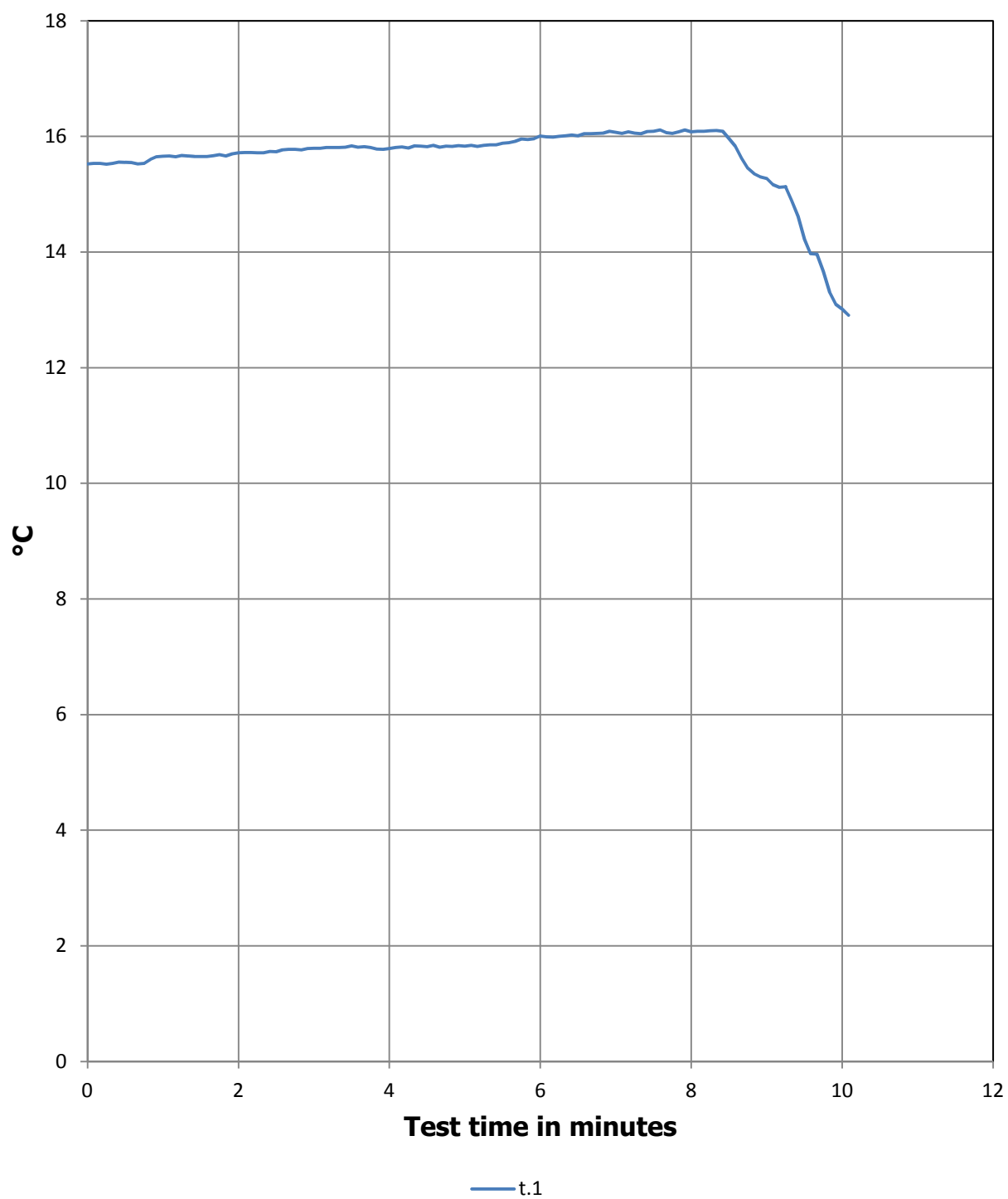




Temperature in area 1

Min. / °C	F1.1	F1.2	F1.Avg
0.0	18.5	19.2	18.8
0.5	18.5	19.2	18.8
1.0	18.6	19.2	18.9
1.5	19.3	19.8	19.5
2.0	21.8	21.8	21.8
2.5	26.8	25.8	26.3
3.0	34.2	31.7	32.9
3.5	43.0	39.2	41.1
4.0	52.9	47.7	50.3
4.5	63.0	57.0	60.0
5.0	73.0	66.5	69.8
5.5	84.6	75.8	80.2
6.0	95.7	84.3	90.0
6.5	100.3	92.2	96.2
7.0	102.1	98.8	100.5
7.5	104.6	101.5	103.0
8.0	106.5	106.0	106.3
8.5	107.1	111.8	109.5
9.0	108.7	116.7	112.7
9.5	111.0	122.0	116.5
10.0	183.9	127.7	155.8

Ambient temperature (test 1)

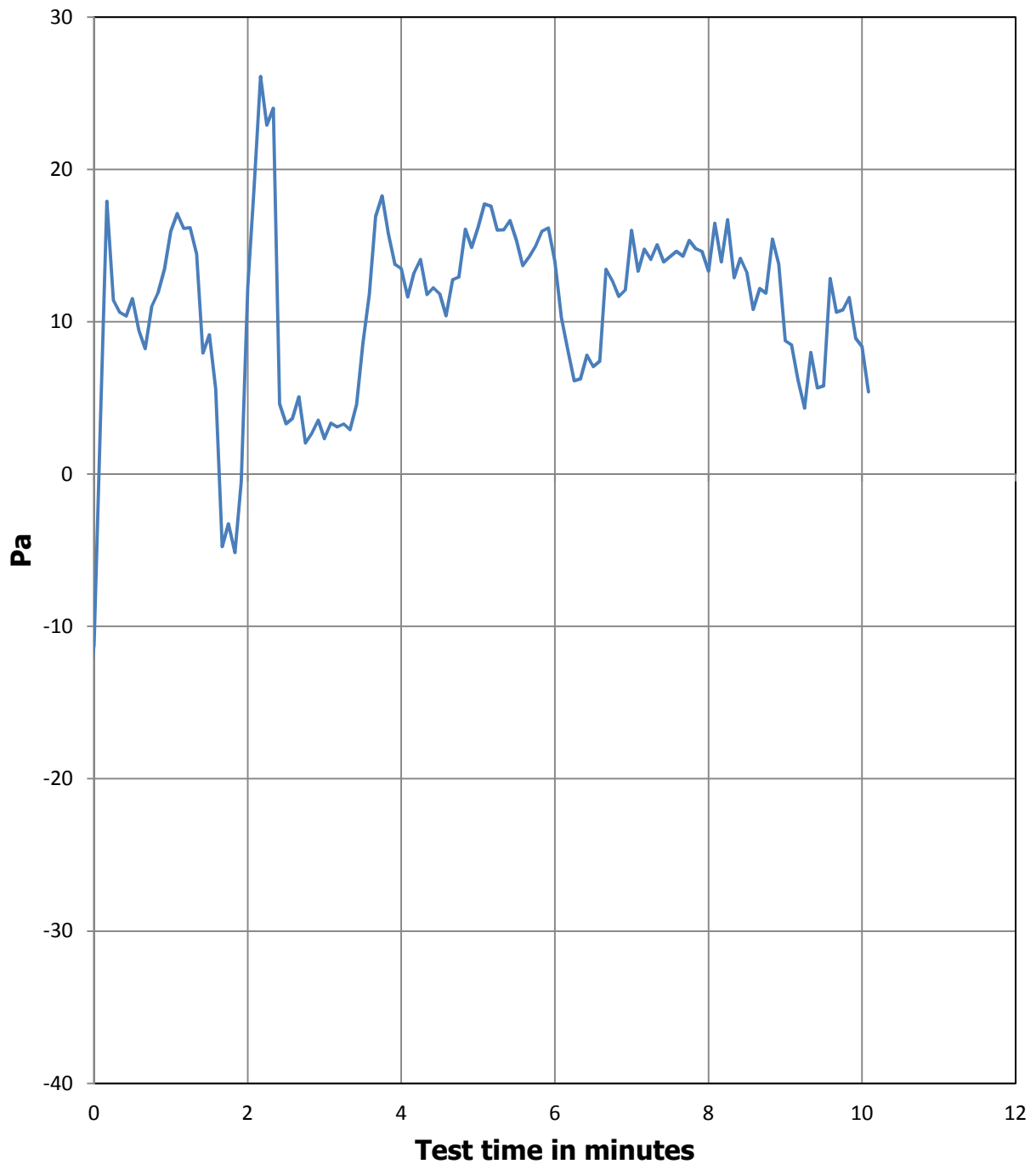




Ambient temperature (test 1)

Min. / °C	t.1
0.0	15.5
0.5	15.6
1.0	15.7
1.5	15.7
2.0	15.7
2.5	15.7
3.0	15.8
3.5	15.8
4.0	15.8
4.5	15.8
5.0	15.8
5.5	15.9
6.0	16.0
6.5	16.0
7.0	16.1
7.5	16.1
8.0	16.1
8.5	16.0
9.0	15.3
9.5	14.2
10.0	13.0

Furnace pressure (test 1)



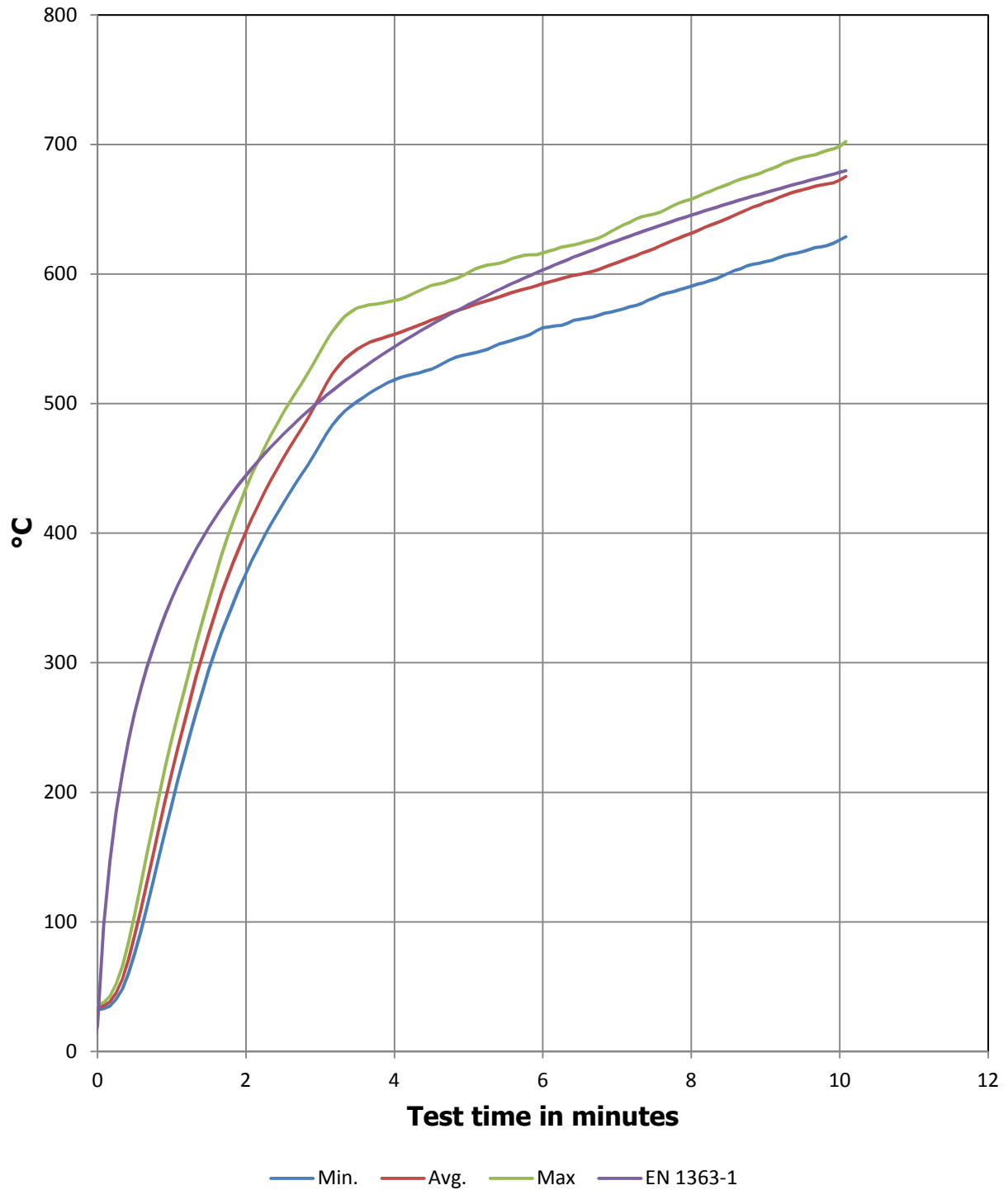
— p.1



Furnace pressure (test 1)

Min. / Pa	p.1
0.0	-11.2
0.5	11.5
1.0	15.9
1.5	9.1
2.0	12.3
2.5	3.3
3.0	2.3
3.5	8.5
4.0	13.5
4.5	11.8
5.0	16.2
5.5	15.3
6.0	14.0
6.5	7.1
7.0	16.0
7.5	14.3
8.0	13.3
8.5	13.2
9.0	8.8
9.5	5.8
10.0	8.4

Furnace temperature (test 2)

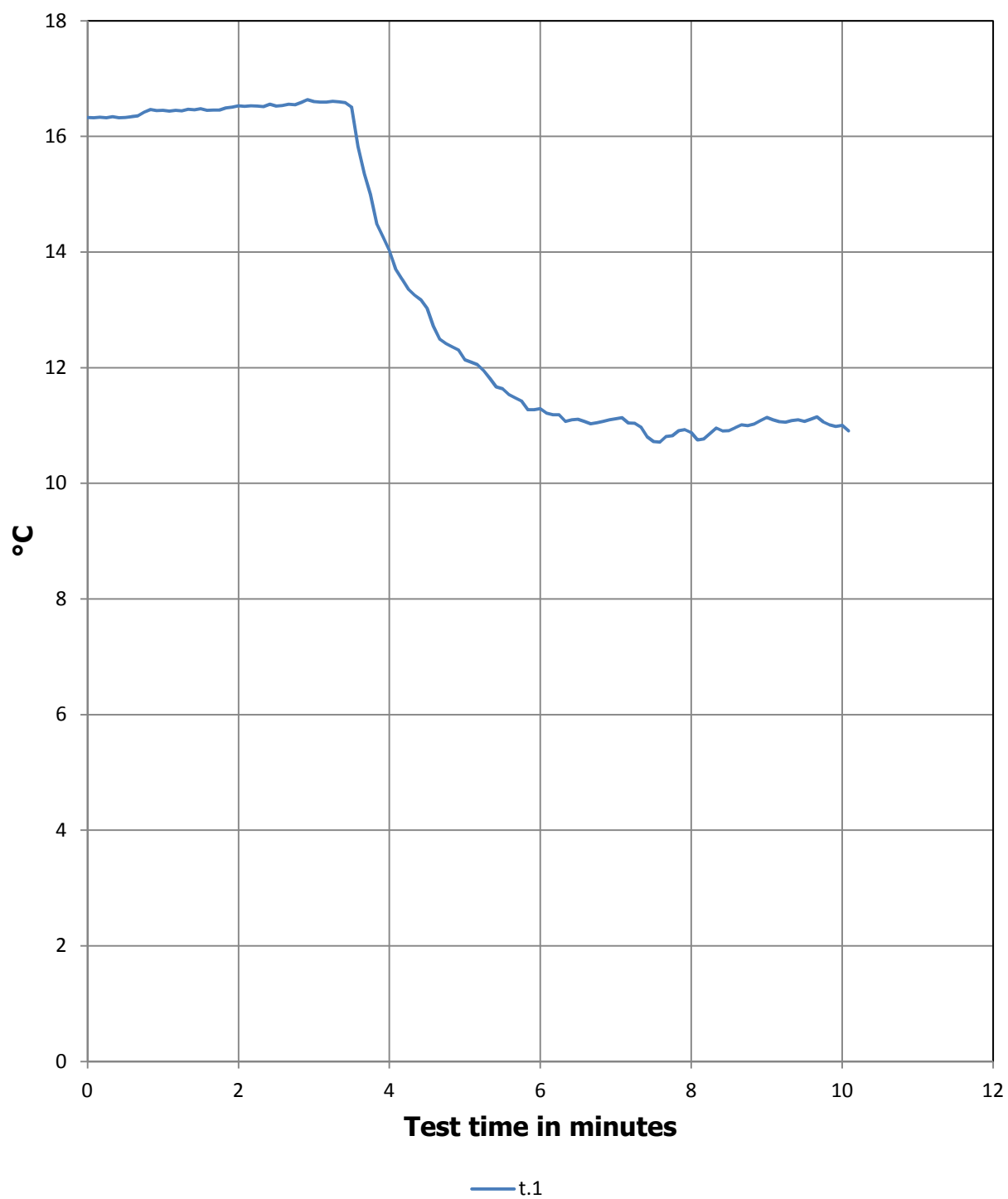




Furnace temperature (test 2)

Time Minutes	Measured			Norm EN 1363-1	Area under curve		Dev. [%]	Limit [%]
	Minimum	Average	Maximum		Measured	EN 1363-1		
0.0	32.1	33.9	35.6	20.0	0	0	#DIV/0!	
0.5	75.2	89.0	105.3	261.1	26	85	-70.0	
1.0	190.4	215.0	241.1	349.2	102	240	-57.7	
1.5	294.6	322.4	349.2	404.3	237	429	-44.8	
2.0	368.8	401.1	434.9	444.5	419	642	-34.7	
2.5	422.7	457.6	492.7	476.2	634	872	-27.3	
3.0	468.6	506.3	540.3	502.3	875	1117	-21.7	
3.5	501.6	542.1	573.9	524.5	1139	1374	-17.1	
4.0	518.4	553.6	579.6	543.9	1413	1641	-13.9	
4.5	526.6	564.4	591.1	561.0	1692	1917	-11.7	
5.0	538.2	574.7	601.1	576.4	1977	2202	-10.2	
5.5	547.3	584.0	609.8	590.4	2267	2494	-9.1	15.0
6.0	558.5	592.5	616.2	603.1	2561	2792	-8.3	15.0
6.5	565.1	599.8	623.7	614.9	2859	3096	-7.7	15.0
7.0	571.8	608.8	635.3	625.8	3161	3407	-7.2	15.0
7.5	581.6	619.6	646.4	635.9	3468	3722	-6.8	15.0
8.0	590.5	631.3	657.8	645.5	3781	4042	-6.5	15.0
8.5	600.7	643.2	669.4	654.4	4100	4367	-6.1	15.0
9.0	609.5	655.2	679.4	662.8	4425	4697	-5.8	15.0
9.5	617.3	665.1	690.2	670.8	4755	5030	-5.5	15.0
10.0	626.2	672.4	698.5	678.4	5089	5368	-5.2	15.0

Ambient temperature (test 2)

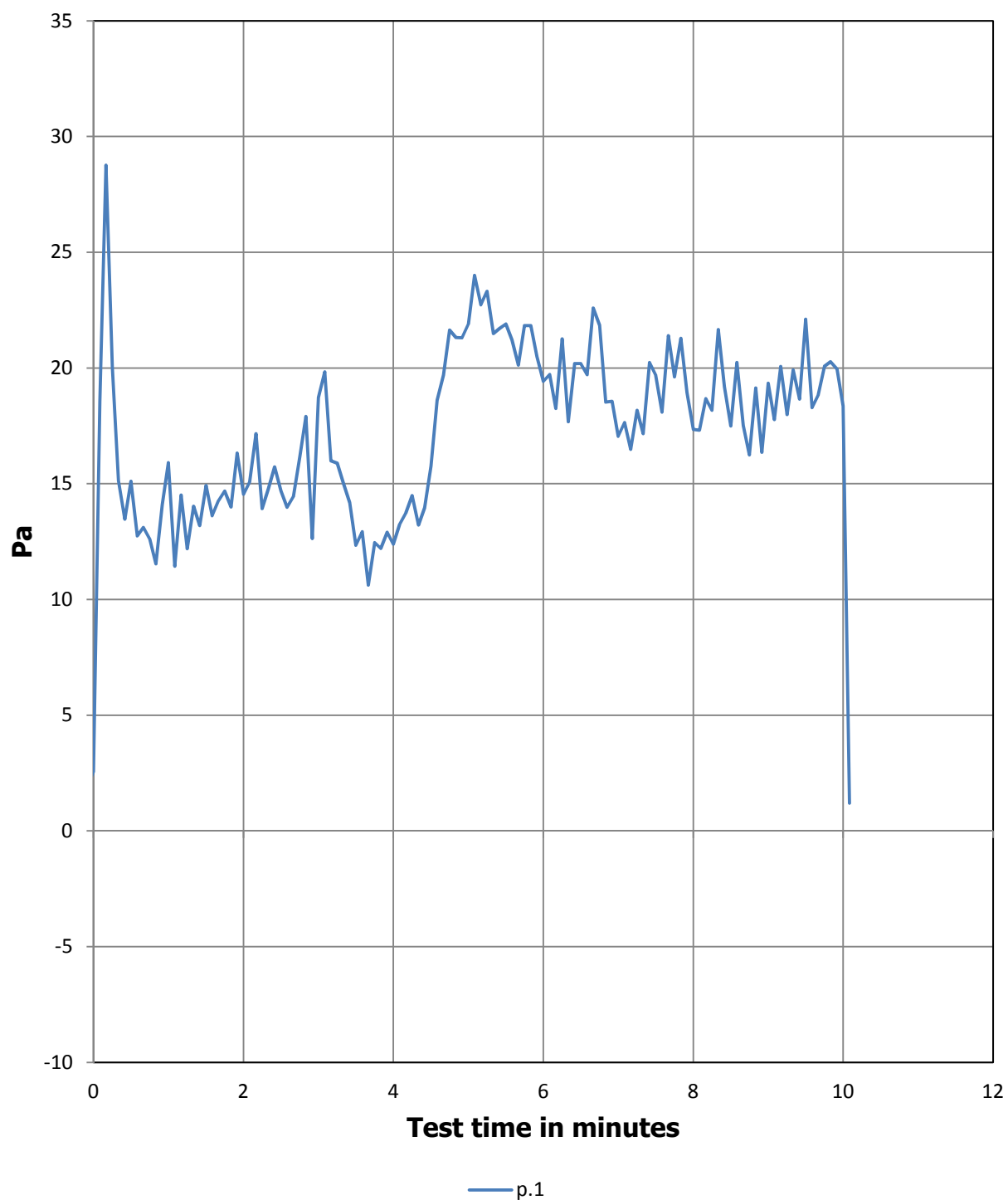




Ambient temperature (test 2)

Min. / °C	t.1
0.0	16.3
0.5	16.3
1.0	16.5
1.5	16.5
2.0	16.5
2.5	16.5
3.0	16.6
3.5	16.5
4.0	14.0
4.5	13.0
5.0	12.1
5.5	11.6
6.0	11.3
6.5	11.1
7.0	11.1
7.5	10.7
8.0	10.9
8.5	10.9
9.0	11.1
9.5	11.1
10.0	11.0

Furnace pressure (test 2)

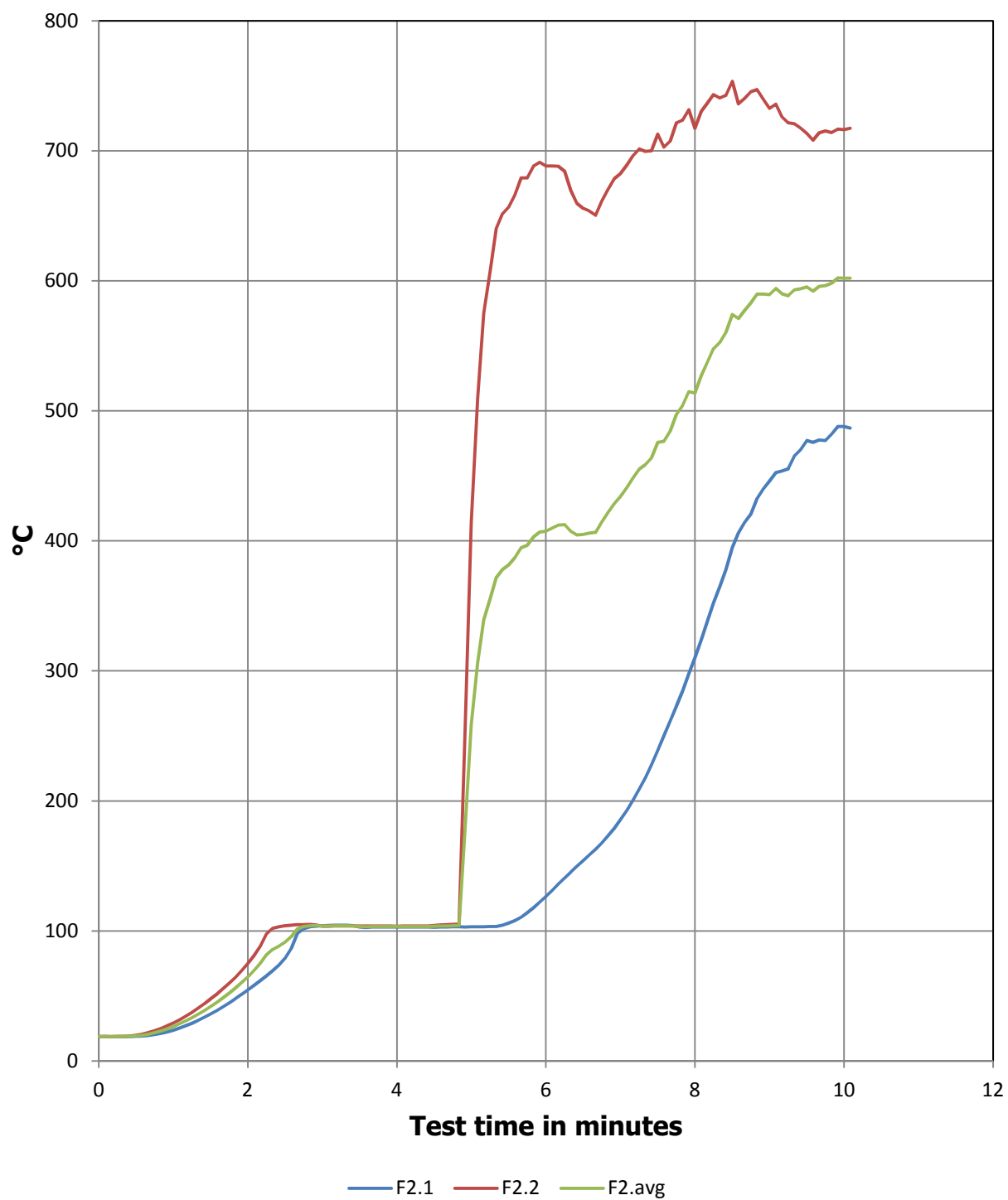




Furnace pressure (test 2)

Min. / Pa	p.1
0.0	2.6
0.5	15.1
1.0	15.9
1.5	14.9
2.0	14.5
2.5	14.7
3.0	18.7
3.5	12.3
4.0	12.4
4.5	15.8
5.0	21.9
5.5	21.9
6.0	19.4
6.5	20.2
7.0	17.0
7.5	19.7
8.0	17.3
8.5	17.5
9.0	19.3
9.5	22.1
10.0	18.4

Temperature in area 2

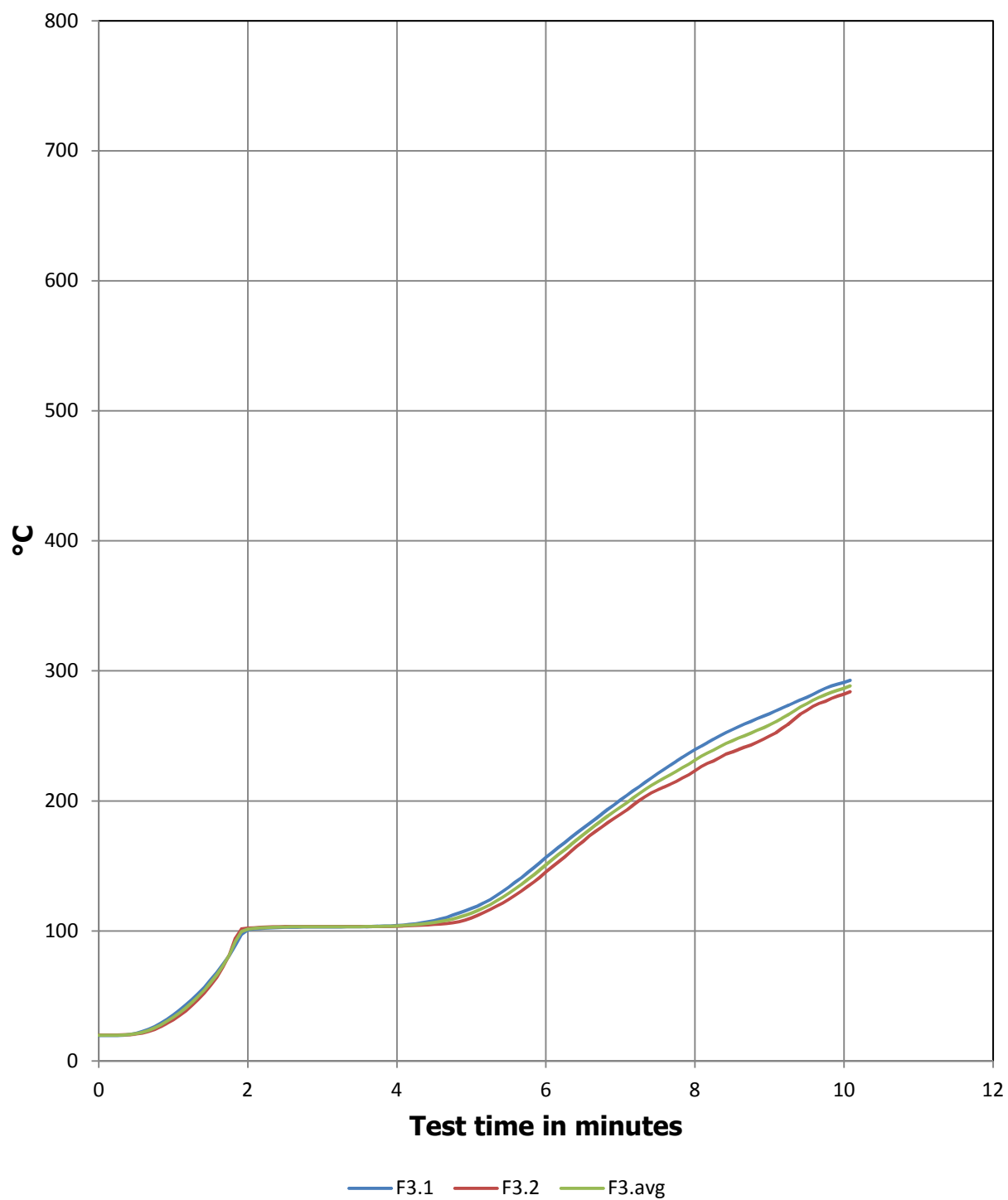




Temperature in area 2

Min. / °C	F2.1	F2.2	F2.Avg
0.0	18.7	18.8	18.8
0.5	18.9	19.7	19.3
1.0	23.7	29.2	26.4
1.5	36.1	47.6	41.9
2.0	54.7	74.8	64.7
2.5	78.9	104.0	91.5
3.0	103.9	103.6	103.8
3.5	103.1	103.7	103.4
4.0	103.0	103.7	103.3
4.5	102.9	104.2	103.6
5.0	103.1	414.4	258.8
5.5	106.1	656.7	381.4
6.0	126.6	688.4	407.5
6.5	154.0	655.8	404.9
7.0	185.4	682.5	434.0
7.5	238.6	712.8	475.7
8.0	310.0	717.3	513.6
8.5	394.9	753.4	574.1
9.0	446.0	732.6	589.3
9.5	477.1	713.3	595.2
10.0	488.0	716.2	602.1

Temperature in area 3

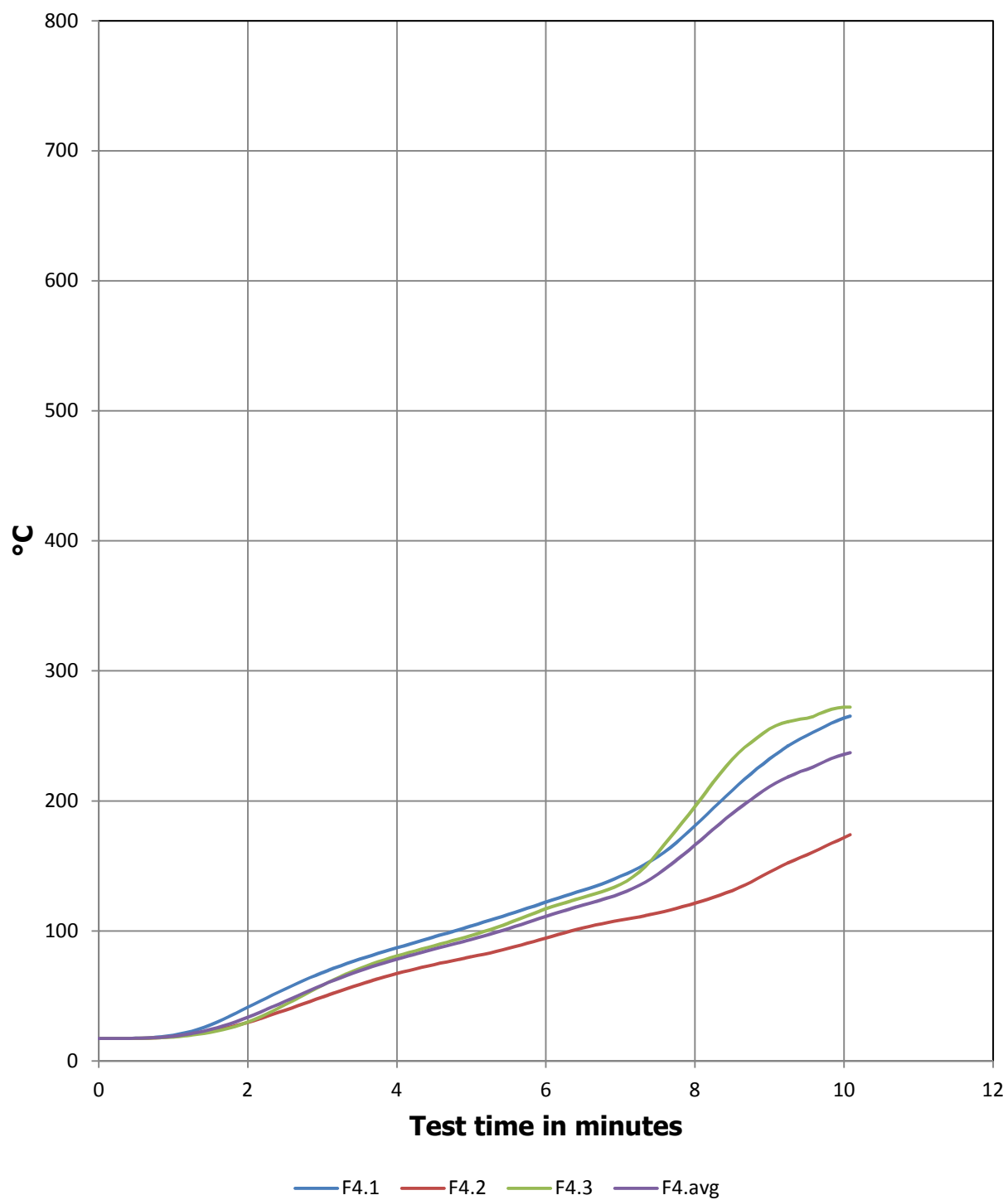




Temperature in area 3

Min. / °C	F3.1	F3.2	F3.Avg
0.0	19.5	20.0	19.8
0.5	21.2	20.7	21.0
1.0	35.4	31.7	33.6
1.5	62.1	58.0	60.1
2.0	100.8	102.1	101.4
2.5	102.8	103.4	103.1
3.0	102.9	103.4	103.2
3.5	103.2	103.4	103.3
4.0	104.2	103.5	103.9
4.5	107.9	105.0	106.5
5.0	117.3	109.9	113.6
5.5	133.6	124.2	128.9
6.0	156.4	145.2	150.8
6.5	179.0	169.0	174.0
7.0	200.6	189.8	195.2
7.5	221.0	208.5	214.8
8.0	239.4	223.1	231.3
8.5	254.7	237.7	246.2
9.0	267.1	249.9	258.5
9.5	279.8	269.7	274.7
10.0	291.2	282.1	286.6

Temperature in area 4

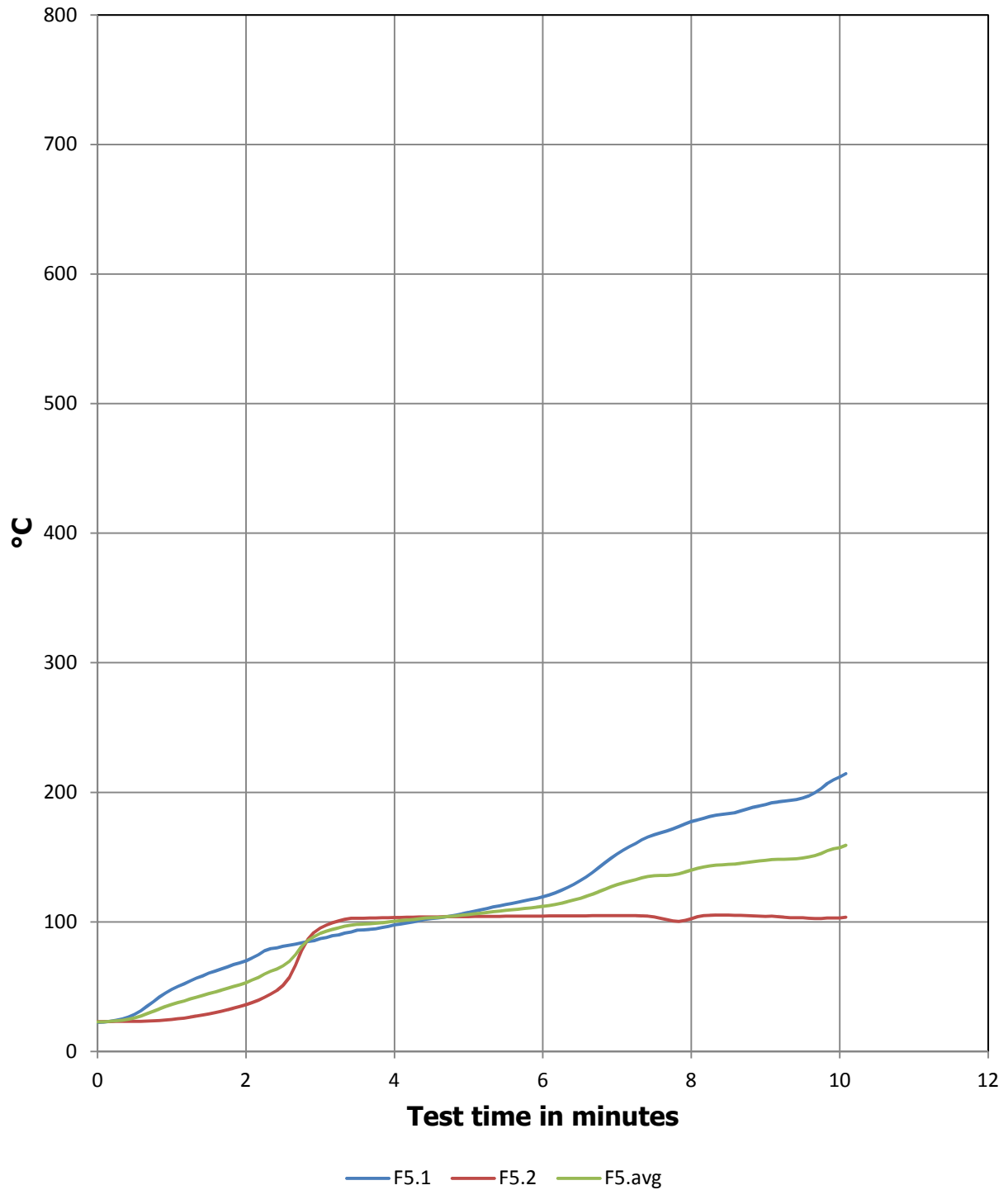




Temperature in area 4

Min. / °C	F4.1	F4.2	F4.3	F4.Avg
0.0	17.3	17.3	17.3	17.3
0.5	17.5	17.4	17.4	17.4
1.0	19.9	18.8	18.4	19.0
1.5	27.8	22.8	22.1	24.2
2.0	41.3	29.6	29.9	33.6
2.5	55.2	39.0	43.2	45.8
3.0	67.9	49.1	58.1	58.4
3.5	78.2	58.8	71.0	69.4
4.0	87.0	67.2	80.7	78.3
4.5	95.4	74.1	88.6	86.0
5.0	103.9	80.1	96.5	93.5
5.5	112.8	86.6	106.0	101.8
6.0	122.1	94.5	117.0	111.2
6.5	131.4	102.4	125.8	119.9
7.0	141.9	108.3	135.6	128.6
7.5	157.1	113.8	160.1	143.7
8.0	180.9	121.4	195.7	166.0
8.5	208.1	131.0	232.0	190.4
9.0	232.3	145.3	255.4	211.0
9.5	250.3	158.6	263.7	224.2
10.0	263.7	171.8	272.1	235.9

Temperature in area 5

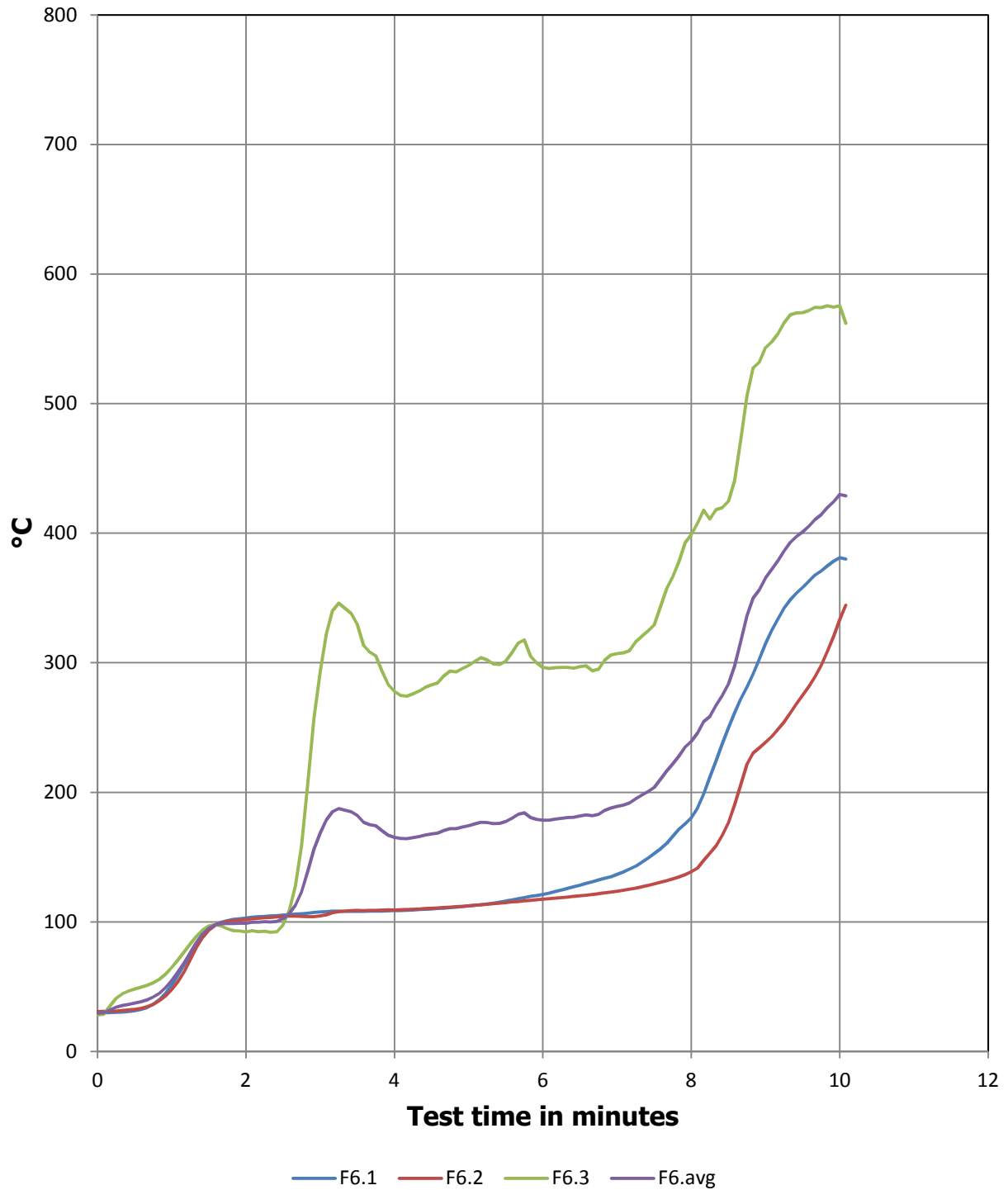




Temperature in area 5

Min. / °C	F5.1	F5.2	F5.Avg
0.0	22.4	23.0	22.7
0.5	28.5	23.2	25.9
1.0	48.0	24.7	36.3
1.5	60.3	29.0	44.7
2.0	69.9	36.2	53.0
2.5	81.2	51.0	66.1
3.0	87.1	95.3	91.2
3.5	93.5	102.8	98.2
4.0	97.6	103.4	100.5
4.5	102.5	103.9	103.2
5.0	107.3	104.1	105.7
5.5	113.4	104.4	108.9
6.0	119.4	104.5	111.9
6.5	131.7	104.6	118.2
7.0	152.4	104.9	128.6
7.5	167.4	103.8	135.6
8.0	177.5	102.3	139.9
8.5	183.5	105.2	144.3
9.0	190.6	104.3	147.5
9.5	195.5	103.1	149.3
10.0	211.8	103.0	157.4

Temperature in area 6

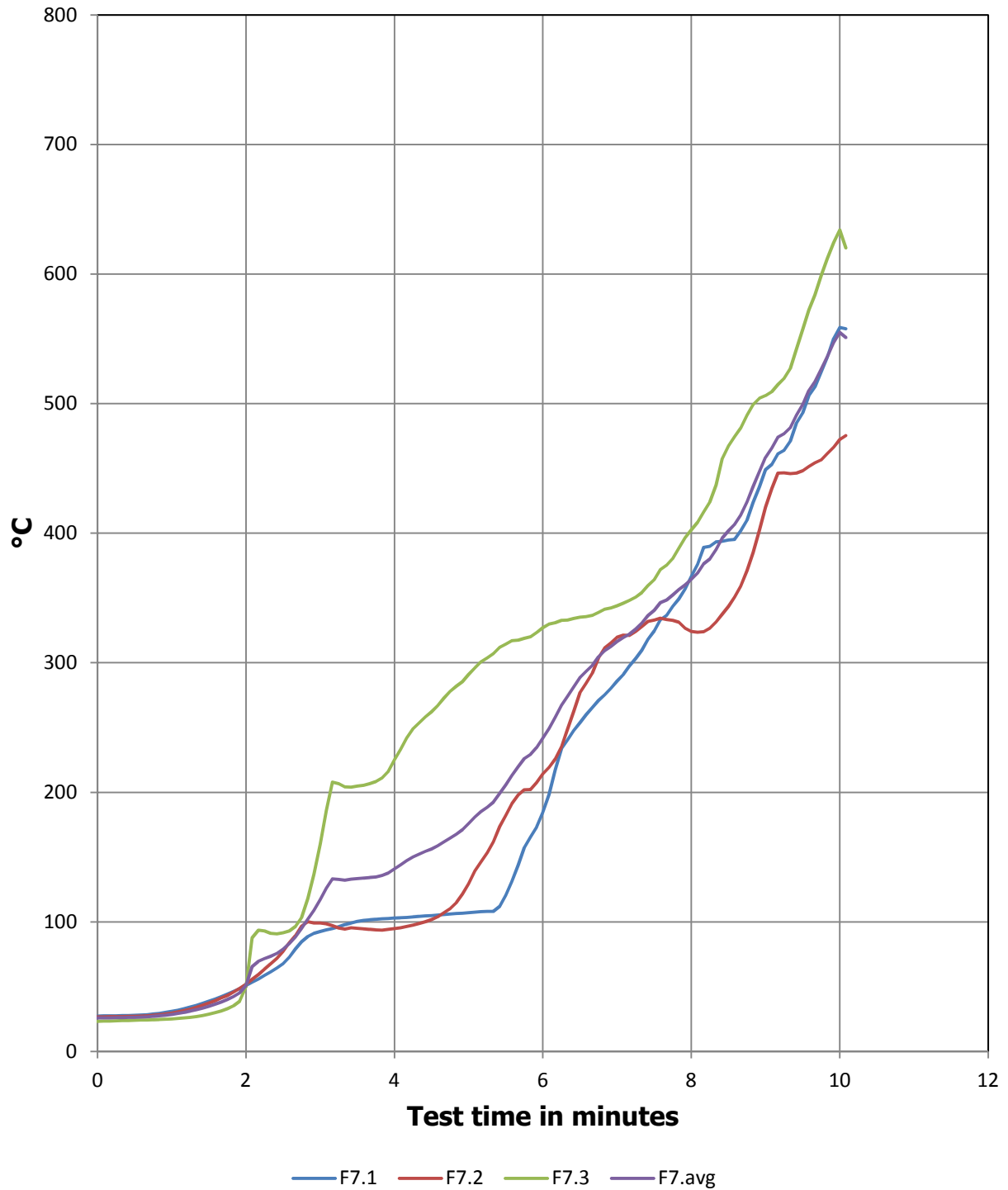




Temperature in area 6

Min. / °C	F6.1	F6.2	F6.3	F6.Avg
0.0	29.8	30.8	28.1	29.5
0.5	31.4	32.5	48.1	37.3
1.0	51.3	47.7	64.8	54.6
1.5	94.7	93.6	96.8	95.1
2.0	103.0	101.7	92.1	98.9
2.5	105.3	104.2	97.5	102.3
3.0	107.8	104.6	293.4	168.6
3.5	108.1	108.9	329.7	182.2
4.0	108.6	109.2	277.8	165.2
4.5	110.0	110.5	282.9	167.8
5.0	112.3	112.4	297.9	174.2
5.5	116.0	114.9	301.2	177.4
6.0	121.2	117.5	296.4	178.4
6.5	128.4	120.1	297.0	181.8
7.0	136.7	123.6	307.0	189.1
7.5	152.8	129.3	329.3	203.8
8.0	180.3	138.7	398.9	239.3
8.5	249.8	176.6	424.7	283.7
9.0	314.8	238.4	543.1	365.4
9.5	358.3	274.9	570.2	401.2
10.0	381.0	333.3	575.4	429.9

Temperature in area 7

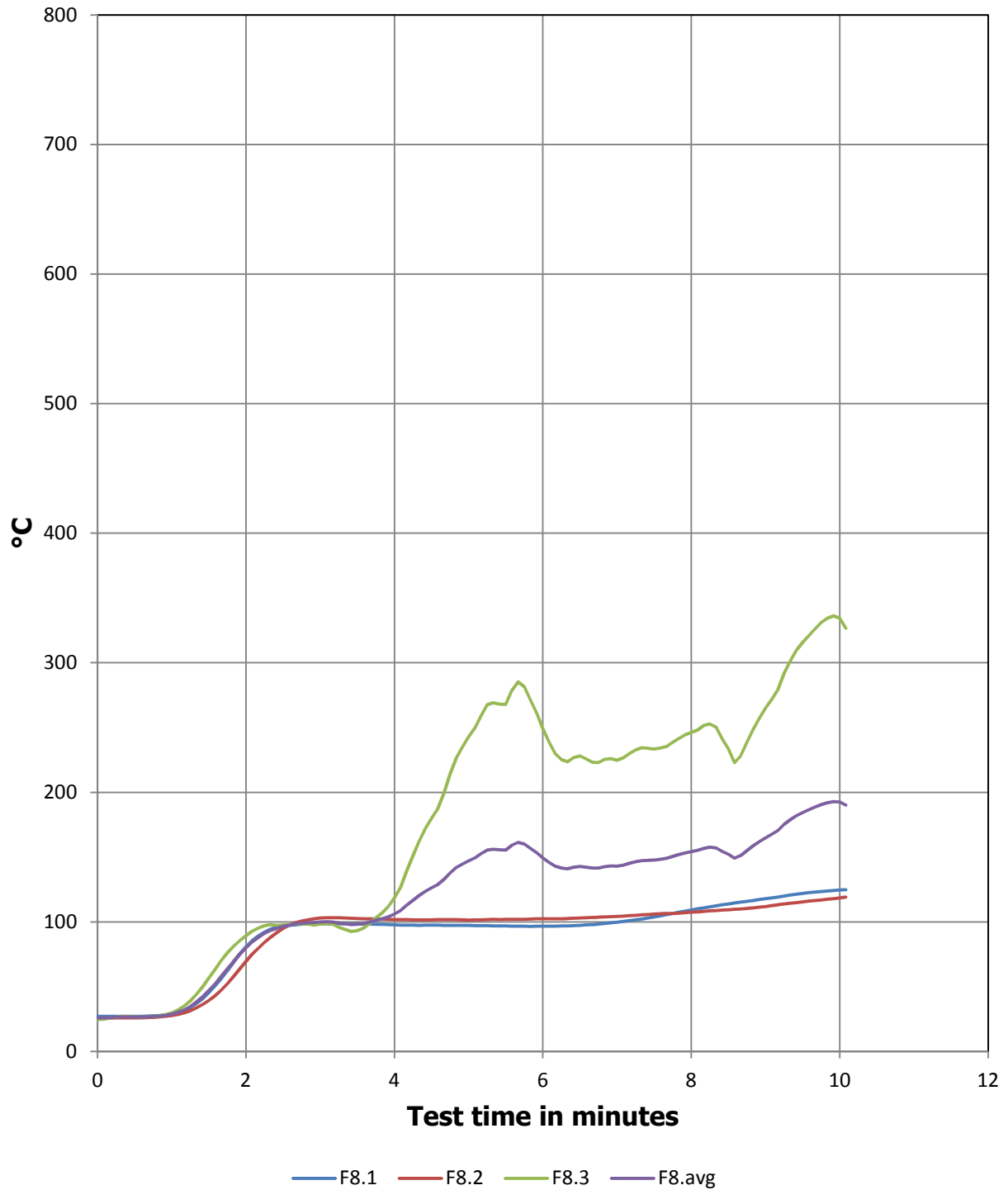




Temperature in area 7

Min. / °C	F7.1	F7.2	F7.3	F7.Avg
0.0	27.4	26.7	23.3	25.8
0.5	27.9	27.1	24.1	26.3
1.0	30.9	29.6	25.1	28.6
1.5	38.7	37.3	28.7	34.9
2.0	50.9	52.0	49.8	50.9
2.5	67.8	77.2	91.6	78.8
3.0	92.6	99.0	160.2	117.3
3.5	100.3	95.1	204.8	133.4
4.0	102.9	94.8	225.3	141.0
4.5	104.9	101.8	262.1	156.3
5.0	107.0	129.3	290.9	175.7
5.5	120.6	182.2	314.4	205.7
6.0	184.2	214.1	327.1	241.8
6.5	253.9	277.0	335.1	288.7
7.0	285.9	319.7	343.9	316.5
7.5	324.6	332.9	364.1	340.5
8.0	366.7	324.1	402.5	364.4
8.5	394.7	343.4	467.3	401.8
9.0	449.0	420.0	506.0	458.3
9.5	492.8	448.2	557.4	499.5
10.0	558.7	472.2	634.0	555.0

Temperature in area 8

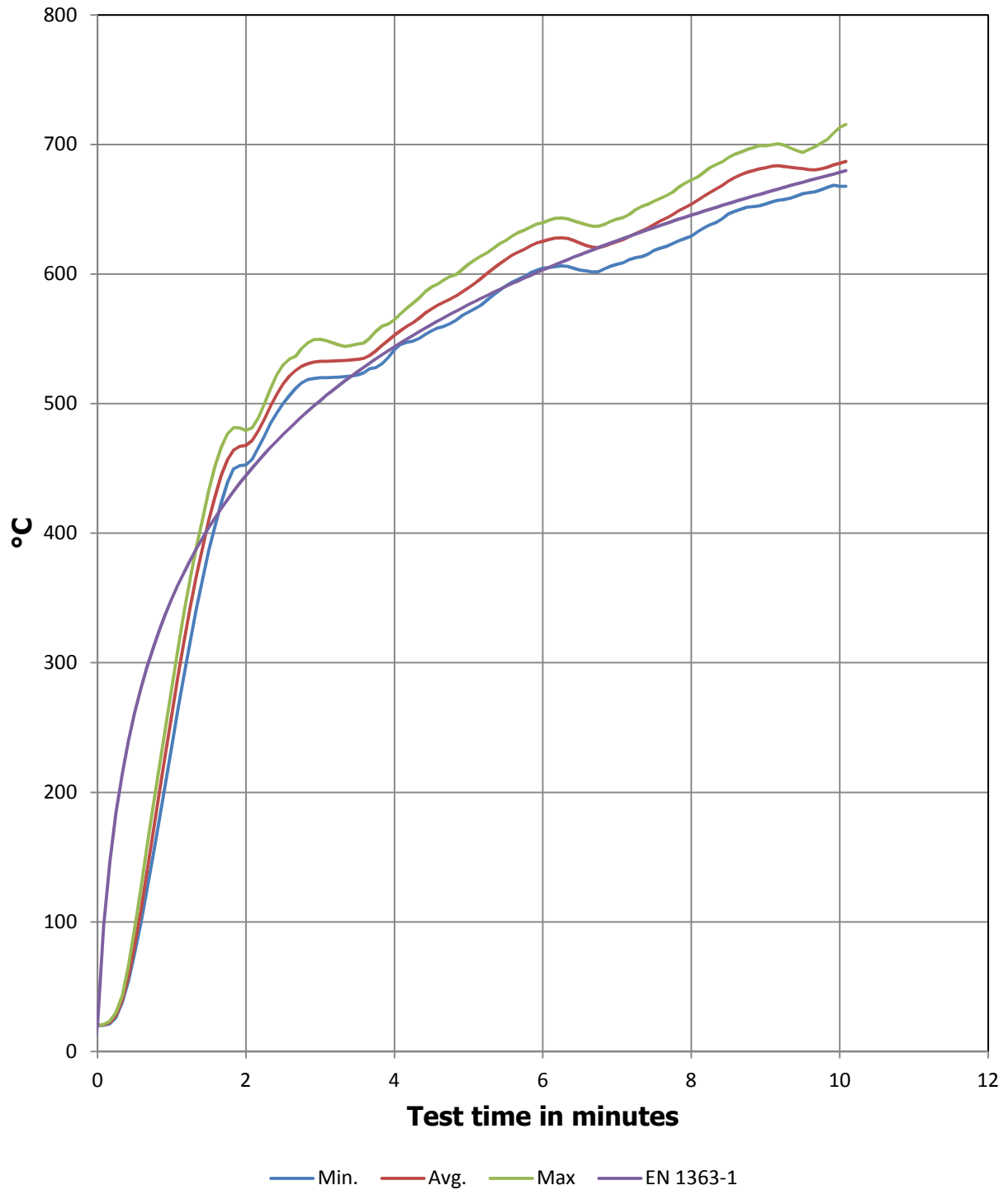




Temperature in area 8

Min. / °C	F8.1	F8.2	F8.3	F8.Avg
0.0	27.0	25.7	24.7	25.8
0.5	27.2	25.9	26.7	26.6
1.0	28.8	27.7	29.8	28.8
1.5	45.3	39.3	56.4	47.0
2.0	80.9	69.6	89.3	79.9
2.5	96.8	94.9	97.6	96.4
3.0	98.4	103.1	98.3	99.9
3.5	98.3	102.6	93.2	98.1
4.0	97.7	101.9	118.6	106.1
4.5	97.5	101.5	179.9	126.3
5.0	97.3	101.4	242.7	147.1
5.5	96.8	101.9	267.8	155.5
6.0	96.6	102.3	249.3	149.4
6.5	97.3	103.0	228.1	142.8
7.0	99.7	104.3	224.8	142.9
7.5	103.8	106.0	233.3	147.7
8.0	109.2	107.5	246.2	154.3
8.5	113.9	109.4	233.4	152.2
9.0	117.9	111.8	265.0	164.9
9.5	122.0	115.4	315.9	184.4
10.0	124.6	118.6	334.3	192.5

Furnace temperature (test 1)





Furnace temperature (test 1)

Time Minutes	Measured			Norm EN 1363-1	Area under curve		Dev. [%]	Limit [%]
	Minimum	Average	Maximum		Measured	EN 1363-1		
0.0	20.0	20.2	20.4	20.0	0	0	#DIV/0!	
0.5	75.5	81.1	94.3	261.1	18	85	-78.5	
1.0	235.4	259.7	280.4	349.2	103	240	-57.1	
1.5	386.8	410.1	433.0	404.3	273	429	-36.4	
2.0	452.6	467.8	479.2	444.5	498	642	-22.4	
2.5	499.9	515.1	529.9	476.2	743	872	-14.9	
3.0	520.0	532.6	549.7	502.3	1006	1117	-9.9	
3.5	522.1	534.0	545.9	524.5	1273	1374	-7.4	
4.0	541.5	552.7	564.6	543.9	1544	1641	-5.9	
4.5	556.0	573.1	589.9	561.0	1825	1917	-4.8	
5.0	570.6	589.4	607.5	576.4	2115	2202	-3.9	
5.5	590.8	611.2	626.0	590.4	2416	2494	-3.1	15.0
6.0	604.5	625.3	639.6	603.1	2725	2792	-2.4	15.0
6.5	603.0	623.8	639.5	614.9	3039	3096	-1.9	15.0
7.0	607.5	625.1	642.3	625.8	3350	3407	-1.7	15.0
7.5	618.4	638.4	656.2	635.9	3665	3722	-1.5	15.0
8.0	629.1	653.8	672.5	645.5	3988	4042	-1.3	15.0
8.5	646.6	671.8	689.8	654.4	4320	4367	-1.1	15.0
9.0	654.1	682.0	699.0	662.8	4659	4697	-0.8	15.0
9.5	662.0	681.3	693.8	670.8	5000	5030	-0.6	15.0
10.0	667.8	685.5	713.2	678.4	5341	5368	-0.5	15.0