

Pittsburgh Corning Europe SA  
Albertkade 1  
BE-3980 TESSENDERLO  
Belgien

## Fire resistance test of load-bearing floor

(4 appendices)

### Test:

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 the accredited test methods:

- EN 1365-2:2014
- EN 1363-1:2012

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 relevant test method is not covered by this report.

### Product:

Fire resisting load-bearing floor of steel profiles and FOAMGLAS<sup>®</sup> insulation covered with gypsum boards

### Product designation:

KOLJERN<sup>®</sup> roof terrace system made with FOAMGLAS<sup>®</sup>

### Sponsor / owner of the report:

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Albertkade 1  
BE-3980 TESSENDERLO  
BELGIUM

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### Reference number:

7P07277-1

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## **1 Purpose of the test**

The purpose of the test was to determine the fire resistance of the test specimen described in chapter 2.

## **2 Test specimen and test setup**

### **2.1 General information**

The test specimen consisted of one fire resisting load-bearing floor of steel profiles and FOAMGLAS<sup>®</sup> insulation covered with gypsum boards.

Manufacturer was Pittsburgh Corning Europe.

The construction of the test specimen can be seen from the sponsor's drawings and specifications in Appendix 1 and the description in chapter 2.3 below.

### **2.2 Sampling and delivery of the test specimen**

Materials and components for assembling and mounting of the test specimen were selected and delivered to RISE by the sponsor of test.

The sponsor delivered more material and components than needed for the test specimen. RISE randomly sampled material and components for the test specimen from what have been delivered.

Four identical insulated steel frames enough for two identical test specimens were manufactured by the sponsor of the test and were delivered to RISE. Two frames were randomly chosen of RISE, mounted and tested. The other components were used for verification of the construction.

The rest of the material needed for a complete mounting of the test specimen was sent in by the sponsor.

The material and components for the test specimen arrived to RISE December 17, 2017.

### **2.3 Description of the construction**

The construction consisted of two KOLJERN<sup>®</sup> elements placed beside each other. The elements were covered with a cladding of gypsum boards on the underside and FOAMGLAS<sup>®</sup> and roof covering on the upper side. The outer dimension was (width x length x thickness) 3000 x 6000 x 336 mm.

#### *Framework - Element*

The framework of the elements consisted of steel profiles with different dimensions. The steel profiles were screwed together. The elements were screwed together at the top with tinplates and steel profiles at the edges. The joint was sealed with sealant.

#### *Insulation - Element*

The space within the framework was filled with FOAMGLAS<sup>®</sup> insulation.

### *Seals between element*

The joint between the two KOLJERN<sup>®</sup> elements was tightened with a sealant designated Veidec S-Bond.

### *Roof Covering*

The upper side of the elements were covered with one layer of 80 mm thick FOAMGLAS<sup>®</sup> Insulation glued to the elements. One layer of underfelt was glued on top of the of the insulation.

### *Cladding*

The underside of the elements were covered with two layers of gypsum boards on a framework of hat profiles.

### *Framework - Cladding*

The framework for the cladding was built up by hat profiles of steel mounted on the underside of the elements. The hat profiles were mounted with centre distance 400 mm and transverse to the length of the elements. The hat profiles were screwed in the frame of the element.

### *Boards - Cladding*

The gypsum boards were designated Gyproc GF. The boards were manufactured with a nominal width of 1200 mm, a thickness of 12,5 mm. The boards were constructed with recesses along the longitudinal edges.

### *Joints between board - Cladding*

There were two layers of boards mounted on the underside of the framework. The outer layer in the centre was a full width board. On each layer boards were cut to fit the length and width of the test specimen.

The boards were mounted with joints. The longitudinal joints were not supported in any of the layers. The longitudinal joints on each layer were staggered 600 mm between the two layers on the test specimen.

The boards were mounted with joints at the short side edges of the boards. The joints for the outer and inner layers were supported under the hat-profiles. The short side joints on each layer were staggered 400 mm between the two layers on the test specimen.

### *Details- Cladding*

The boards were attached to the framework with screws of steel. Screws were mounted on the maximum centre distance 300 mm on the inner layer 300 mm in the outer layer.

Information about the major components of the test specimens are described in the table in Appendix 1.

The information regarding the test specimen and its detailed components given in the sponsor's drawings and specifications, e.g. dimensions, quantities and physical properties, are nominal values provided by the sponsor. In case of the sponsor's drawings not corresponds with the construction of the test specimen RISE has crossed details or altered the drawings.

## **2.4 Number of test specimens and test direction**

The test specimen was an asymmetrical separating element according to the test method.

The test specimen was tested with fire exposure from below.

According to EN 13501-2, tests are only necessary in this direction. Fire from below is generally classified as being the most critical.

## **2.5 Test setup**

The test setup can be seen in Appendix 2.

## **2.6 Supporting construction**

The load bearing components of the test specimen were put on supports of steel pulleys with diameter 50 mm. On one side the steel pulleys were free with function as rolling supports and on the other side they were fixed and worked as hinged supports. The distance between the top of the steel pulleys was the same as the span.

A supporting construction was built on the sides of the test specimen. The supporting construction was custom made for the size and shape of the test specimen.

The supporting construction was consisting of aerated concrete blocks with a nominal density of 550 kg/m<sup>3</sup> and a nominal thickness of 150 mm.

To provide a Free edge, a seal without restricting freedom of movement, a 45 mm thick board of resilient non-combustible mineral fibre was mounted at both sides between the test specimen and the supporting construction. The seal was designed so that it was tight even when the specimen deformed.

The connections between the test specimen and the supports were sealed with mineral wool. The mineral wool was placed between the underside of the test specimen and the supporting construction.

The supporting construction was built by RISE in RISE's furnace hall.

The structure of the supporting constructions is described in the test setup in Appendix 2.

## **2.7 Mounting of the test specimen**

The test specimen was assembled and mounted at RISE. The mounting of the test specimen was overseen by RISE.

The test specimen was placed on the supporting construction after the mounting.

Both sides along the span were kept unrestrained to ensure free movement.

The mounting was performed between December 18 and 21, 2017 at RISE by the sponsor.

## 2.8 Conditioning

### 2.8.1 Climate conditions

The test specimen was stored in RISE's furnace hall before the test. The temperature in the furnace hall was in average 16 °C and the relative humidity was in average 57 % during this time.

## 2.9 Verification

### 2.9.1 Verification of the construction of the test specimen

The verification of the test specimen being in accordance with the sponsors drawings and specifications was carried out by RISE. The verification was performed on an identical test specimen randomly chosen to be used for verification, see chapter "Sampling and delivery of the test specimen". The test specimen was demounted and used for verification of the inside of the construction and material properties. The verification on details possible to check without damage the construction of the test specimen was performed on the test specimen used for the fire test.

*Table: Control of materials*

Material	Thickness [mm]	Density [kg/m <sup>3</sup> ]	Moisture ratio <sup>1</sup> [%]	Moisture ratio <sup>2</sup> [%]	Loss on ignition <sup>3</sup> [%]
FOAMGLAS <sup>®</sup> 80mm	80,9	121	-	0,0	0,7
FOAMGLAS <sup>®</sup> Ready board 50 mm	50,4	154	-	0,1	0,5
FOAMGLAS <sup>®</sup> T4+	100,6	115	-	0,0	0,6
FOAMGLAS <sup>®</sup> 50 mm	50,0	122	-	0,1	0,4
Gips	12,5	834	0,7	-	-

- 1) Moisture ratio calculated from weight loss after being heated at 52,5 °C.
- 2) Moisture ratio calculated from weight loss after being heated at 105 °C.
- 3) Loss on ignition calculated from weight loss after being heated at 500 °C.

The verification was performed on January 5, 2018.

The purpose of the control is to verify and/or determine material data and dimensions of materials and components included in the test specimen. The extent of performed measurements and applied methodology can deviate from standardized methods. The results shall therefore not be considered as formal material data.

### 2.9.2 Strength grading of load bearing beams

No control of the strength of the loadbearing components were made before the test.

## 2.10 Placing of test specimen on the furnace

The test specimen was placed on the supporting construction built on RISE's horizontal furnace.

### **3 Test procedure and results**

#### **3.1 General information**

The test was performed on January 9, 2018. The test lasted 92 minutes.

The test was performed on RISE's horizontal furnace for fire resistance test. The maximum fire exposed area of the furnace is (width x length) 3000 x 5100 mm and the depth of the furnace is 2670 mm. The heat exposure comes from 12 propane driven burners.

#### **3.2 Witness of test**

The test was witnessed by Mr Piet Vitse, Mr Kim Mård, Mr Joel Mondelaers, Mr Peter Hellqvist and Mr Björn Ask from FOAMGLAS® and Mr Hugo Van Keymeulen from Gyproc.

#### **3.3 Fire test procedure**

The fire test means in principle that the test specimen is subjected to exposure from one side (fire exposed side) and measurements and visual judgments are performed at the opposite side (unexposed side). The test specimen is also subjected for an external load from above during the test. The extent of the measurements and assessments depends on the sponsor's desired use of the results from the test.

#### **3.4 Loading with external force**

The test specimen was loaded with an external force during the fire test to evaluate load bearing capacity during fire.

##### **3.4.1 Loading equipment**

The load was applied on the test specimen by hydraulic pistons and by dead weight. The load from each piston was measured during the test with load cells. The load from the load cells was continuously controlled to maintain the same load independent on deflection of the test specimen.

The dead weight come from the equipment used to transfer the load from the hydraulic system to the test specimen and the rod. The dead weight was constant during the test.

The loading equipment is shown in Appendix 2.

##### **3.4.2 Load arrangement**

The load applied vertically on the upper side of the test specimen through rigid steel beams with dimensions (height x width x length) 100 x 100 x 3000 mm.

The loading arrangement is shown in Appendix 2.

### 3.4.3 Load level

The test specimen is loaded in a manner such that the maximum torque and the maximum shear force that the evaluated load meant was evaluated. In order to get a reasonable balance between the torque and transverse force applied and the torque and shear force evaluated the load was applied by 2 line-loads placed 1450 mm respectively 1450 mm from the centre.

The evaluated load level during the test was 1,96 kN/m<sup>2</sup> (200kg/m<sup>2</sup>).

To achieve the desired load-level a total of 41,0 kN was applied on the test specimen. The dead weight from the equipment and the beams was 1,08 kN. The rest of the load came from the hydraulic system. Overall, this meant 20,48 kN per beam which meant that 6,83 kN/m was applied to the test specimen from each beam.

The load level was prescribed by the sponsor.

The applied load during the test is shown in a graph in Appendix 3.

### 3.4.4 Performance criteria - Loadbearing capacity

The load-bearing capacity is judged according to the criteria in EN 1363-1:2012 chapter 11.1a.

Maximum allowed limiting deflection:  $D = L^2/400d$

Maximum allowed limiting rate of deflection:  $dD/dt = L^2/9000d$

Where L is the span (5800 mm) and d is the height of the load-bearing part (340 mm) of the test specimen.

The load-bearing criteria for actual test specimen are:

$D = 247$  mm

$dD/dt = 11,0$  mm/min

Measured deflection and calculated rate of vertical contraction during the test is reported in chapter "Deflection".

## 3.5 Test conditions

The furnace was controlled in accordance with EN 1363-1:2012.

### 3.5.1 Temperatures

The furnace temperature was measured with 10 plate thermometers (PT1 – PT10). The plate thermometers were positioned approximately 100 mm from the fire exposed surface of the test specimen at the commencement of the test. The position of the thermometers can be seen in Appendix 3.

The average temperature in the furnace (average of PT1 – PT10) in relation to the standard time-temperature curve is shown in Appendix 3.

The temperature at each plate thermometer (PT1 – PT10) in relation to the standard time-temperature curve and permitted deviation are shown in Appendix 3.

The percent deviation of the area under the average furnace time-temperature curve from the area under the standard time-temperature curve and permitted deviation, is shown in Appendix 3.

### 3.5.2 Pressure

The furnace pressure was controlled so that a pressure of 20 Pa was kept on level with 100 mm below the fire exposed side of the test specimen.

The furnace pressure was controlled at the position 750 mm below the test specimen. Using a pressure gradient of 8,5 Pa/m the control pressure was calculated to be 14,5 Pa in order to establish a pressure of 20 Pa on level with 100 mm below the fire exposed side of the test specimen.

The calculated furnace pressure 100 mm below the fire exposed side of the test specimen and permitted deviation is shown in Appendix 3.

The equipment for pressure measurements fulfils the EGOLF agreement EA 03:2006. The measured pressure is presented in the graph as a moving average over a period of time one minute.

### 3.6 Ambient temperature

The ambient air temperature was measured with one thermocouple. The ambient air temperature during the test is shown in Appendix 3. The ambient air temperature at the beginning of the test was 16 °C.

### 3.7 Measurements on test specimen

During the test the properties needed for desired classification desires by the sponsor were measured and the behavior of the test specimen was evaluated during heat exposure.

#### 3.7.1 Temperatures

The temperature rise on the unexposed side of the test specimen was measured with 5 thermocouples (C1 – C5). The position of the thermocouples are shown in Appendix 4.

The measured temperature and the average temperature rise on the unexposed surface of the test specimen (average of thermocouples C1 – C5) on the test specimen are shown in Appendix 4.

The average temperature of all thermocouples (C1-C5) at the start of the test was 17,5°C.

#### 3.7.2 Deflection

The points for measuring vertical deflections (Dy1 - Dy2) were located 50 mm in from the free longitude edges, at mid-span of the test specimen. See also Appendix 4.

Measured vertical deflections of the test specimen are shown in a graph in Appendix 4. Calculated vertical rate of deflection is shown in a graph in Appendix 4.

#### 3.7.3 Measurements for extended field of application evaluations

No additional measurements for use at extended field of application were made.



### 3.7.4 Additional optional measurements

The temperature inside the test specimen was measured with 20 thermocouples. The thermocouples were placed in cross section sections (A and B). The thermocouples were positioned as shown in Appendix 4. The temperatures are shown in Appendix 4.

## 3.8 Observations

### 3.8.1 Photographs from the test

Photographs taken in connection with the test are shown in Appendix 4.

### 3.8.2 Observations during the test

Table: Observations

Time [min:s]	Observations (refer to the unexposed side if nothing else is stated)
-23:50	The loading of the test specimen starts.
-22:00	Full load on the test specimen.
00:00	The fire test starts.
03:40	Fire exposed side: The paper in the first fire exposed layer of the gypsum plaster boards are black. The joint filler and paper strip flakes off.
06:50	Fire exposed side: The paper on the first fire exposed layer of gypsum plaster boards flakes off.
12:20	Fire exposed side: The joints between the first fire exposed layer of the gypsum plaster boards have opened slightly.
19:40	Fire exposed side: The joint between the first fire exposed layer of the gypsum plaster boards have opened approx. 2-3 mm.
50:30	Fire exposed side: Small flames emerges from the joint between the first fire exposed layer of the gypsum plaster boards.
60:50	Fire exposed side: The long side joints of the first fire exposed layer full size gypsum plaster board have come loose and hangs down slightly.
66:20	Fire exposed side: Parts of the first fire exposed layer of gypsum plaster boards have fallen down. The joint between the first fire exposed layer of the gypsum plaster boards have opened approx. 10-15 mm.
70:50	Fire exposed side: Parts of the second fire exposed layer of gypsum plaster boards have fallen down.
73:20	Fire exposed side: Most parts of the second fire exposed layer of gypsum plaster boards have fallen down. The insulation is unharmed.
77:20	Fire exposed side: Blisters has come up in the fire exposed insulation.
80:50	Clicks from the test specimen.
82:30	Fire exposed side: The test specimen burns heavily.
88:20	Fire exposed side: The test specimen burns heavily.
90:00	The test specimen bends but no cracks or discolorations is observed.
92:00	The test terminates on request of the sponsor.

- Integrity tests with cotton wool pads were not performed during the test since no leakage of hot gasses were observed.
- Integrity tests with gap gauges were not performed during the test since no through gaps were observed.
- Temperature measurements with roving thermocouple were not performed during the test since no hot spots were observed.

### 3.9 Post-test measurements and observations

After the test following tests, measurements, evaluations and observations were made.

#### 3.9.1 Observations after the test

##### *Unexposed side*

Unharmed

##### *Fire exposed side*

The gypsum bards have fallen down. The steel profiles are slightly bended. The first fire exposed layer of FOAMGLAS® is gone. Holes have come up in the layer behind.

## 4 Summary

The test specimen, a fire resisting load-bearing floor of steel profiles and FOAMGLAS® insulation covered with gypsum boards, described in chapter 2, has been tested according to the accredited test methods:

- EN 1365-2:2014
- EN 1363-1:2012

Below is a summary of the results obtained during the test and essential information about the test specimen.

### 4.1 Fire test

The test lasted for 92 minutes.

The test specimen was tested with fire exposure from below.

For information regarding the validity of the result in different directions see chapter "Number of test specimens and test direction".

*Table: Summary integrity measurements*

<b>Integrity</b>	<b>Result</b>
• Sustained flaming exceeding 10 seconds	92 minutes, no failure*
• Gap gauges diameter 6 mm and 25 mm	92 minutes, no failure*
• Cotton wool pad test	92 minutes, no failure*

*Table: Summary temperature measurements*

<b>Insulation</b>	<b>Result</b>
• Average temperature rise, 140 °C	92 minutes, no failure*
• Maximum temperature rise, 180 °C	92 minutes, no failure*

*Table: Summary loadbearing capacity*

Loadbearing capacity	Result
• Maximum deflection 247 mm	92 minutes, no failure*
• Maximum rate of deflection 11,0 mm/min	88 minutes

*The rate of deflection criteria is not applied in the first 10 min of the fire test.*

*\*The test has been discontinued before failure, at the request of the sponsor.*

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.

## 5 Field of direct application of test results

The direct application of the test results to constructions similar to the constructions described in this report is described in EN 1365-2:2014 in chapter 13.

### RISE Research Institutes of Sweden AB Safety - Fire Research, Fire Resistance

Performed by

Examined by

Pär Johansson

Patrik Johansson

## Appendices

*Table: Appendices*

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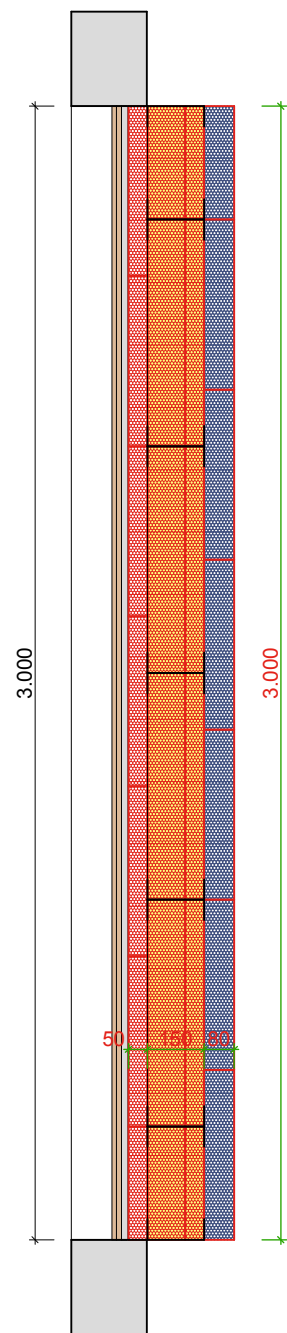
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Koljern element	Quantity per element	Note: Manufacturer/Supplier	Item number
C-beams LINDAB, 156x57x2 mm S350GD+Z	6 pcs á 5996 mm	Lindab	6017
C-beams LINDAB, 160x57x2 mm S350GD+Z	2 pcs á 1500 mm	"	6017
L-profiles Lindab, 45x45x1 mm - S355N	18 pcs á 600 mm and 9 pcs á 288 mm	"	1662
SCREW UNITE B08 4,8x16mm	200 pcs	"	510262
5 cm FOAMGLAS Floorboard T4+	6x1,5 m = 9m2	Pittsburgh Corning Europé NV	FBT4+ 05020
10 cm Foamglas Floorboard T4+	6x1,5 m = 9m2	"	FBT4+ 10020
Airtight layer HALOTEX D50	6x1,7 m = 10,2 m2	Mataki/	6630
5 cm Foamglas T4+ block	5.6x1,5 m =8,4 m2	Pittsburgh Corning Europé NV	T4+ 05001
Gyproc/Rigips Ceiling Hatprofile	16 pcs á 1500 mm	Gyproc/	
Screw for hatprofile 4,8x80 mm	128 pcs	"	470520
Foamglas density 125kg/m³			

Supplies to connect the 2 tested elements	Quantity for 2 elements	Note: Manufacturer/Supplier	Item number
Sealant Veidec - S-Bond, Black	1 pcs á 290 ml.	Veidec/	15462
SCREW UNITE B08, PKFH, 4,8x16mm	120 pcs.	Unite/Lindab	510262
"Spikbleck" JOMA - 1,0 x 40 x 120 mm	4 pcs.	JOMA/	4901412
L-profiles Lindab, 45x45x1 mm - S355N	4 pcs á 600 mm	Lindab	1662

Layers above the 2 connected elements	Quantity for 2 elements	Note: Manufacturer/Supplier	Item number
Icopal Mono PM	6x3 m = 18 m2	Icopal/	55020
80 mm FOAMGLAS Ready board T4+	"	Pittsburgh Corning Europé Nv	RDBT4+ 08020
Glue PC58	80 kg	Pittsburgh Corning Europé Nv	PC 0058

Layers below the 2 connected elements	Quantity for 2 elements	Note: Manufacturer/Supplier	Item number
Gyproc Rf Boards 12,5 mm	6 x 3 m and 2 layers = 36 m2	Gyproc/	
Gyproc 25 mm fixing screws	229 pcs	"	(1st layer board)
Gyproc 212/35 mm fixing screws	374 pcs	"	(2nd layer board)
Gyproc Joint filler 45	30,2 m (16 + 14,2)	"	
Gyproc joint tape P50	"	"	

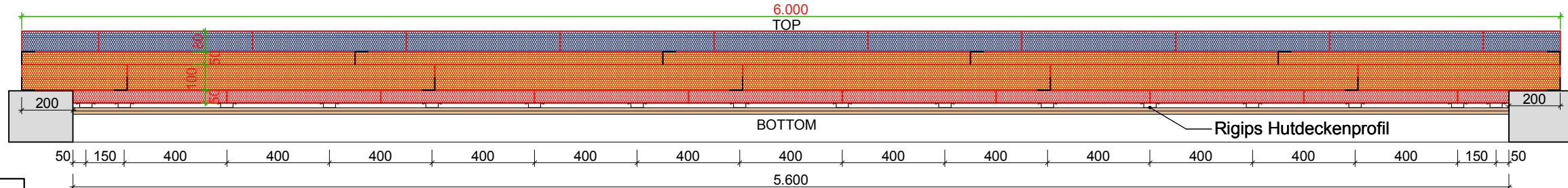
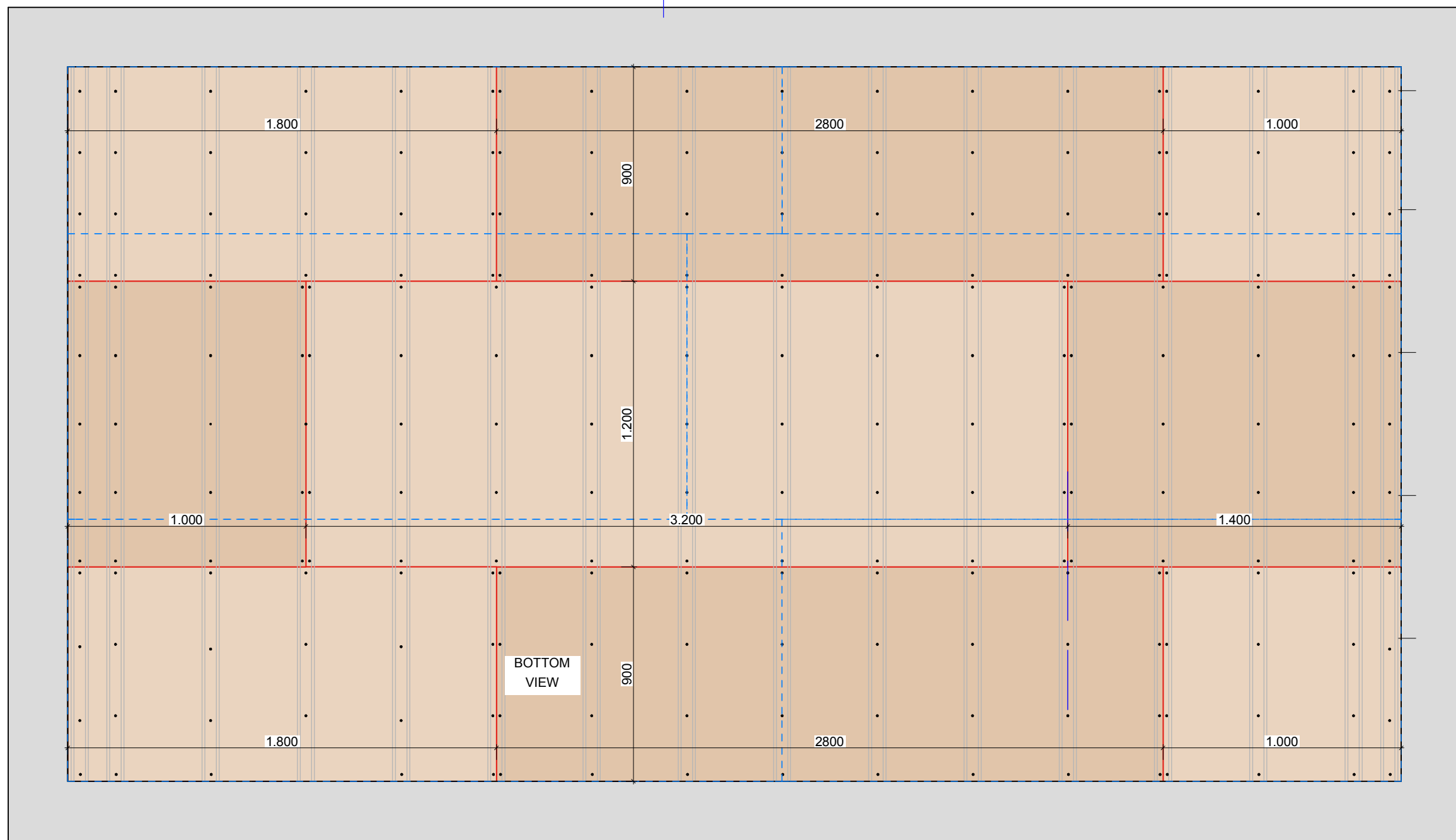


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**1st Layer**  
Gyproc RF boards 12.5 mm  
Fixing screws 25 mm,  
centred 300 mm

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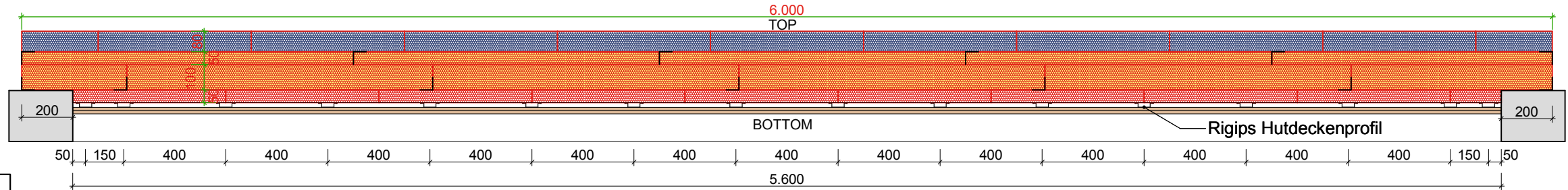
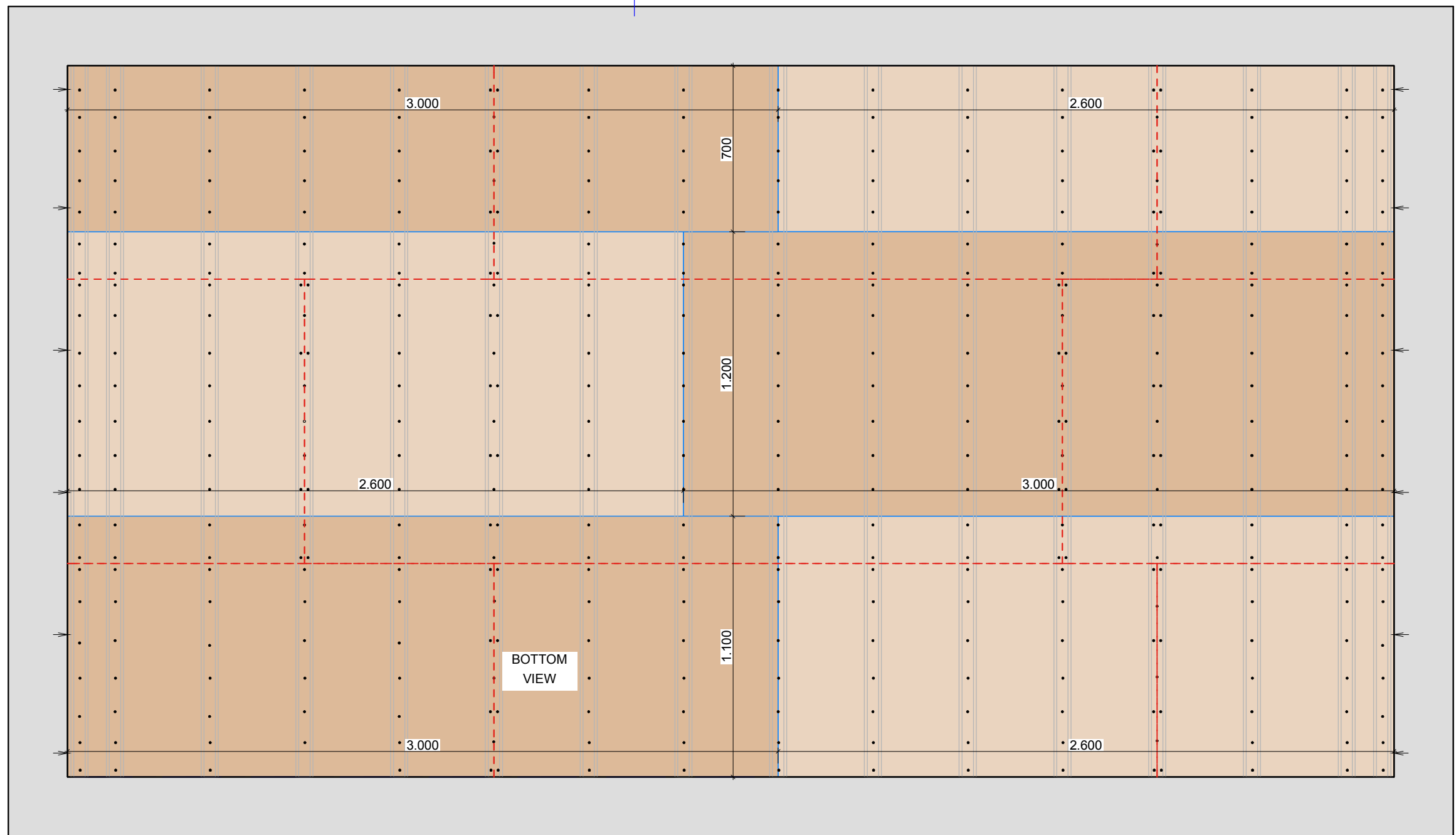
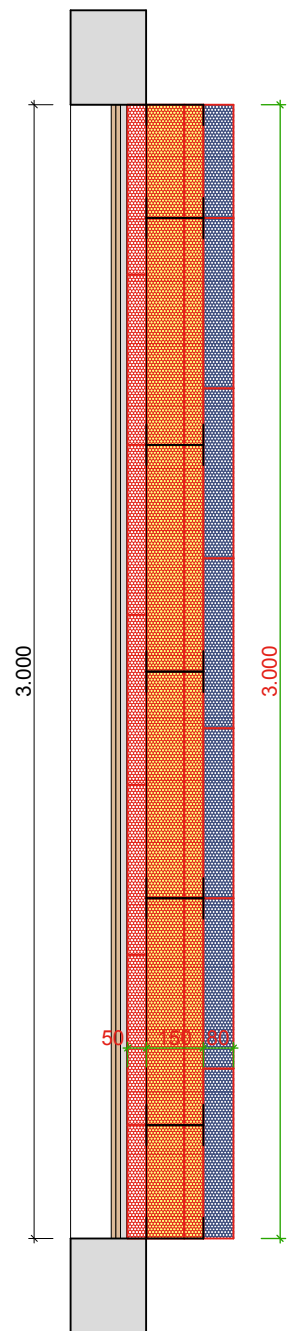
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0	26/03/2018	Original	PB

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	TITLE:	KOLJERN TERRACE ELEMENT ETA #2 - FIRE RESISTANT Gyproc Boards - 1st Layer					
DRAWING NUMBER:	K02_14_46_K1_PB						
Date:	26/03/2018	Drawn by:	PH BRUWIER	Scale:	1:20	Sheet size:	

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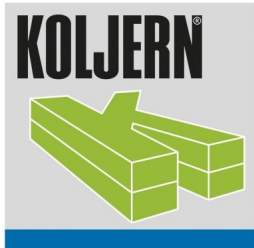
**2nd Layer**  
Gyproc RF boards 12.5 mm  
Fixing screws 35 mm,  
centred 150 mm

**RI SE** REF: 7P07277-1  
APP: 1 (8 pages)

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0	26/03/2018	Original	PB
Rev:	Date:	Description of changes:	Made by:

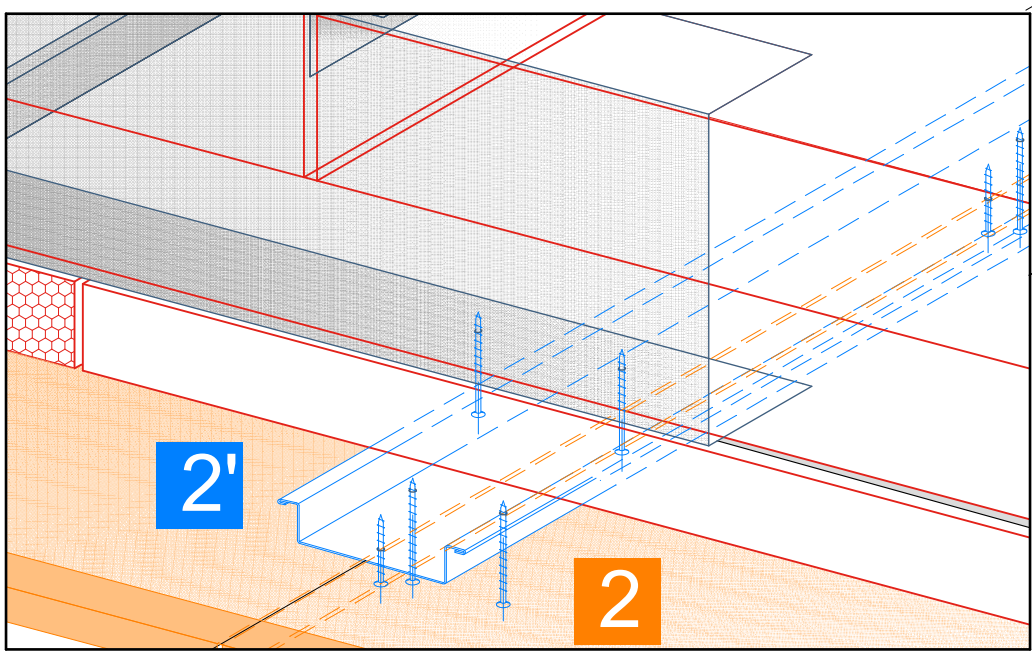
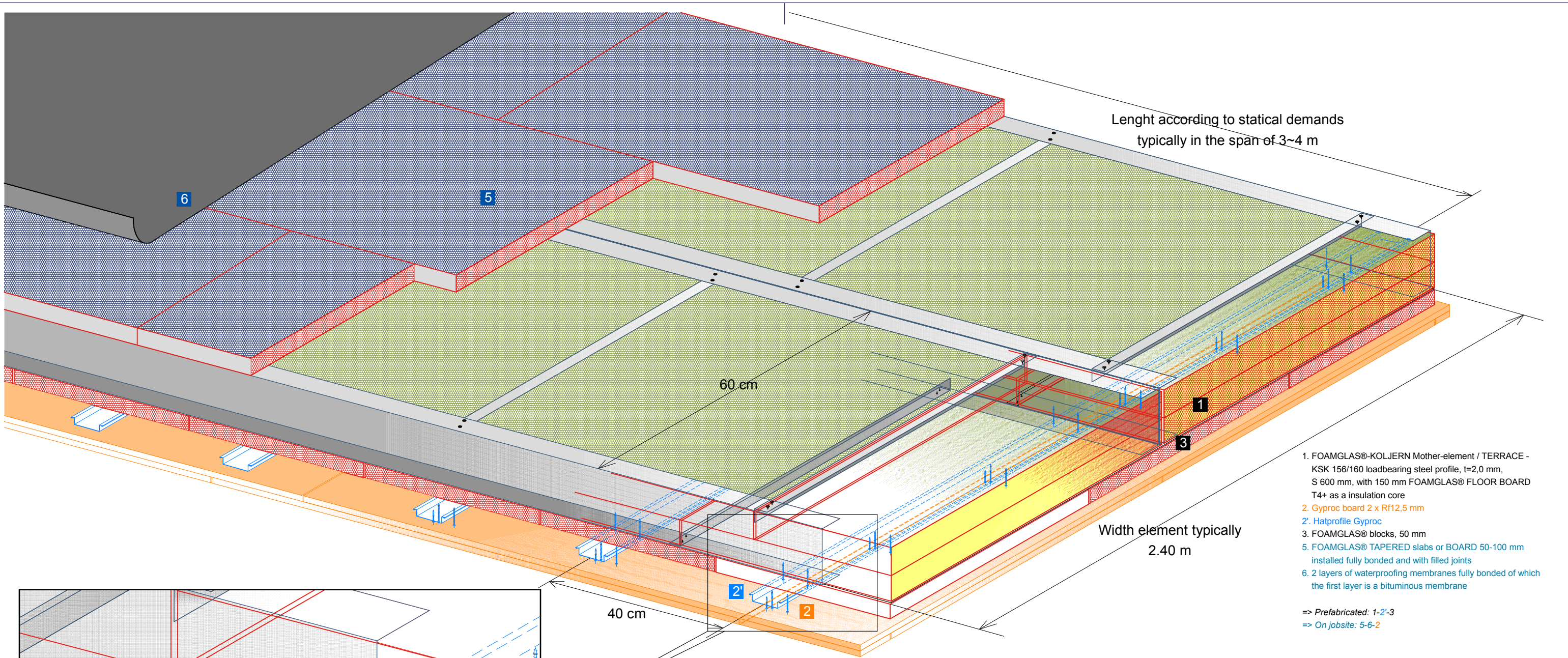


PROJECT: KOLJERN / ETA

TITLE: KOLJERN TERRACE ELEMENT  
ETA #2 - FIRE RESISTANT  
Gyproc Boards - 2nd Layer

DRAWING NUMBER: K02\_14\_46\_K1\_PB

Date: 26/03/2018 Drawn by: PH BRUWIER Scale: 1:20 Sheet size:



**RISE** REF: 7P07277-1  
APP: 1 (8 pages)

6	26/03/2018	ETA #2 - 3 D VIEW	PB
5	03/11/2017	ETA #2 - 3 D VIEW	PB
4	02/06/2017	ETA #2 - CROSS SECTIONS	PB
3	27/03/2017	PROMATECT-100 FIRE RESISTANT-FIXED ON STEEL HAT PROFILES	PB
2	14/02/2017	PROMATECT-100 FIRE RESISTANT SYSTEM ADDED	PB
1	02/12/2016	.K16-BUTYL JOINT ADDED	PB
0	02/11/2016	Original	PB
Rev:	Date:	Description of changes:	Made by:

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PROJECT: KOLJERN / ETA

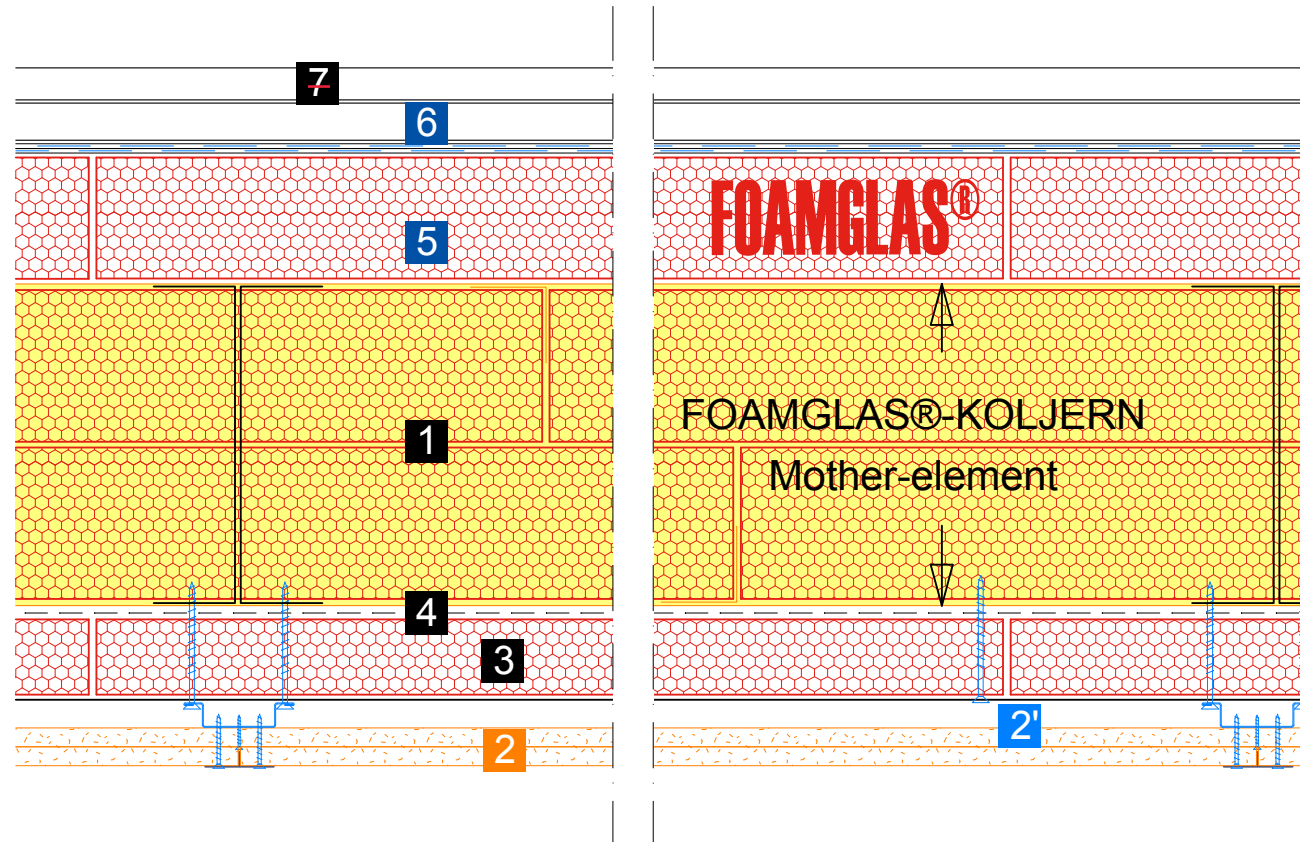
TITLE: KOLJERN TERRACE ELEMENT  
ETA #2 - FIRE RESISTANT  
3D VIEW

DRAWING NUMBER: K02\_14\_46\_K1\_PB

Date: 26/03/2018 Drawn by: PH BRUWIER Scale: 1:5 Sheet size:

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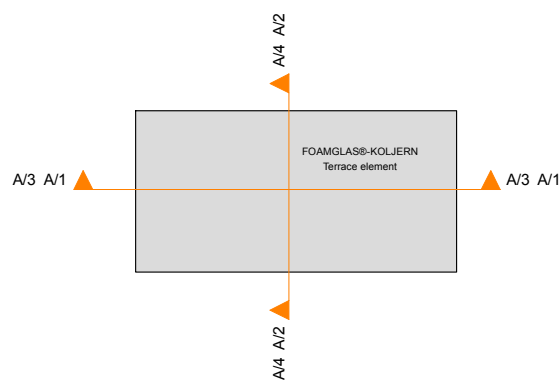
# section A/2



1. FOAMGLAS®-KOLJERN Mother-element / TERRACE - KSK 156/160 loadbearing steel profile, t=2,0 mm, S 600 mm, with 150 mm FOAMGLAS® FLOOR BOARD T4+ as a insulation core
2. Gyproc board 2 x Rf12,5 mm
- 2'. Hatprofile Gyproc
3. FOAMGLAS® BLOCK T4+, 50 mm
4. Airtight layer
5. FOAMGLAS® READYBOARD 80 mm installed fully bonded and with filled joints
6. 2 layers of waterproofing membranes fully bonded of which the first layer is a bituminous membrane
7. ~~Finishing layer i.e. Concrete slabs, wood floor etc.~~

=> Prefabricated: 1-2'-3-4


=> On jobsite: 5-6-2-7



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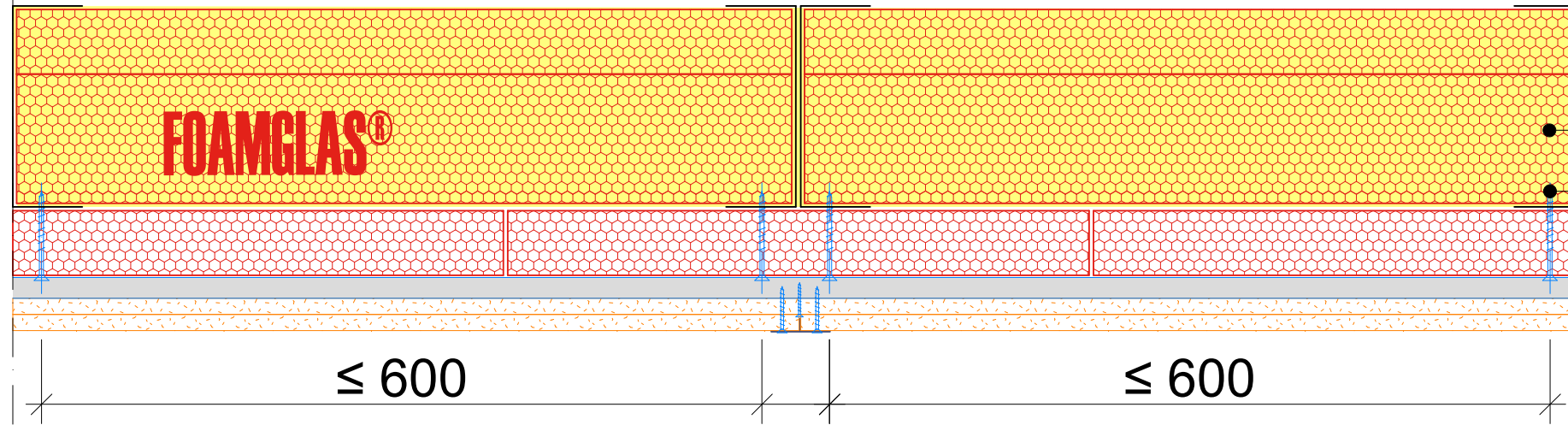
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Rev:	Date:	Description of changes:	Made by:
6	26/03/2018	ETA #2 - CROSS SECTIONS-READY BOARD 80mm	PB
5	03/11/2017	ETA #2 - CROSS SECTIONS	PB
4	02/06/2017	ETA #2 - CROSS SECTIONS	PB
3	27/03/2017	PROMATECT-100 FIRE RESISTANT-FIXED ON STEEL HAT PROFILES	PB
2	14/02/2017	PROMATECT-100 FIRE RESISTANT SYSTEM ADDED	PB
1	02/12/2016	.K16-BUTYL JOINT ADDED	PB
0	02/11/2016	Original	PB

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	TITLE: KOLJERN TERRACE ELEMENT ETA #2 - FIRE RESISTANT CROSS SECTION			
	DRAWING NUMBER: K02_14_46_K1_PB			
Date: 26/03/2018	Drawn by: PH BRUWIER	Scale: 1:5	Sheet size:	



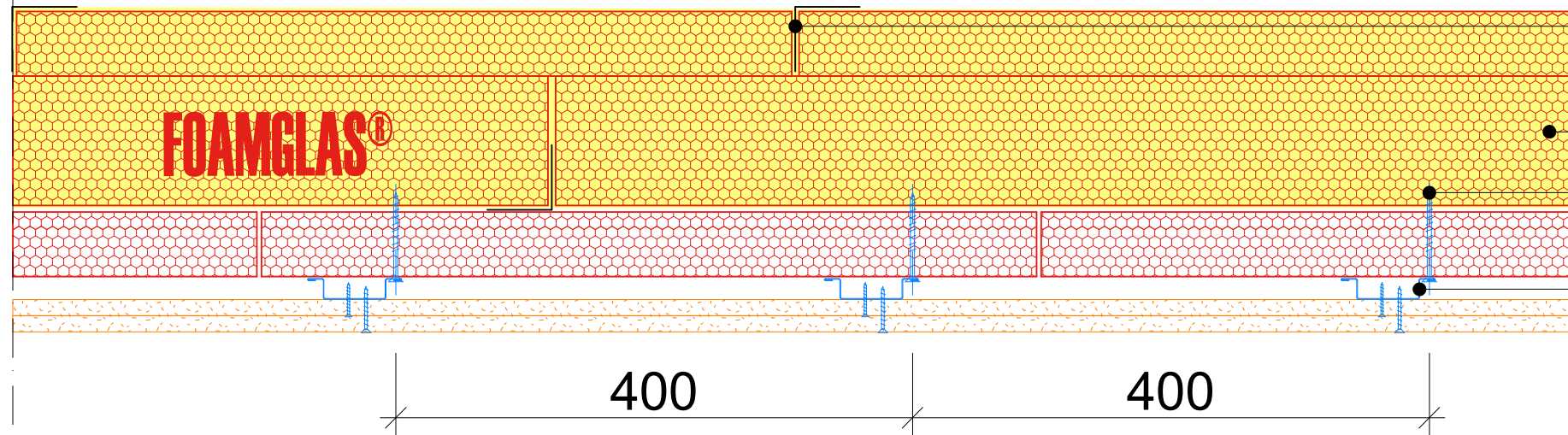
# SECTION A/3



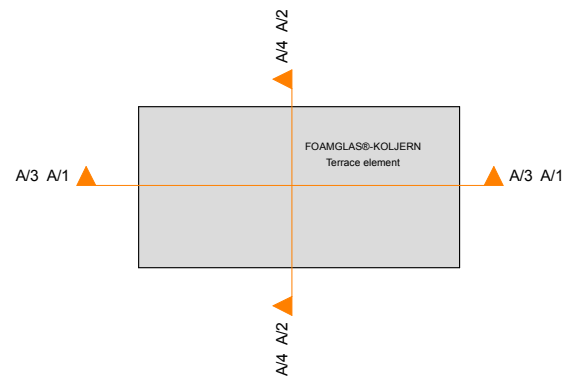
- U profile KOLJERN element
- FOAMGLAS® KOLJERN Mother-element
- Schroef met boorkop of voorboren 3,5 x 65 mm
- FOAMGLAS® block, 50mm
- Hatprofile Gyproc
- Gyproc board 2x Rf 12,5 mm

**RI SE** REF: 7P07277-1  
APP: 1 (8 pages)

# SECTION A/4



- U profile KOLJERN element
- FOAMGLAS® KOLJERN Mother-element
- Schroef met boorkop of voorboren 3,5 x 65 mm
- FOAMGLAS® block, 50mm
- Hatprofile Gyproc
- Gyproc board 2x Rf 12,5 mm



6	26/03/2018	ETA #2 - CROSS SECTIONS	PB
5	03/11/2017	ETA #2 - CROSS SECTIONS	PB
4	02/06/2017	ETA #2 - CROSS SECTIONS	PB
3	27/03/2017	PROMATECT-100 FIRE RESISTANT-FIXED ON STEEL HAT PROFILES	PB
2	14/02/2017	PROMATECT-100 FIRE RESISTANT SYSTEM ADDED	PB
1	02/12/2016	.K16-BUTYL JOINT ADDED	PB
0	02/11/2016	Original	PB
Rev:	Date:	Description of changes:	Made by:

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PROJECT: KOLJERN / ETA

TITLE: KOLJERN TERRACE ELEMENT  
ETA #2 - FIRE RESISTANT  
CROSS SECTION A/3 A/4

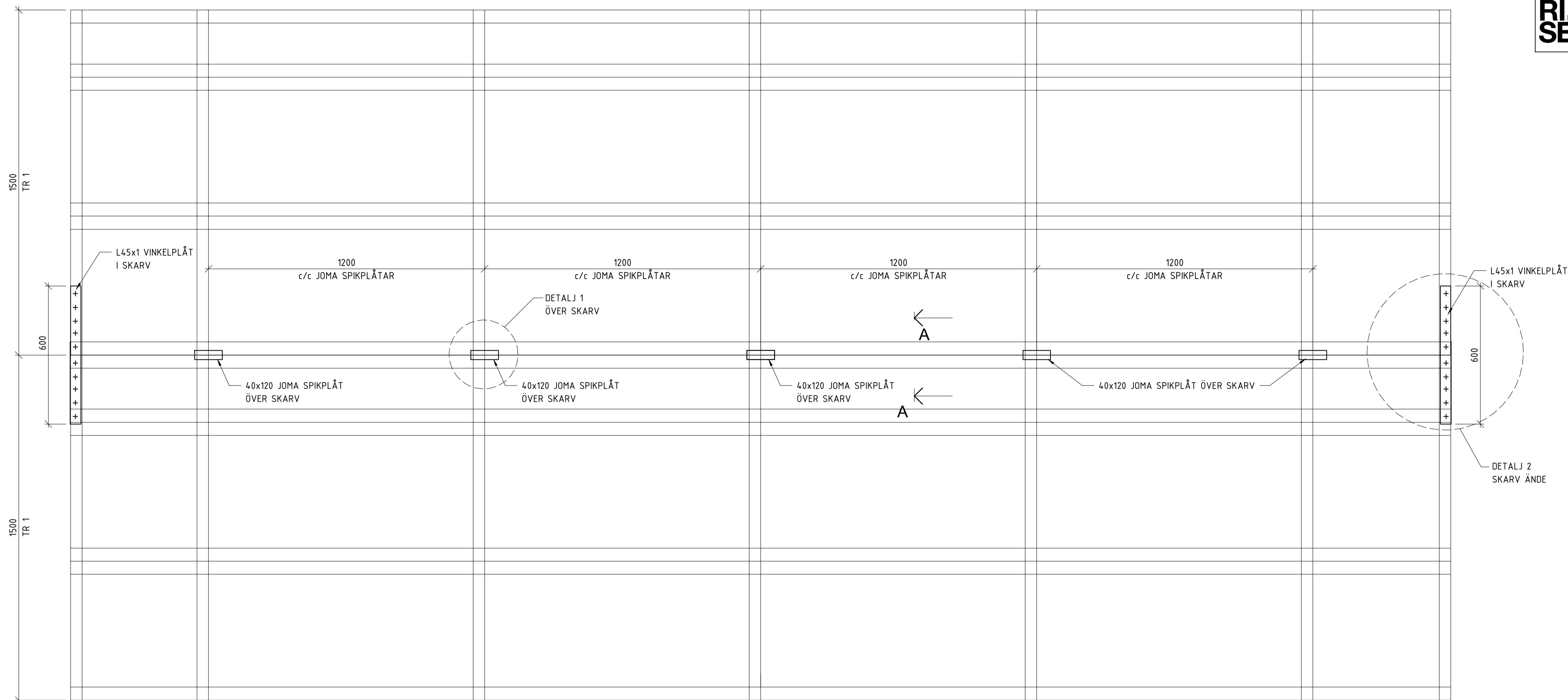
DRAWING NUMBER: K02\_14\_46\_K1\_PB

Date: 26/03/2018

Drawn by: PH BRUWIER

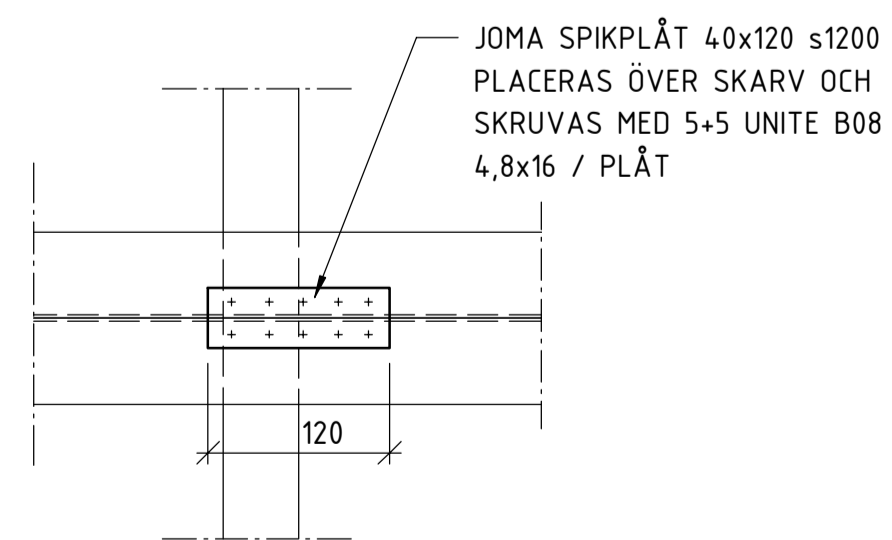
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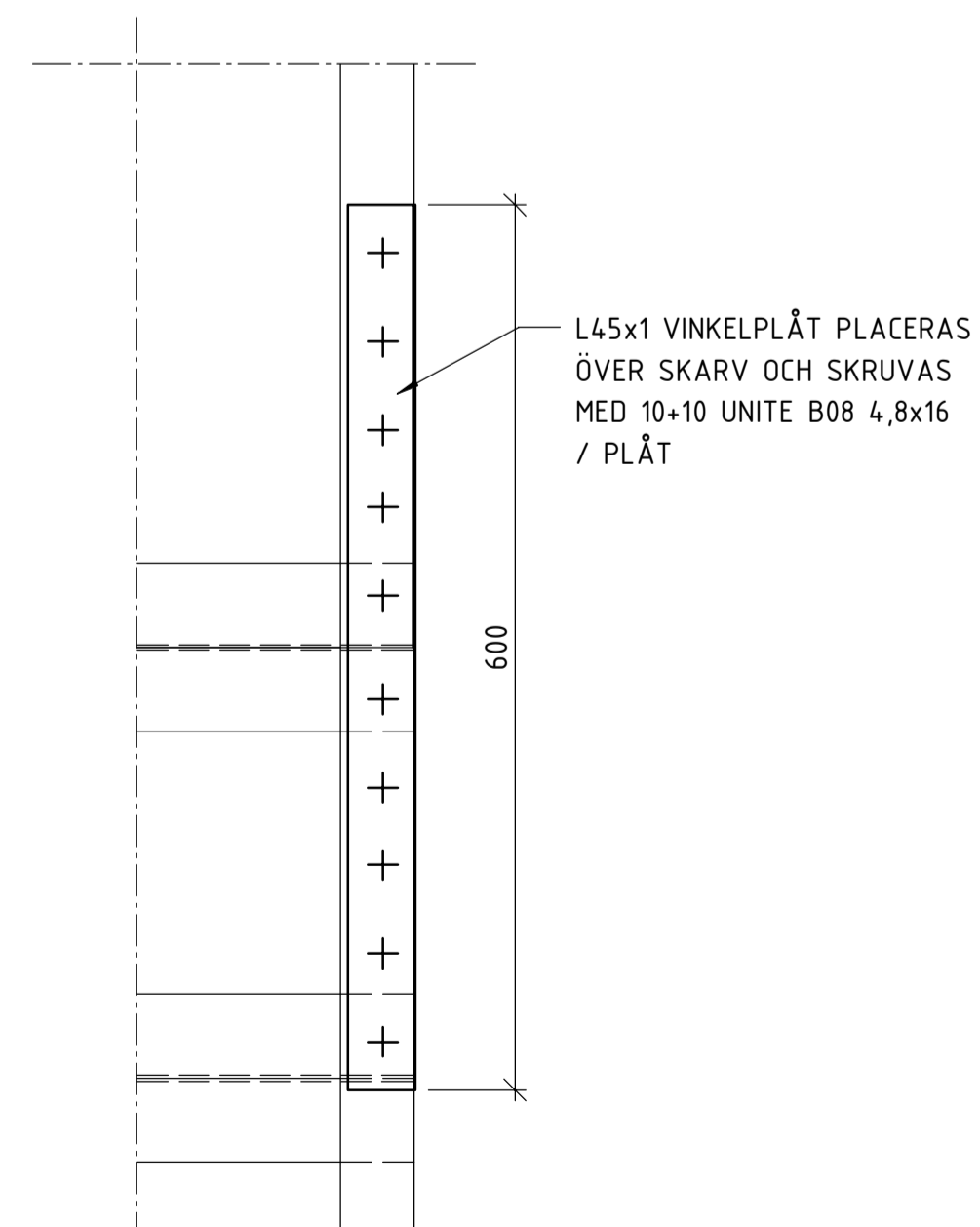
**PLAN TE 1 MONTAGE ÖVER SKARV**

1 : 10



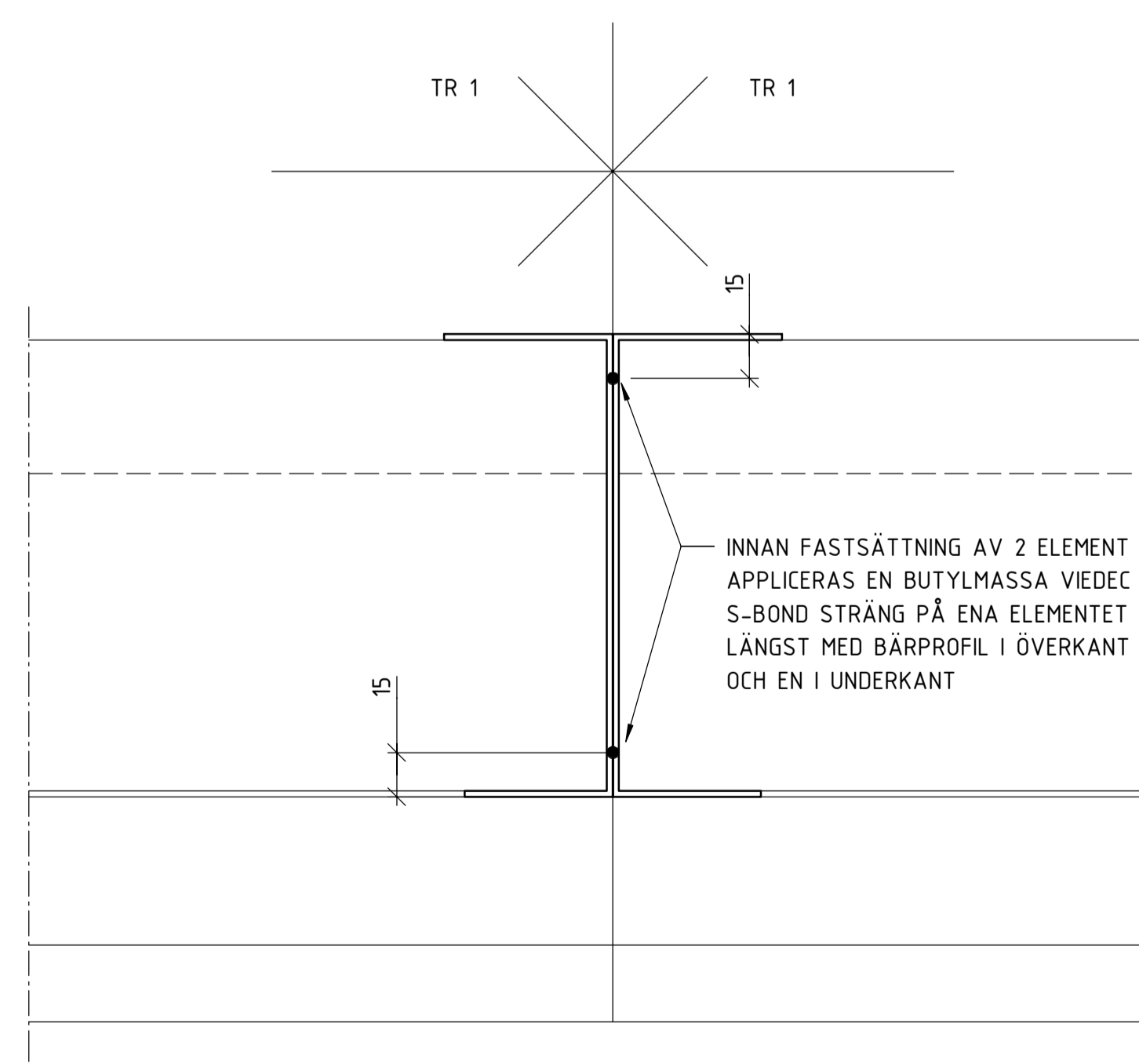
**DETALJ 1 ÖVER SKARV**

1 : 5



**DETALJ 2 SKARV ÄNDE**

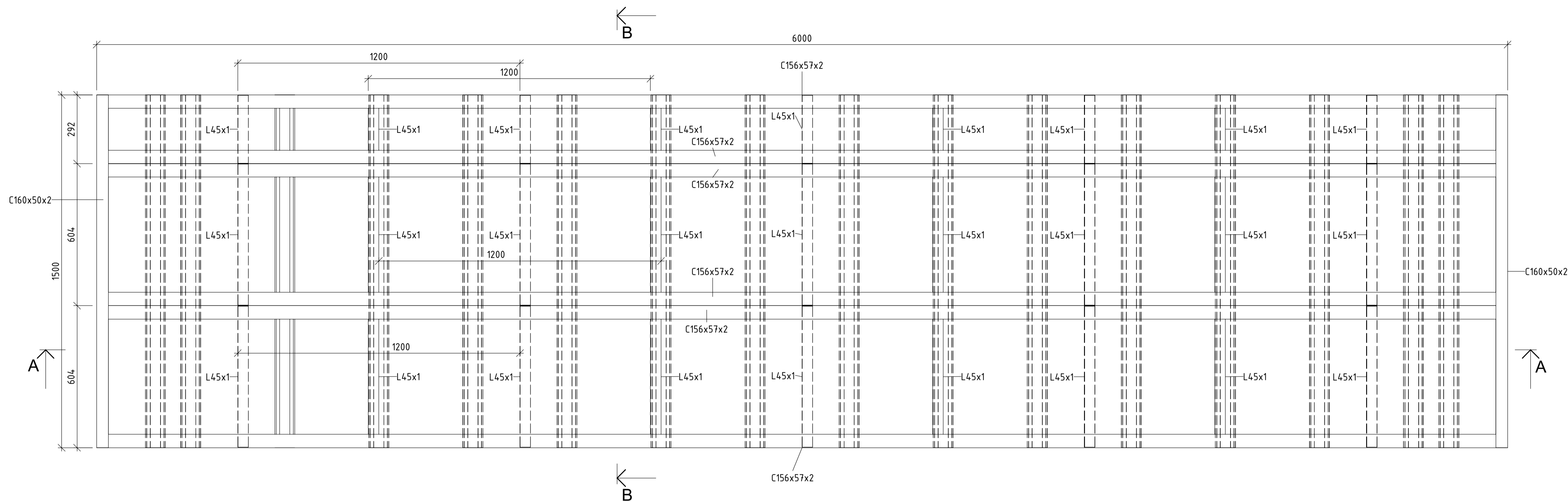
1 : 5



**A-A**

1 : 2

BET	ÄNDRINGEN AVSER	DATUM	SIGN
<b>CONSTRUCTION DOCUMENT</b>			
<b>FIRE TEST ELEMENT</b>			
<b>BORÅS 3431</b>			
WSP BYGGPROJEKTERING Box 758 851 22 Sundsvall Tel: 010-722 50 00 Fax: 010-722 66 94			
UPPDRAG NR 10255266	RITAD/KONSTR. AV M.L.S	HANDLÄGGARE M.LOPEZ	
DATUM 2018-03-28	ANSVÄRIG STEFAN IVARSSON		
BORÅS 3431			
STANDARD DETAILS OF MOTHER ELEMENT CONSTRUCTION			
SKALA A1 1:10 A3 1:20	NUMMER K-20-6-02	BET	

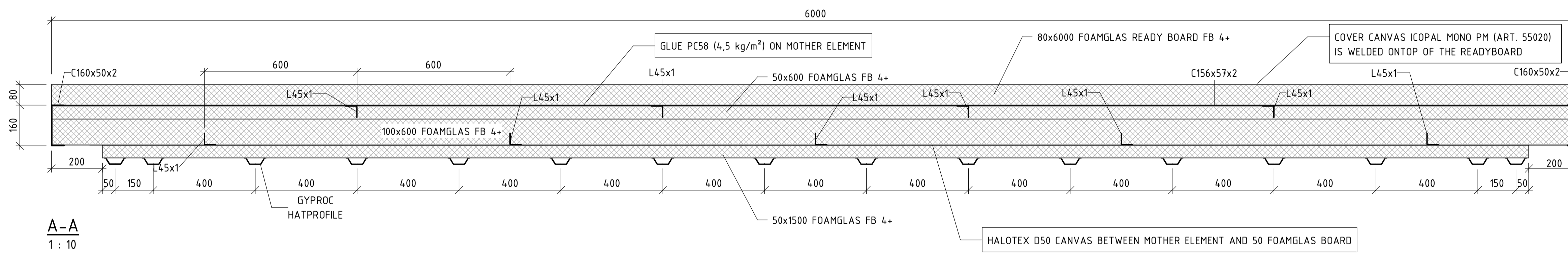


ELEMENT COUNT : 4

TOP VIEW TERRACE ELEMENT TR 1

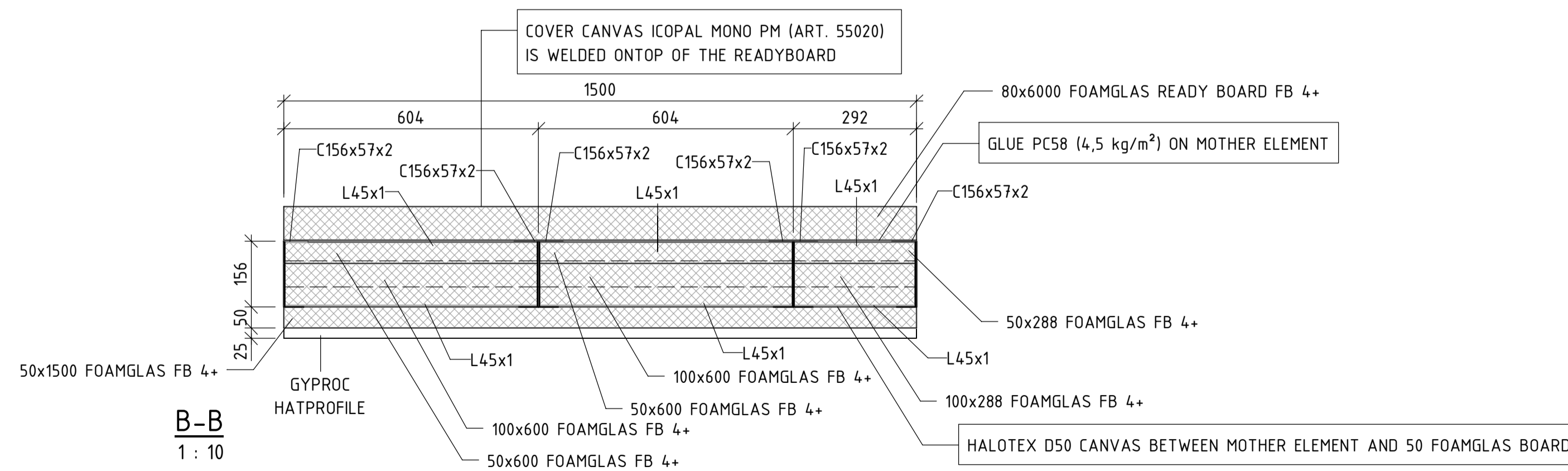
1 : 10

ELEMENT COUNT : 4



A-A

1 : 10



B-B

1 : 10

TYPE, SIZE	GRADE	PER ELEMENT	
		QTY	LENGTH (mm)
C156x57x2	S350GD+Z	6	5996
C160x50x2	S350GD+Z	2	1500
L45x1	S355N	18	600
L45x1	S355N	9	288
FOAMGLAS 50x1500	FB 4+	1	5600
FOAMGLAS 50x600	FB 4+	2	5996
FOAMGLAS 100x600	FB 4+	2	5996
FOAMGLAS 50x288	FB 4+	1	5996
FOAMGLAS 100x288	FB 4+	1	5996
FOAMGLAS 80x6000	READYBOARD FB 4+	1	1500
SCREW UNITE G40 4,8x80	CARBON STEEL	128	80
SCREW UNITE B08 4,8x16	CARBON STEEL	200	16

BET ANDRINGEN AVSER DATUM SIGN

CONSTRUCTION DOCUMENT  
FIRE TEST ELEMENT  
BORÅS 3431

WSP BYGGPROJEKTERING  
Box 758  
851 22 Sundsvall  
Tel: 010-722 50 00  
Fax: 010-722 66 94



LUPPRAG NR 10255266 RITAD/KONSTR. AV M.L.S. HANDLÄGGARE M.ANDERSSON

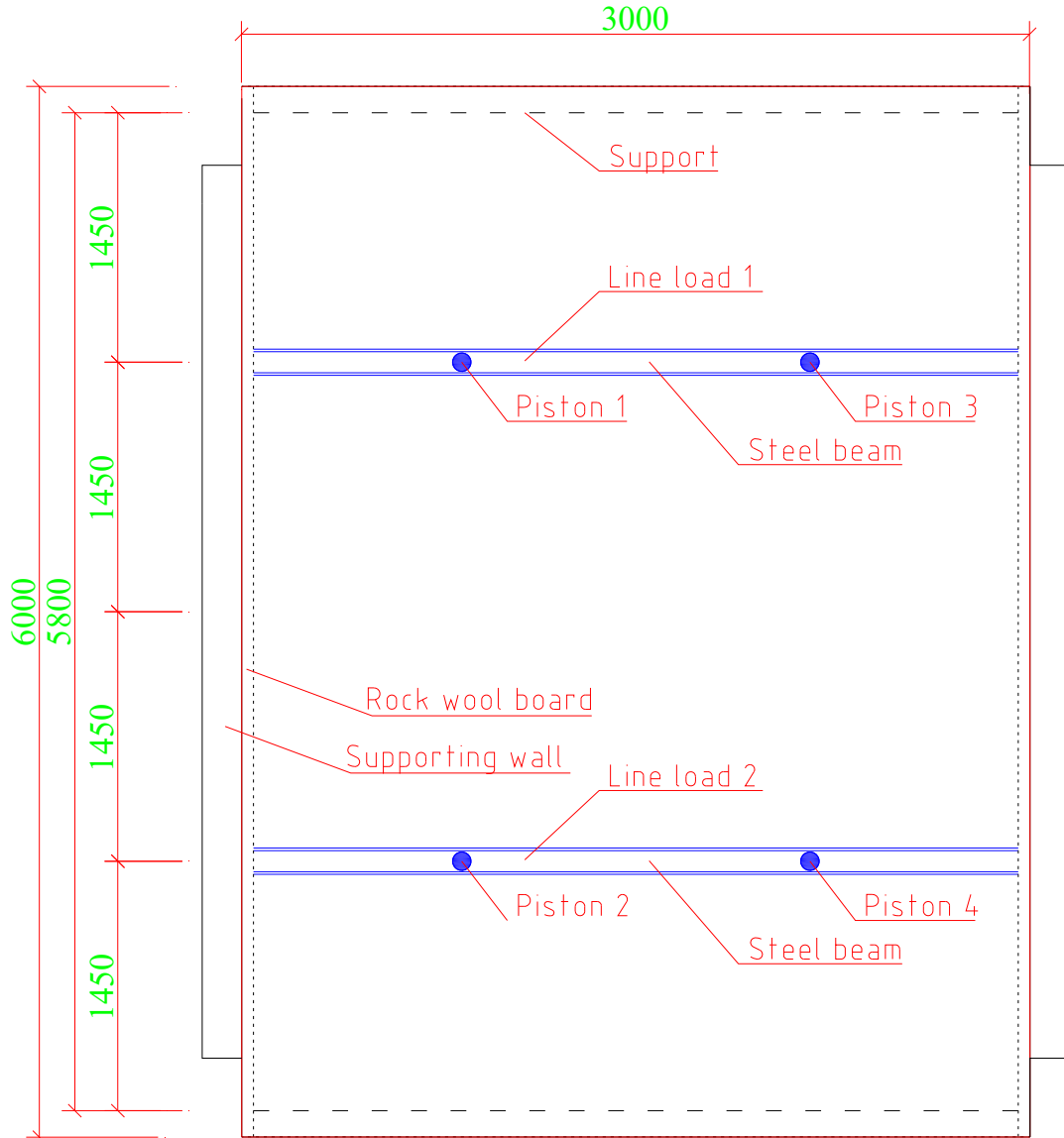
DATUM 2018-03-06 ANSVARIG MIKAEL ANDERSSON

KOLJERN TERRACE MOTHER ELEMENT  
BORÅS 3431  
TE 1  
ASSEMBLY DRAWING

SKALA A1 1:20 A3 1:40 NUMMER TE 1 BET

Appendix 2

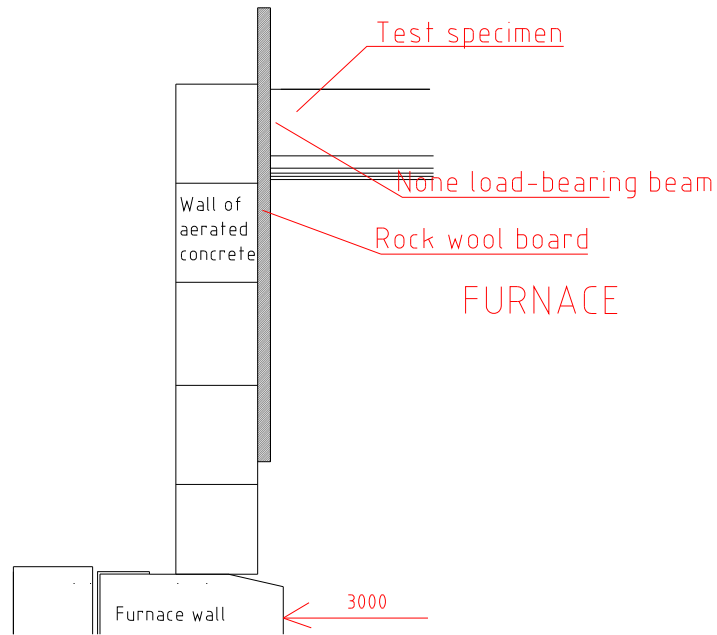
Test setup



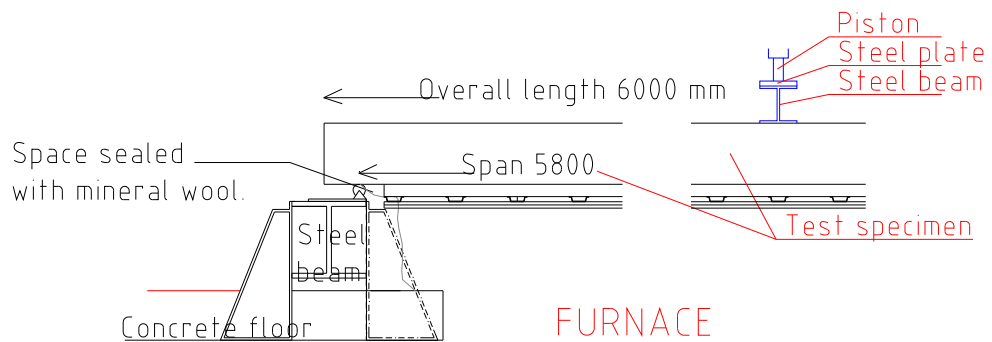
Appendix 2

Test setup

Longitudinal edges,  
perimeter details.

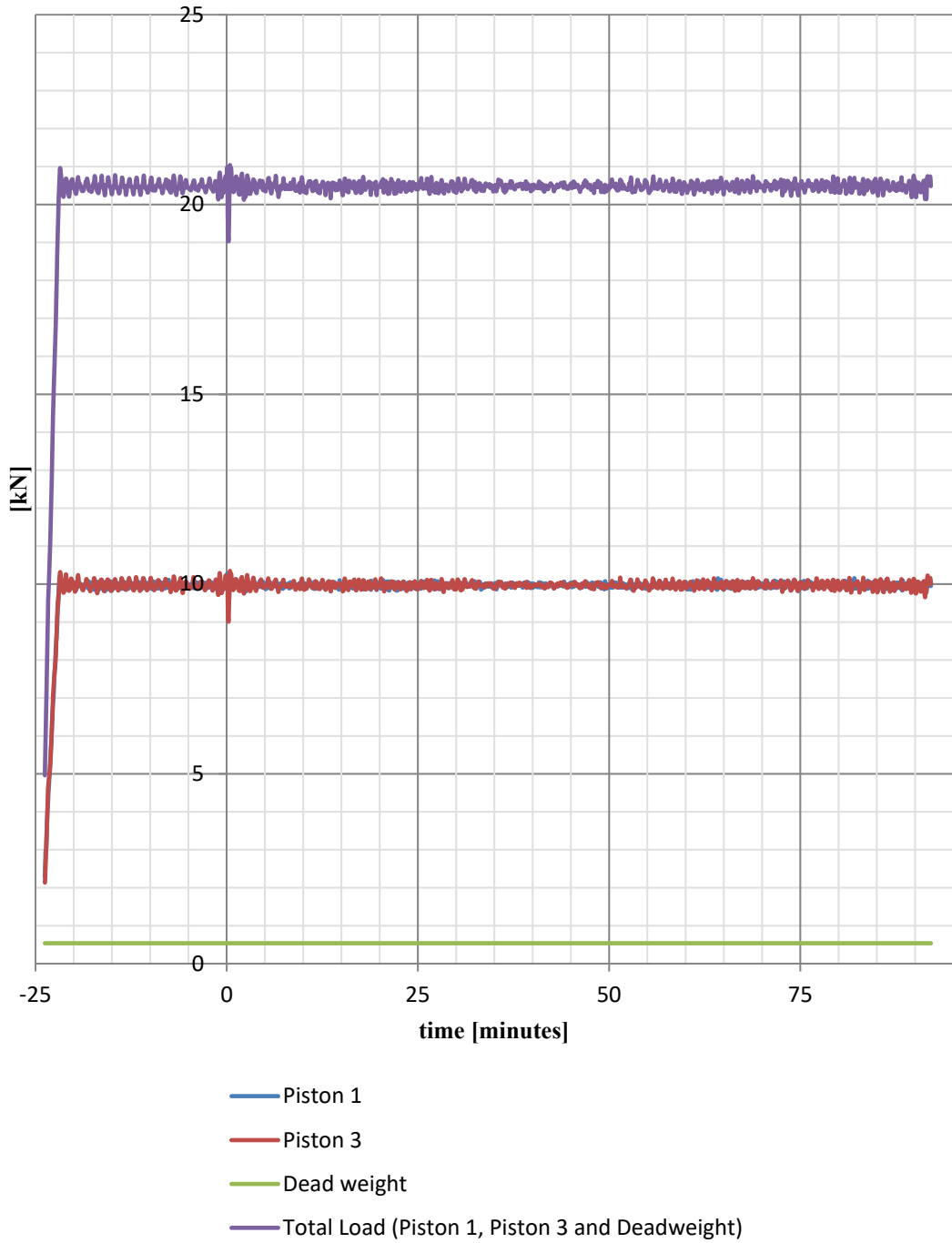


Transverse edges,  
perimeter and support  
details.



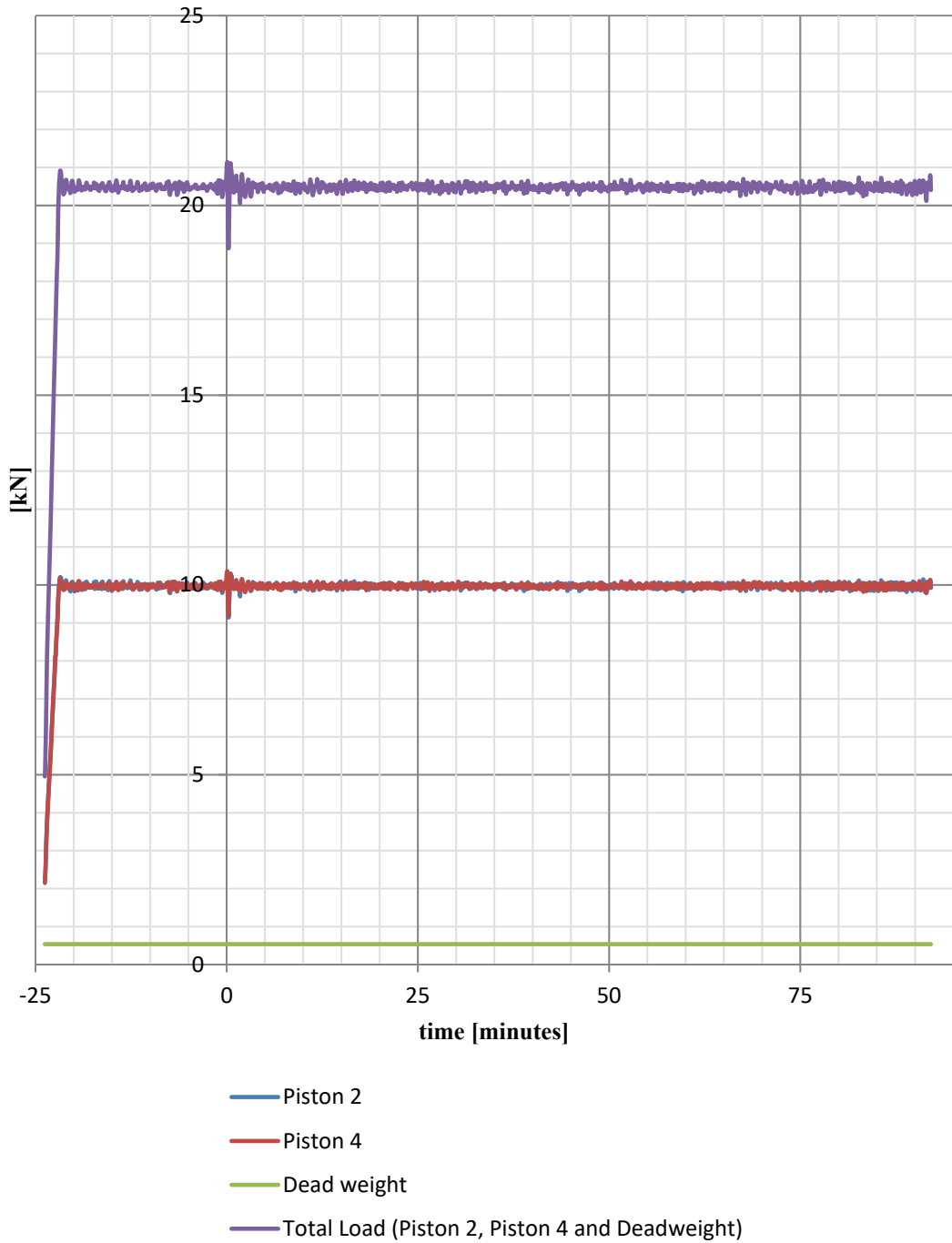
Appendix 3

Load level: Line load 1



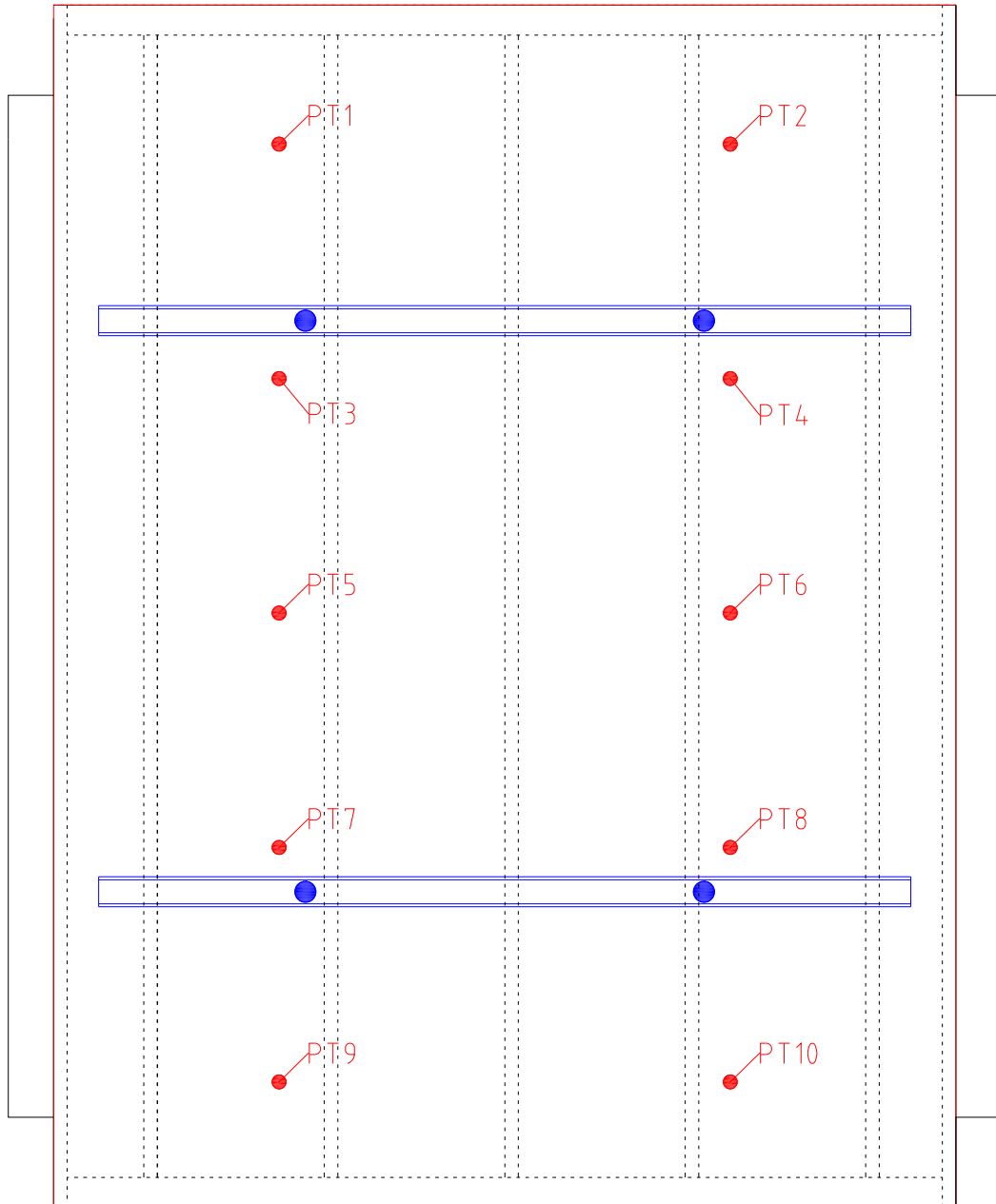
Appendix 3

Load level: Line load 1



Appendix 3

**Position of thermometers in the furnace**



PT1-PT10 Thermocouples in the furnace



Appendix 3

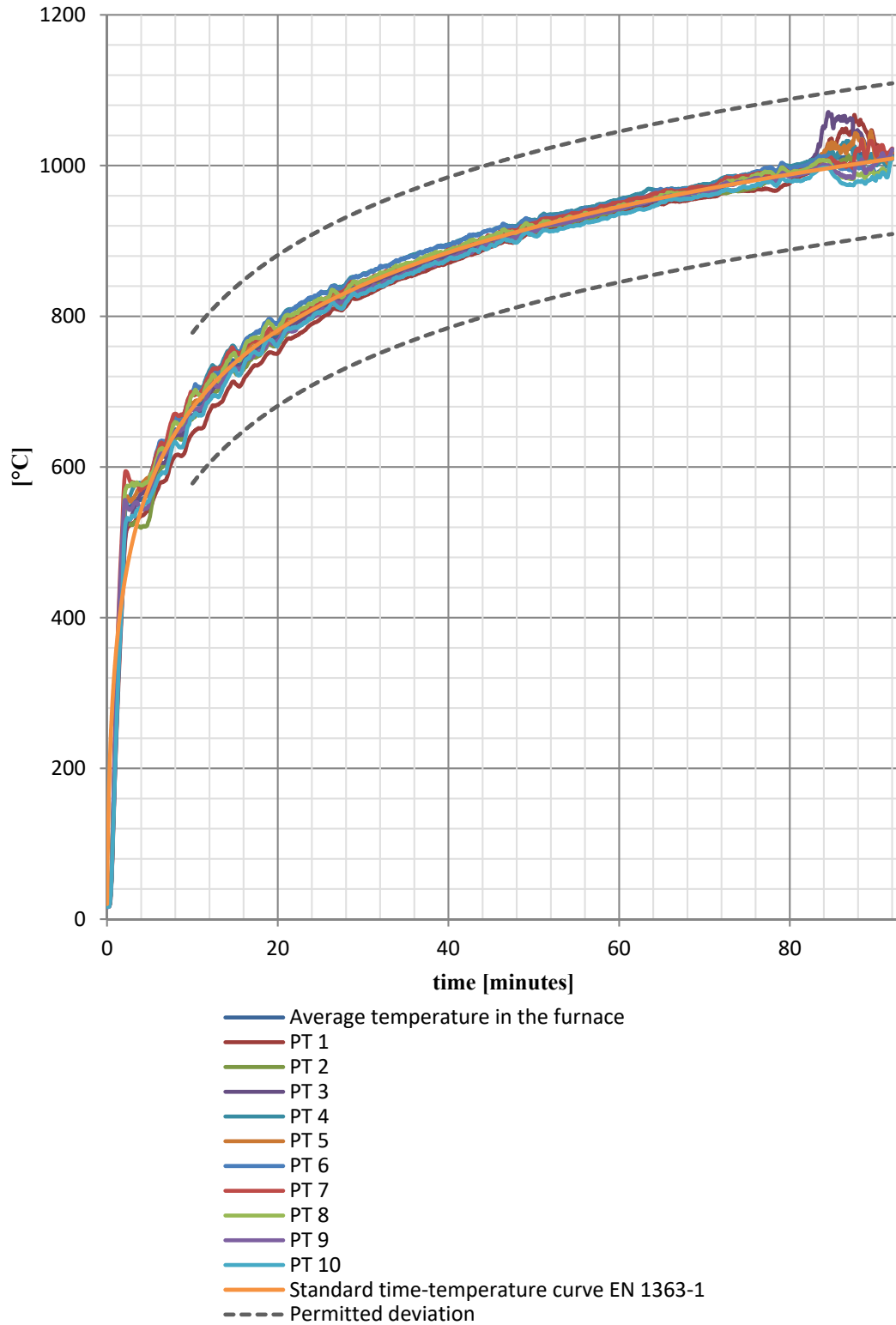
Test condition: The average temperature in the furnace



— Average temperature in the furnace — Standard time-temperature curve EN 1363-1

Appendix 3

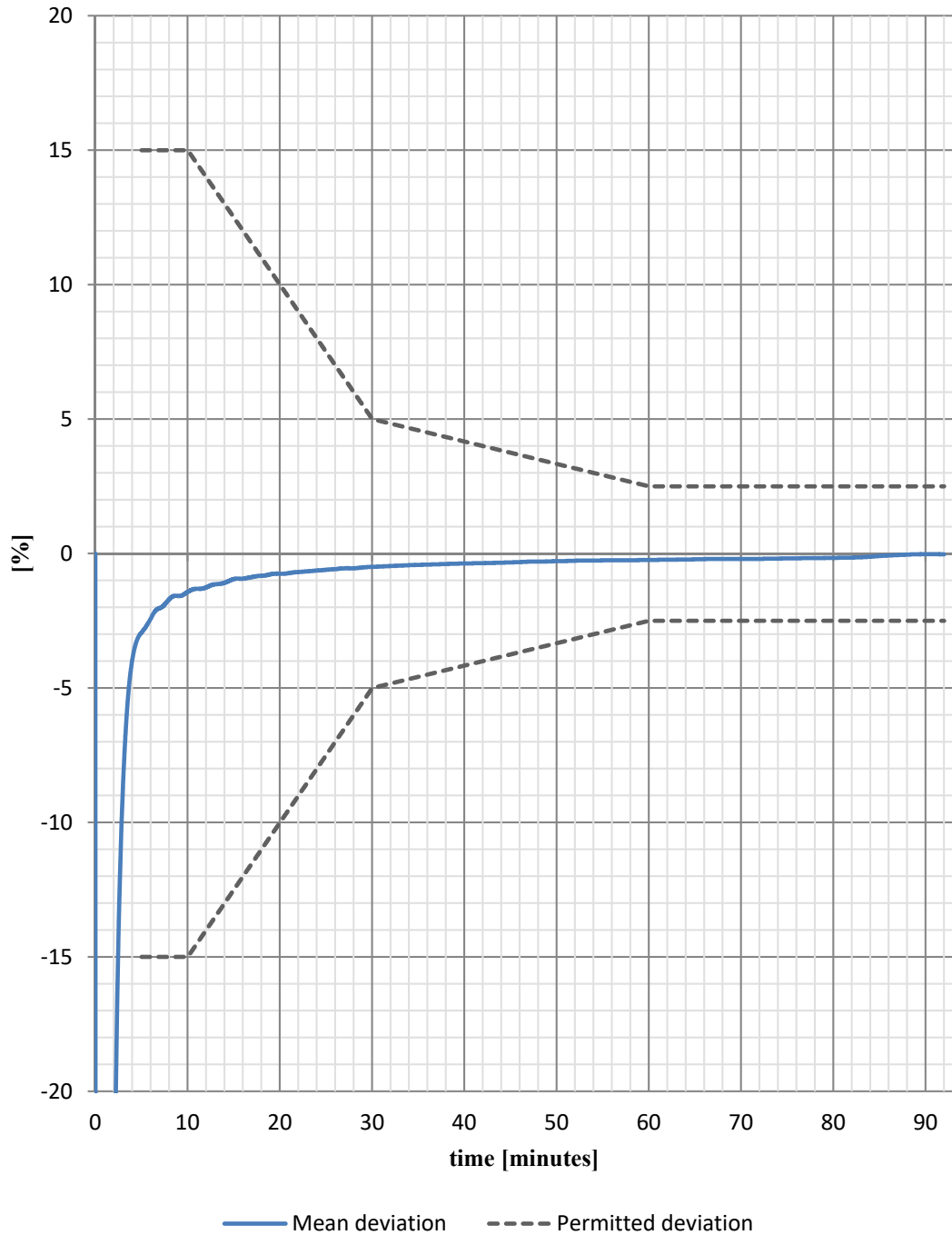
Test condition: The temperature at each thermometer



Thermocouple PT6 was out of order until 5,6 minutes of the test.

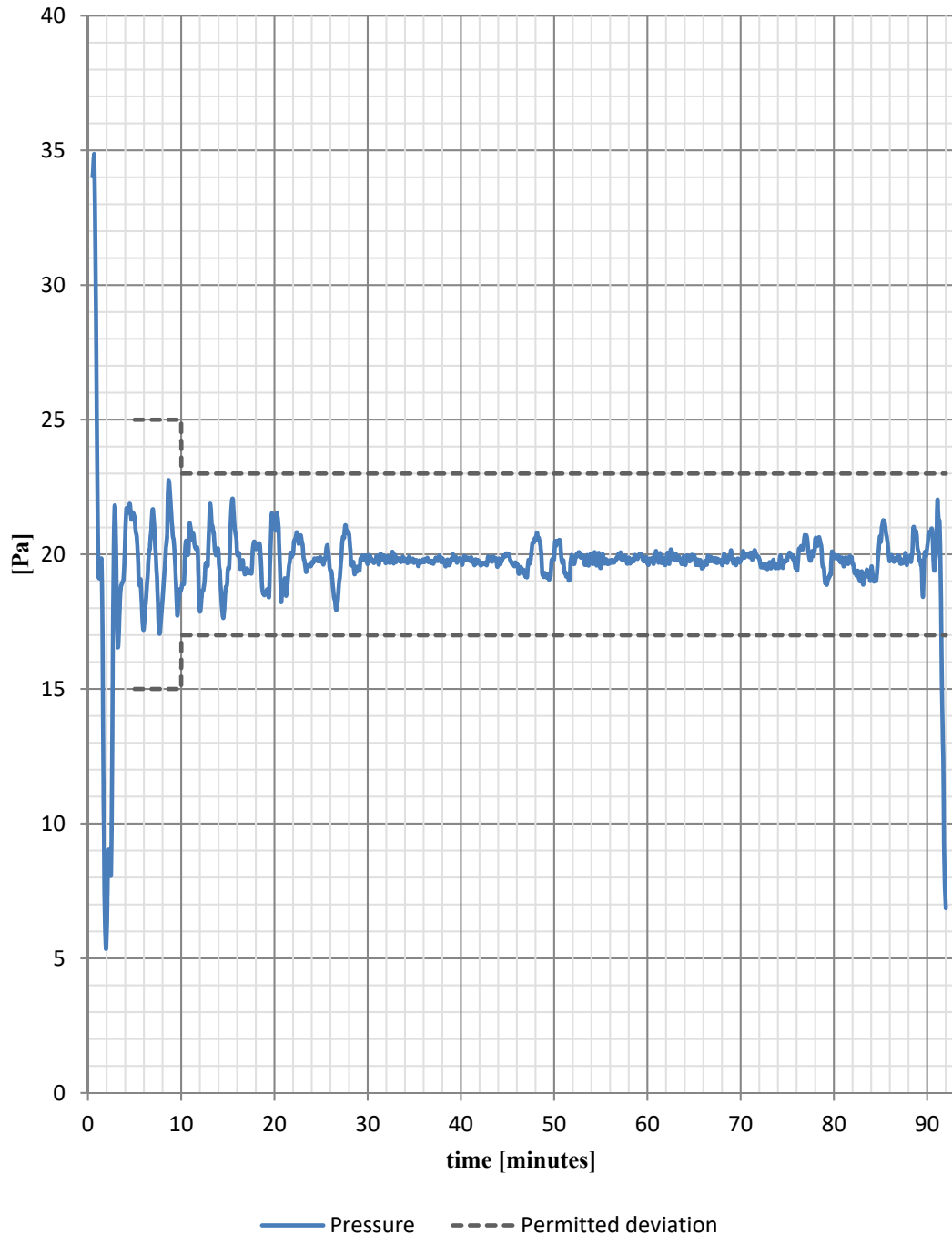
Appendix 3

**Test condition: The percent deviation of the furnace time-temperature**



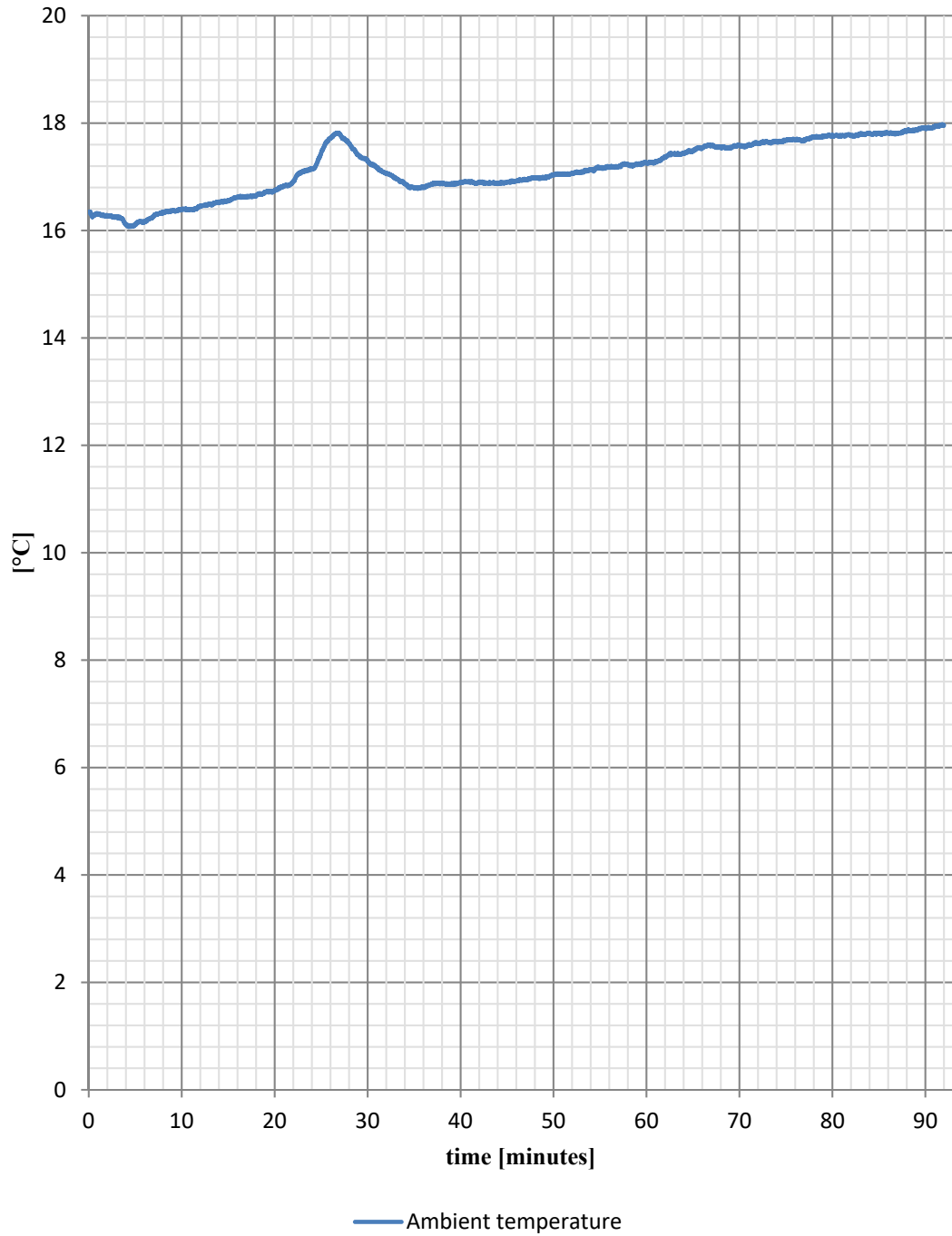
Appendix 3

**Test condition: The calculated furnace pressure on the height of the demand**



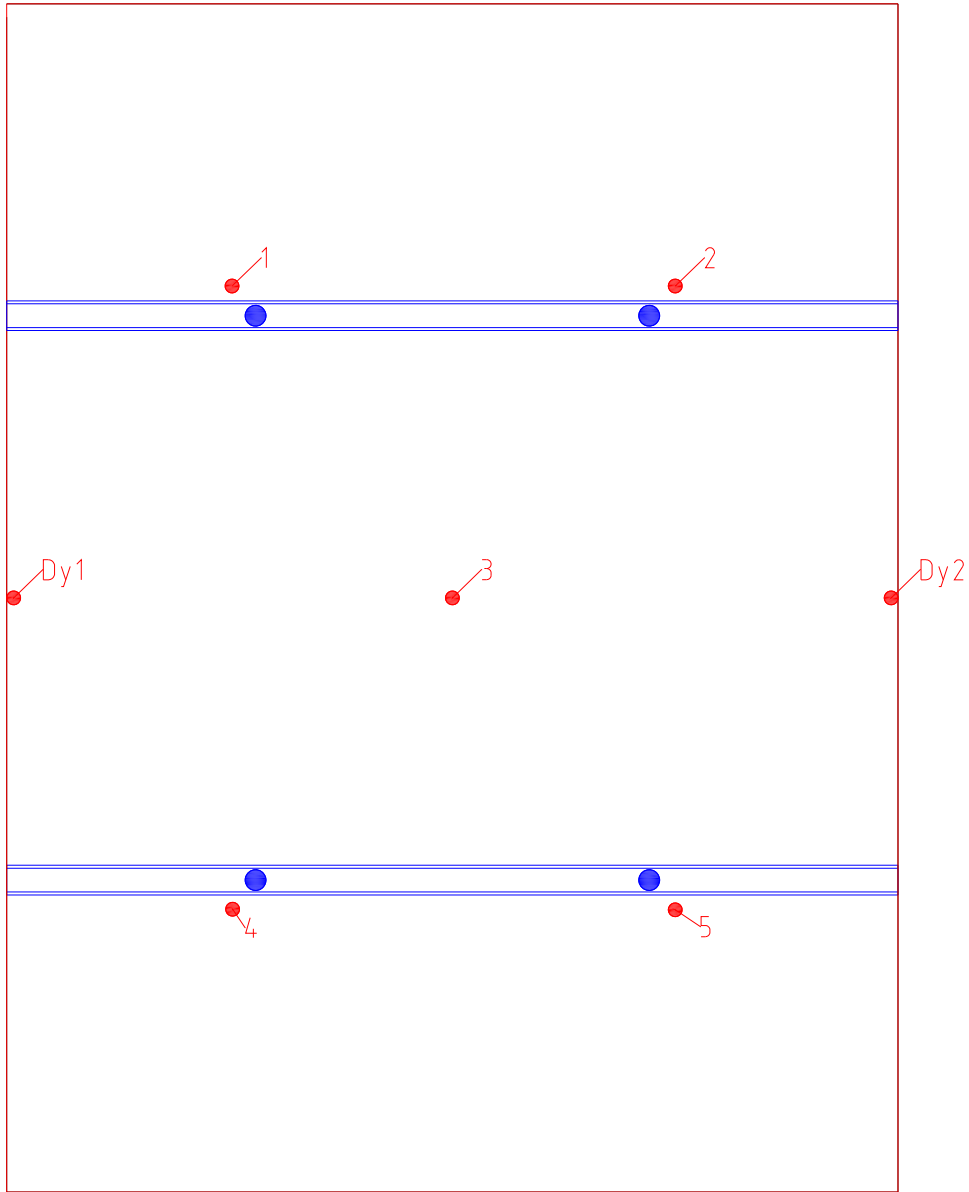
Appendix 3

**Test condition: The ambient air temperature during the test**



Appendix 4

### Position of thermocouples

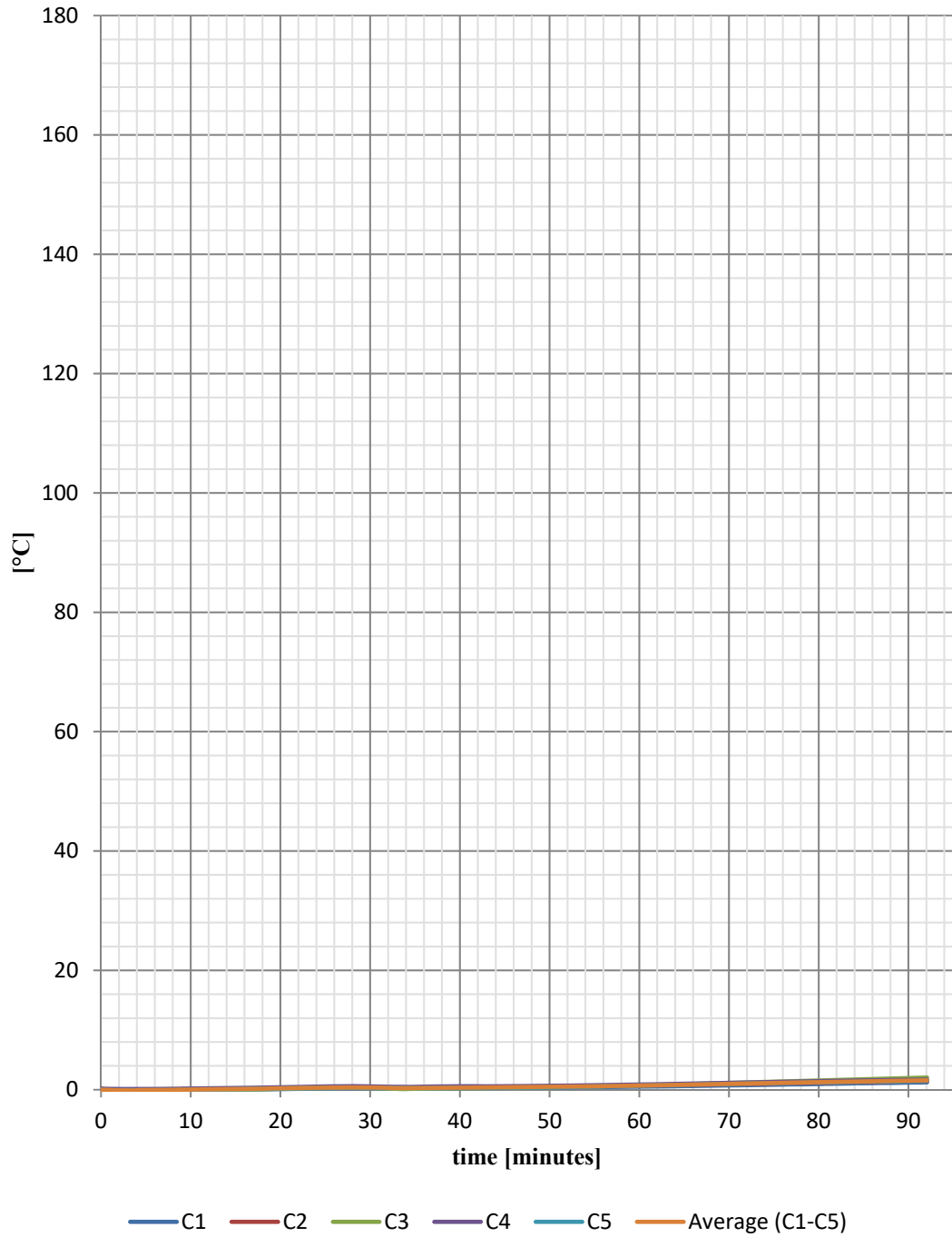


- Thermocouples  
1-5 Average temperature 50 mm from joints

Dy1 Dy2 Deflection

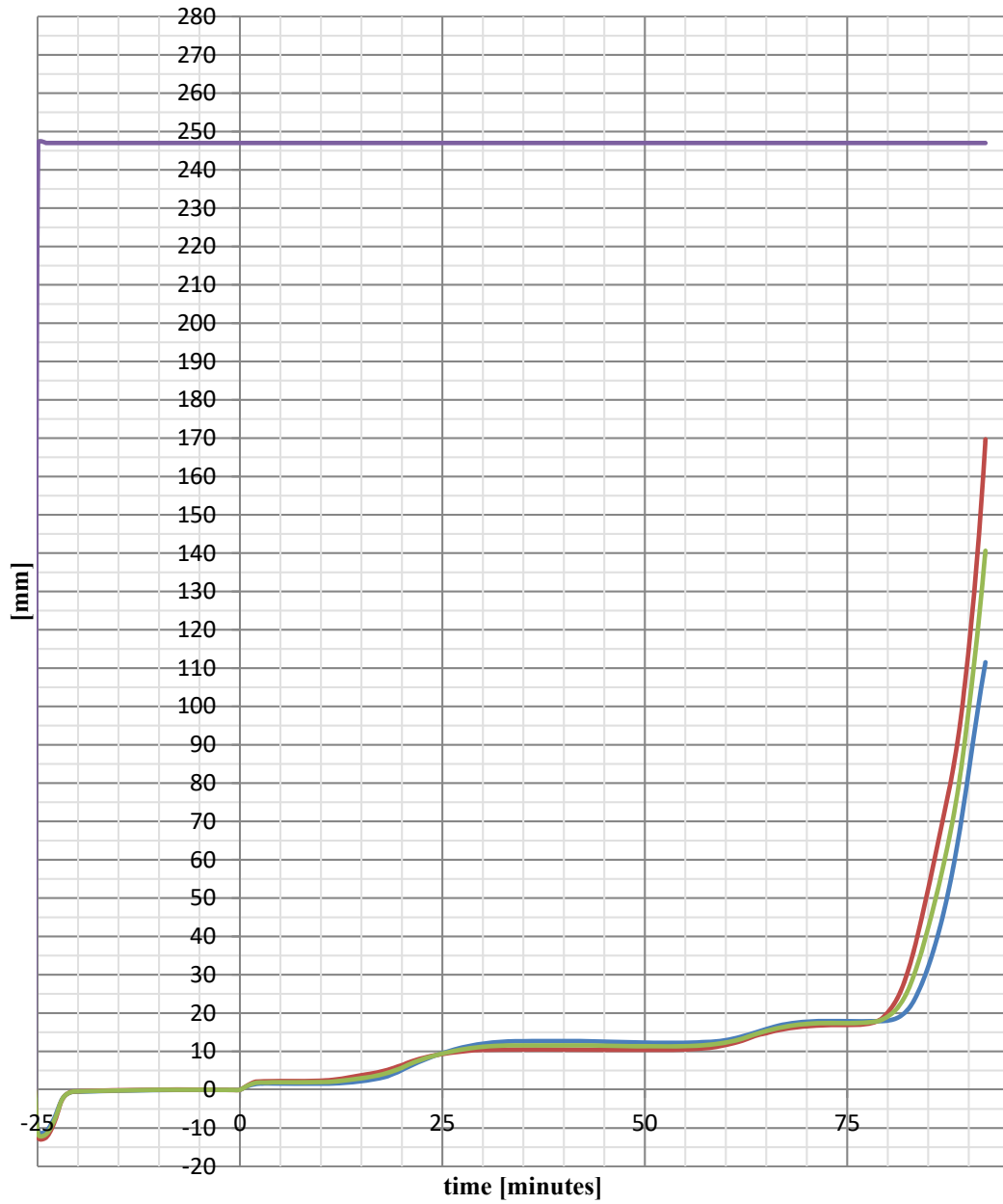
Appendix 4

### Temperatures on test specimen: Graph



Appendix 4

**Deflection**



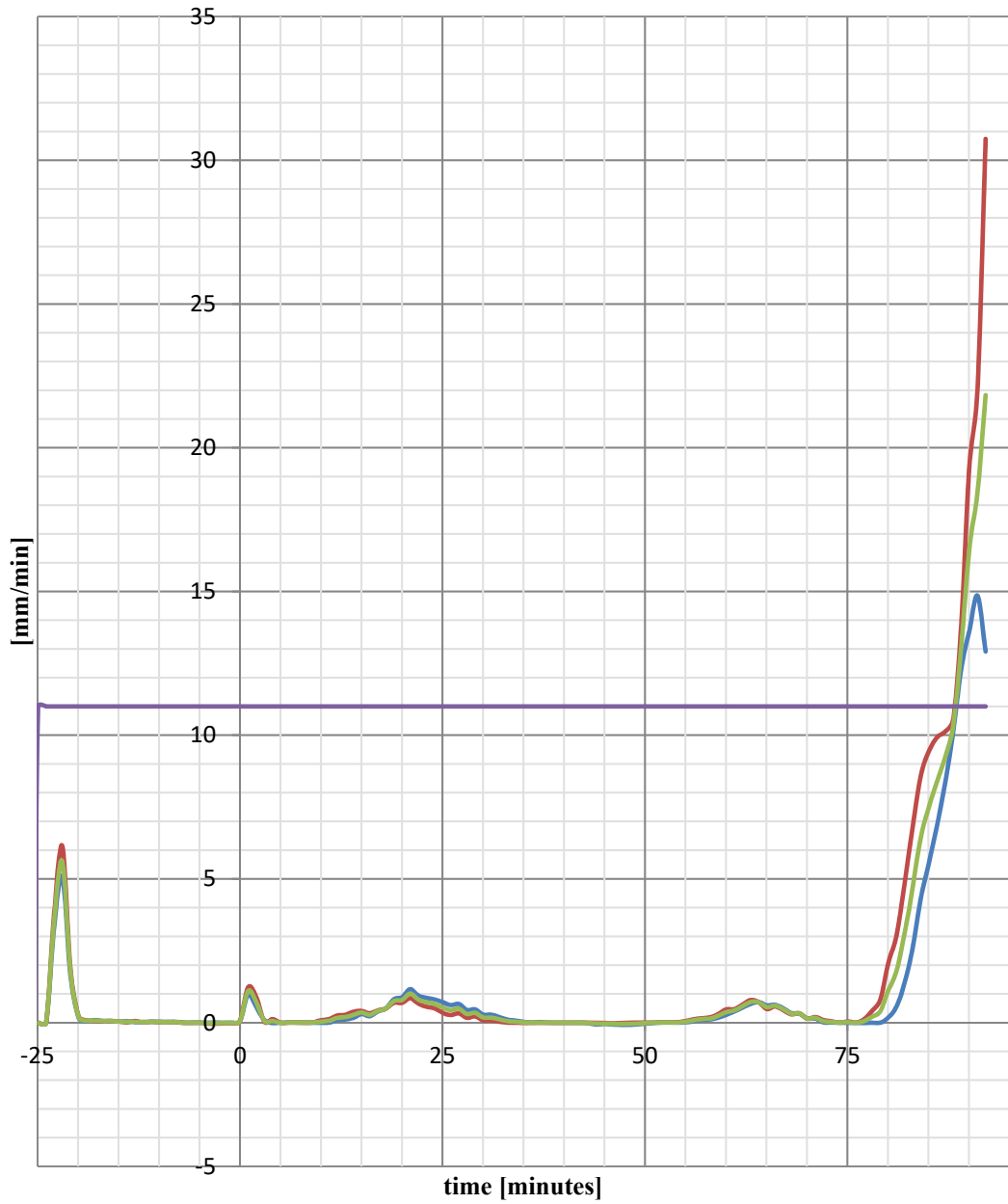
— Deflection Dy1                      — Deflection Dy2  
— Average deflection                      — Maximum permitted deflection

Positive values are deformation downwards.



Appendix 4

Calculated rate of deflection

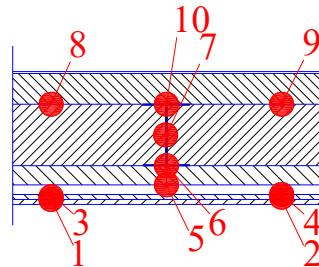
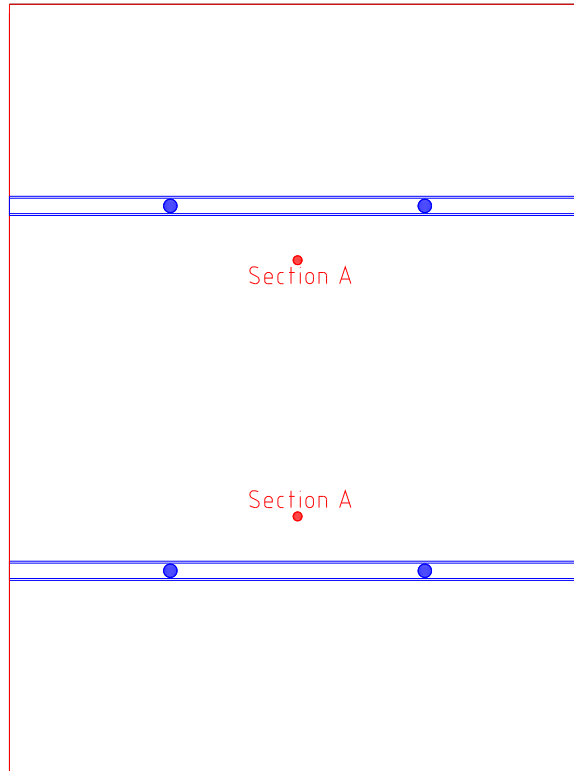


— Rate of deflection Dy1  
— Average rate of deflection

— Rate of deflection Dy2  
— Maximum permitted rate of deflection

Appendix 4

**Additional optional measurements: Temperatures inside test specimen: Position of thermocouples**



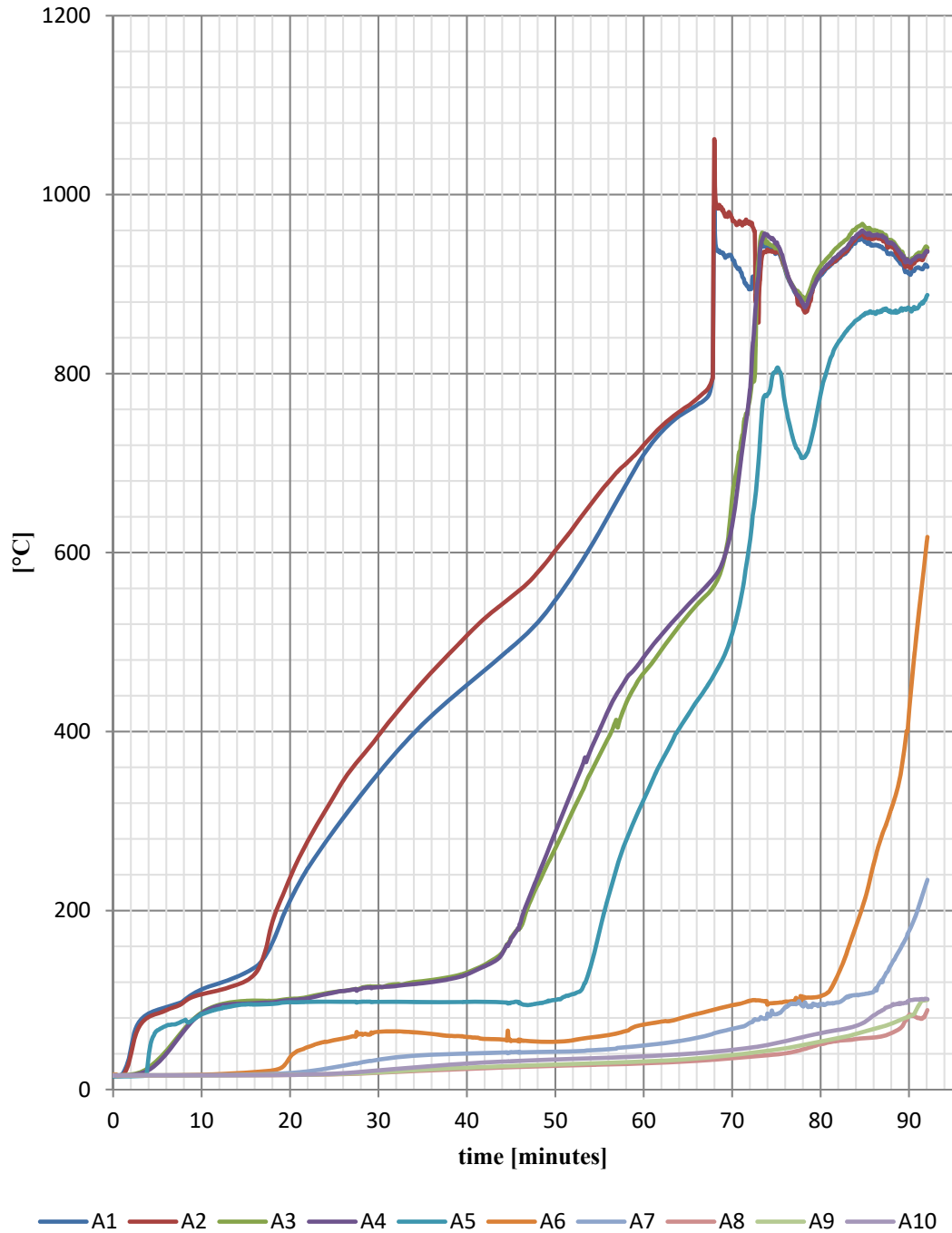
Additional thermocouples inside the construction

Cross Sections A and B

- A1-A2 Between the gypsum boards
- A3-A4 On the upper side of the inner gypsum board layer
- A5 At the joint on the underside of the insulation
- A6 At the joint on the under side of the steel frame
- A7 At the joint on half height of the steel frame
- A8-A9 At the upper side of the steel frame below the upper insulation
- A10 At the joint at the upper side of the elements below the upper insulation

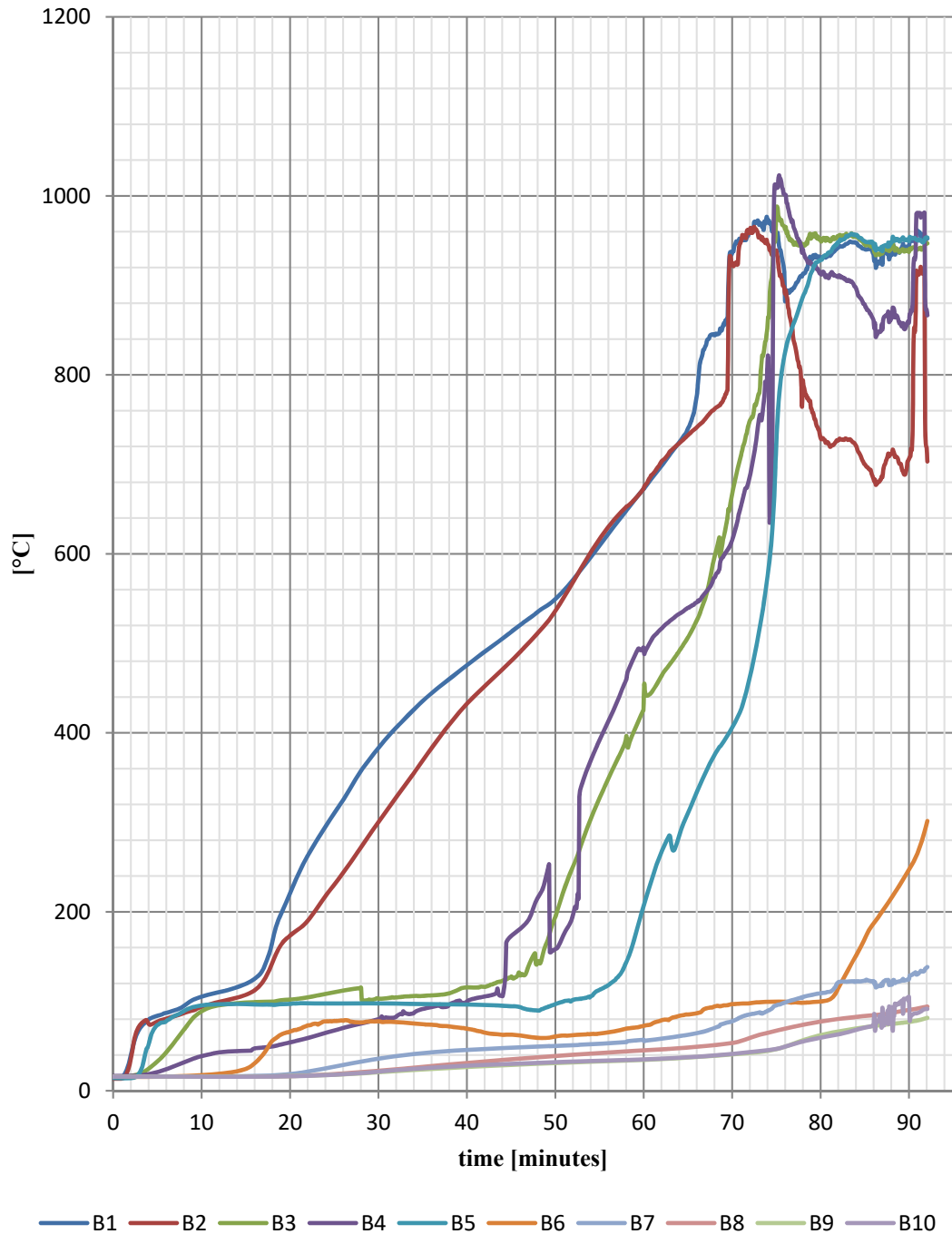
Appendix 4

**Additional optional measurements: Temperatures inside test specimen**



Appendix 4

### Additional optional measurements: Temperatures inside test specimen



## Appendix 4

**Photographs from the test**

*The test specimen after approx. 30 minutes of the test*



*The fire exposed side after approx. 20 minutes of the test.*

## Appendix 4

**Photographs from the test**

*The test specimen at the end of the test*



*The fire exposed side of the test specimen after the test*