

Ewes AB
Lundavägen 53
333 71 BREDARYD
SWEDEN

Fire resistance test of non-loadbearing wall

(4 appendices)

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 1364-1:2015
- EN 1363-1:2020

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

Non-loadbearing wall of wooden studs and gypsum plasterboards.

Product designation

Board, Norgips Standard/Normal 13
Screws, Ewes Sound Fastener and Gipsskruv gips 5,2x38 FZB

Sponsor/owner of the report

Ewes AB
Lundavägen 53
333 71 BREDARYD
SWEDEN

Reference number

O100402-1213768-1

RISE Research Institutes of Sweden AB

Postal address
Box 857
501 15 BORÅS
SWEDEN

Office location
Brinellgatan 4
504 62 Borås
SWEDEN

Phone / Fax / E-mail
+46 10-516 50 00
+46 33-13 55 02
info@ri.se

Confidentiality level
C3 - Sensitive

This report may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.



Accred. No. 1002
Testing
ISO/IEC 17025

1 The 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 non-loadbearing wall of wooden studs and gypsum plasterboards.

The manufacturer was Ewes AB.

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

2.2 Selection 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 the test.

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

The material for the test specimen arrived at RISE on September 22, 2023.

2.3 Description of the construction

The test specimen was built up by a framework of wooden studs. The framework was covered with two layers of gypsum boards on each side. The outer dimensions of the test specimen was (width x height) 2970 x 3020 mm.

Framework

The framework was built up by wooden studs and rails. The studs were mounted vertically and placed on the maximum centre distance 600 mm. The rails were mounted horizontally along the upper and lower edges of the framework.

Boards

The gypsum boards were designated Norgips Standard 12.5. The boards were manufactured with a nominal width of 1200 mm, a thickness of 12.5 mm and a nominal area weight of 9.1 kg/m². The boards were constructed with recesses along the longitudinal edges.

Joints

There were two layers of boards mounted on each side of the framework. The outer layer board towards the free edge at the fire exposed side was a full width board. On each layer boards were cut longitudinally to fit the framework and the width of the test specimen.

The boards were mounted with vertical joints between the longitudinal edges of the boards. The vertical joints were placed over studs. The vertical joints on each layer were staggered 600 mm between the two layers on each side of the test specimen.

On each side of the specimen boards were mounted with a horizontal joint. The joint in the inner layer were located 650 mm from the upper edge of the specimen and for the outer layer 500 mm from the upper edge. The horizontal joint of the outer layer was supported by a 100 mm wide steel strips.

Details

The inner boards were attached to the framework with screws of steel, named Soundfastener. Soundfastener screws were mounted on the maximum centre distance 250 mm in joint on studs and 250 mm along the outer edges of the boards and 250 mm in the centre on the outer layer, screws where mounted 15 mm from joints.

The boards at the outer layer were attached to the inner layer with screws of steel. Screws were mounted on the maximum centre distance 250 mm at joint on the inner layer boards and 250 mm along the outer edges of the boards and 250 mm in the centre of the board. Screws where mounted 50 mm from joints and centre of studs. Screws were mounted as described in Appendix 1.

The screw heads and the joints between the boards at the outer layers were puttied.

Information about the major components of the test specimen is tabulated below.

Table: Included components

Component	Product designation	Manufacturer/Supplier
Screw	EWES Sound Fastener	EWES AB
Screw	Gipsskruv gips 5,2x38 FZB	Västsvensk Byggskruv AB Borås
Screw	Gipsskruv bandad 3,5x25 FOS	Västsvensk Byggskruv AB Borås
Screw	Träskruv TFT 6x90 FZB	Västsvensk Byggskruv AB Borås
Metal strip	PB 100-0,46	Europrofil AB
Paper strip	Drywall 5075	Stovik
Joint filler	Dalapro Joint	Dalapro
Joint filler	Dalapro Nova	Dalapro
Studs	Wood stud 45x70 mm	-
Rails	Wood rail 45x70 mm	-
Board	Norgips Standard 12.5	Norgips Svenska AB
Soft Joint	Sikacryl HM	Sika

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 do not correspond 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 symmetrical with one face being mirror-inverted in relation to the other face. The impact of fire exposure to the test specimen is independent of whichever side the fire is exposed to.

Due to the symmetry of the test specimen, the test specimen was tested from one side only.

The result from the test is valid from both directions.

2.5 Test setup

The test setup can be seen in Appendix 2.

2.6 Supporting construction

The test specimen was mounted in RISE's concrete frame for fire tests with opening dimension (width x height) 3020 x 3020 mm.

To provide a Free edge, a seal without restricting freedom of movement and to fulfil the demands according to chapter 6.3.4 in the test method, a 45 mm thick board of resilient non-combustible mineral fibre was mounted at one side of the concrete frame.

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

2.7 Mounting of the test specimen

The test specimen was assembled and mounted in the supporting construction. The assembling and mounting of the test specimen were overseen by RISE.

The test specimen was mounted to the supporting construction with gun nails with a centre distance of 600 mm.

The right side of the test specimen was kept unrestrained to ensure free movement to fulfil the demands according to chapter 6.3.4 in the test method.

The mounting was performed between September 25 and 26, 2023 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 on average 23 °C and the relative humidity was on average 49 % during this time.

2.9 Verification

2.9.1 Verification of the construction of the test specimen

The verification that the test specimen was in accordance with the sponsor's drawings and specifications was carried out by RISE in conjunction with the assembling and mounting of the test specimen, see chapter "Selection and delivery of the test specimen". Samples of materials from the same batch of materials used for assembling the test specimen were picked out by RISE for verification of included materials.

Table: Control of materials

Material	Thickness [mm]	Density [kg/m ³]	Moisture ratio ¹ [%]	Moisture ratio ² [%]	Loss on ignition ³ [%]
Gypsum board	12.5	718	0.5	-	-
Wood stud	-	455	-	13.4	-

- 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 October 2, 2023.

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.

2.10 Placing of test specimen on the furnace

After the mounting of the test specimen in the concrete frame, the concrete frame and test specimen were placed on RISE's vertical furnace.

3 Test procedure and results

3.1 General information

The test was performed on October 3, 2023. The test lasted for 66 minutes.

The test was performed on RISE's vertical furnace for fire resistance test. The maximum fire-exposed area of the furnace is (width x height) 3000 x 3000 mm and the depth of the furnace is 1800 mm. The heat exposure comes from 6 propane driven burners.

3.2 Witness of test

The test was witnessed by Mr David Gaulier.

3.3 Fire test procedure

The fire test means in principle that the test specimen is subjected to a standardized fire exposure from one side (fire-exposed side) and measurements and visual judgments are performed at the opposite side (unexposed side). The extent of the measurements and assessments depends on the sponsor's requested use of the results from the test.

3.4 Test conditions

The furnace was controlled in accordance with EN 1363-1:2020.

3.4.1 Temperatures

The furnace temperature was measured with 6 plate thermocouples (PT1 - PT6). The plate thermocouples were positioned approximately 100 mm from the fire-exposed surface of the test specimen at the commencement of the test. The position of the thermocouples can be seen in Appendix 3.

The average temperature in the furnace (average of PT1 - PT6) in relation to the standard time-temperature curve is shown in Appendix 3.

The temperature of each plate thermometer (PT1 - PT6) in relation to the standard time-temperature curve and permitted deviation are shown in Appendix 3.

The deviation in per cent 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.

3.4.2 Pressure

The furnace pressure was controlled so that a pressure of 20 Pa was maintained at the level of the top edge of the test specimen. With a pressure gradient of 8,5 Pa/m the neutral pressure plane was by calculation adjusted to be established at a level of 647 mm above the lower edge of the test specimen (the notional floor level).

The furnace pressure was controlled at the position 620 mm above the lower edge of the test specimen. Using a pressure gradient of 8.5 Pa/m the control pressure was calculated to be -0,23 Pa in order to establish a pressure of 20 Pa at a level of the top edge of the test specimen.

The calculated furnace pressure on the top edge of the test specimen and permitted deviation is shown in Appendix 3.

The equipment for pressure measurements fulfils the EGOLF recommendation 024Rev1-2018. The measured pressure is presented in the graph as a moving average over a period of one minute.

3.5 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 21 °C.

The ambient air temperature during the test was in accordance with EN 1363-1:2020.

The ambient temperature was measured with a thermocouple located close to the furnace.

3.6 Measurements on the test specimen

During the test, the properties needed for the requested classification by the sponsor were measured and the behaviour of the test specimen was evaluated during the heat exposure.

3.6.1 Temperatures

The temperature rise on the unexposed side of the test specimen was measured with 19 thermocouples (C1 – C19). The position of the thermocouples is 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 – C19) at the start of the test was 21.7°C.

3.6.2 Deflection

The horizontal deflection of the test specimen during the test was measured with a potentiometer. The measuring position can be seen in Appendix 4.

The measured deflection is shown in Appendix 4.

3.6.3 Additional optional measurements

The temperature inside the test specimen was measured with 12 thermocouples. The thermocouples were placed in cross-section sections (A, B, C, and D). The thermocouples were positioned as shown in Appendix 4.

3.7 Observations

3.7.1 Photographs from the test

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

3.7.2 Observations during the test

Table: Observations

Time [min:s]	Observations (refer to the unexposed side if nothing else is stated)
00:00	The test starts.
04:40	Light smoke production at upper edge.
05:40	Fire-exposed side: Charred surface.
08:00	Light smoke production at free edge.
14:40	Fire-exposed side: Putty gone on entire test specimen.
21:15	Light smoke production at lower left edge between frame and test specimen.
22:00	Fire-exposed side: Outer layer vertical and horizontal joints open up approx. 10 mm.
25:30	Fire-exposed side: Outer layer has a small vertical crack in the centre of the middle board (behind section A).
29:30	Fire-exposed side: Screws in horizontal joints at outer layer cracks towards joints.
36:30	Fire-exposed side: Outer layer joints open up approx. 25mm
50:00	Fire-exposed side: Upper half board at outer layer (behind section A) has fallen of.
54:20	Fire-exposed side: Board at inner layer (behind section A) has fallen of.
56:10	Fire-exposed side: All studs are visible
57:00	Screws approx. 30 cm below top edge of test specimen are discoloured.
58:00	Screw in vertical joints are discoloured.
59:30-59:55	Integrity test with a cotton wool pad is performed at approx. 50 cm left of C7. The cotton wool pad was not affected during the test.
65:00	Smoke production at upper right edge.
66:30	The test terminates on request of the sponsor.

- 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.

3.8 Post-test measurements and observations

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

3.8.1 Observations after the test

Unexposed side

Screws are slightly discoloured. Boards at inner layer are still attached with some horizontal cracks at mid height. No other visible impact.

Fire-exposed side

Studs are charred and some pieces has fallen off. All boards are missing.

4 Summary

The test specimen, a non-loadbearing wall of wooden studs and gypsum plasterboards, has been tested according to the accredited test methods:

- EN 1364-1:2015
- EN 1363-1:2020

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 66 minutes.

Summary of results

Table: Summary of integrity measurements

Integrity	Result
• Sustained flaming exceeding 10 seconds	66 minutes no failure*
• Gap gauges diameter 6 mm and 25 mm	66 minutes no failure*
• Cotton wool pad test	66 minutes no failure*

Table: Summary of temperature measurements

Insulation	Result
• Average temperature rise, 140 °C	66 minutes no failure*
• Maximum temperature rise, 180 °C	66 minutes no failure*

Table: Summary of deflection measurement

Deflection	Result
• Deformation exceeds ± 100 mm for the first time during the test	66 minutes no failure*
• Maximum deflection during the test	47 mm (out from the furnace) after 66 minutes

**The test terminates on 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 1364-1 in chapter 13.

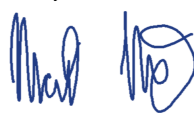
RISE Research Institutes of Sweden AB Fire and safety - Fire Resistance Management

Performed by



Pär Johansson (BRk),

Examined by



Malin Mollsjö

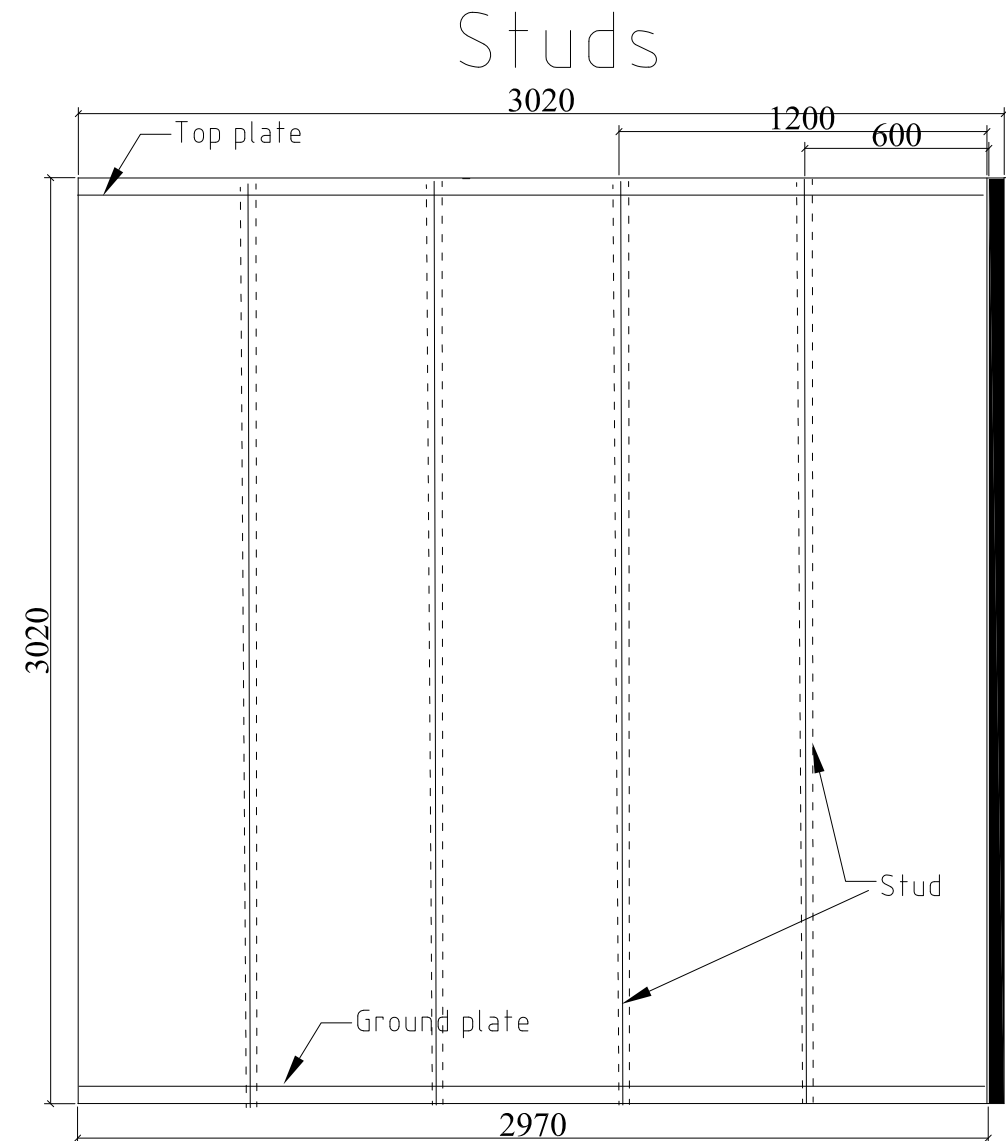
Appendices

Table: Appendices

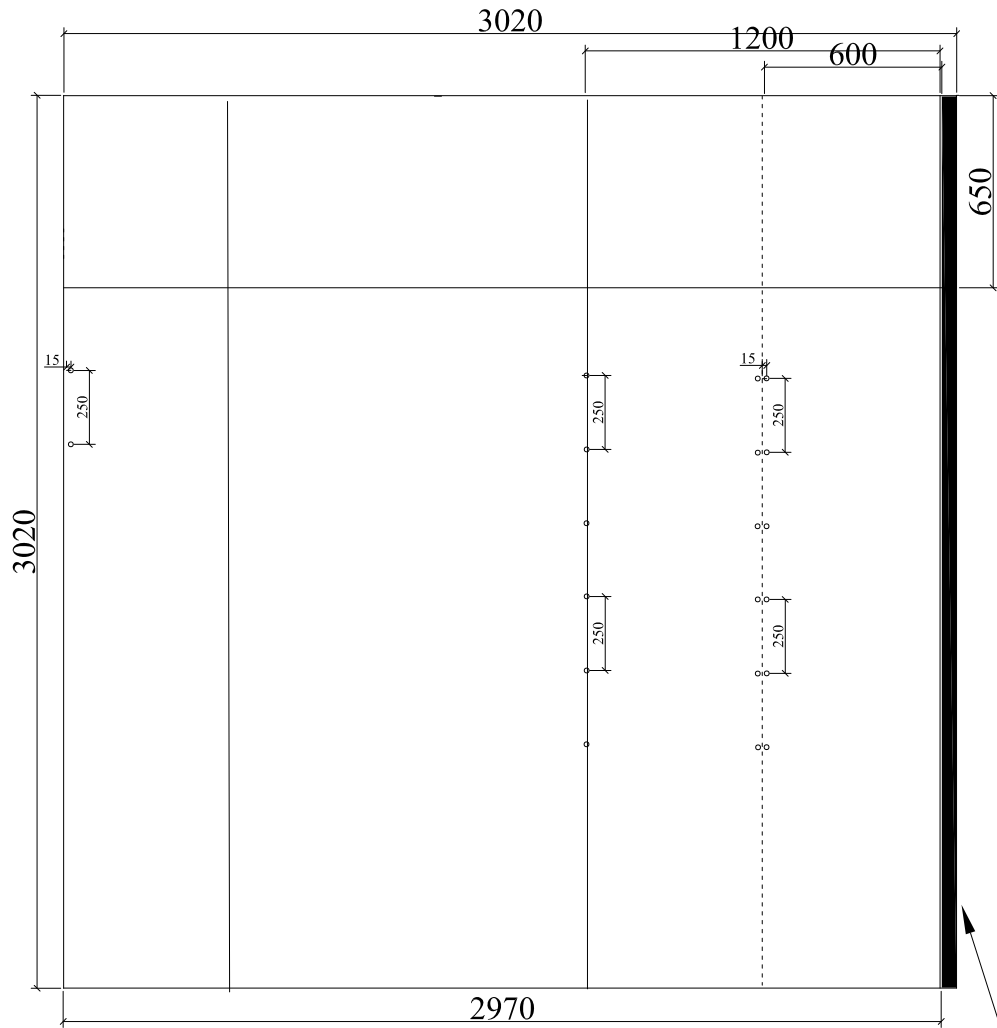
Appendix	Description	Page
1	Drawings and specifications from the sponsor	1-3
2	Test setup	1
3	Position of the thermocouples in the furnace	1
	Test conditions	2-6
4	Instrumentation of test specimen	1
	Temperatures on test specimen: Graph	2-5
	Additional optional measurements	6-8
	Deflection	9
	Photographs from the test	10-11

- Inner layer: Sound fastener Screw, 10-15 mm from joint. Cc 250 mm for joint and stud.
- Outer layer: Screw 50 mm from joint and stud. Cc 250 mm for joint, and stud.
- Outer layer: Screw 15 mm from horizontal joint, cc 200 mm.

Notice: All included components for the construction can be seen in report 0100402-1213768-1 page 3.

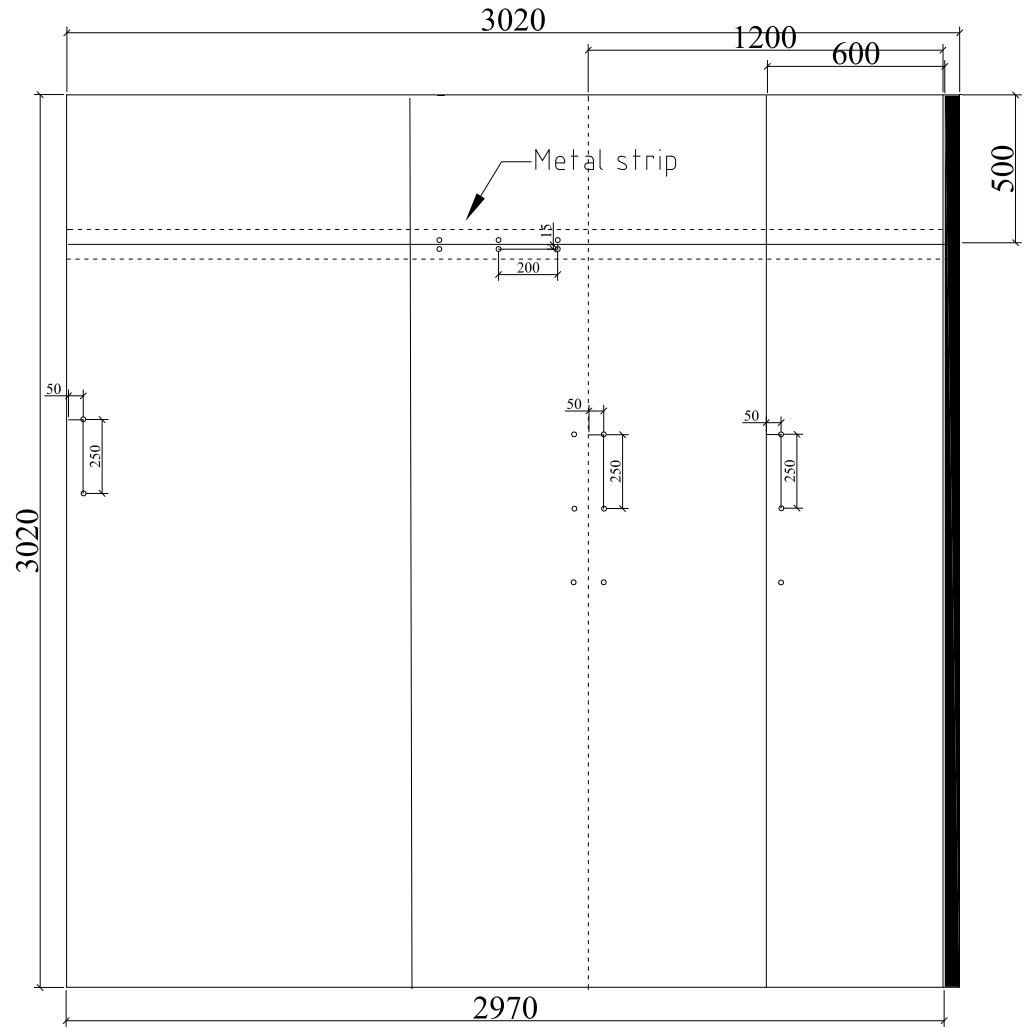


Unexposed side
Inner layer

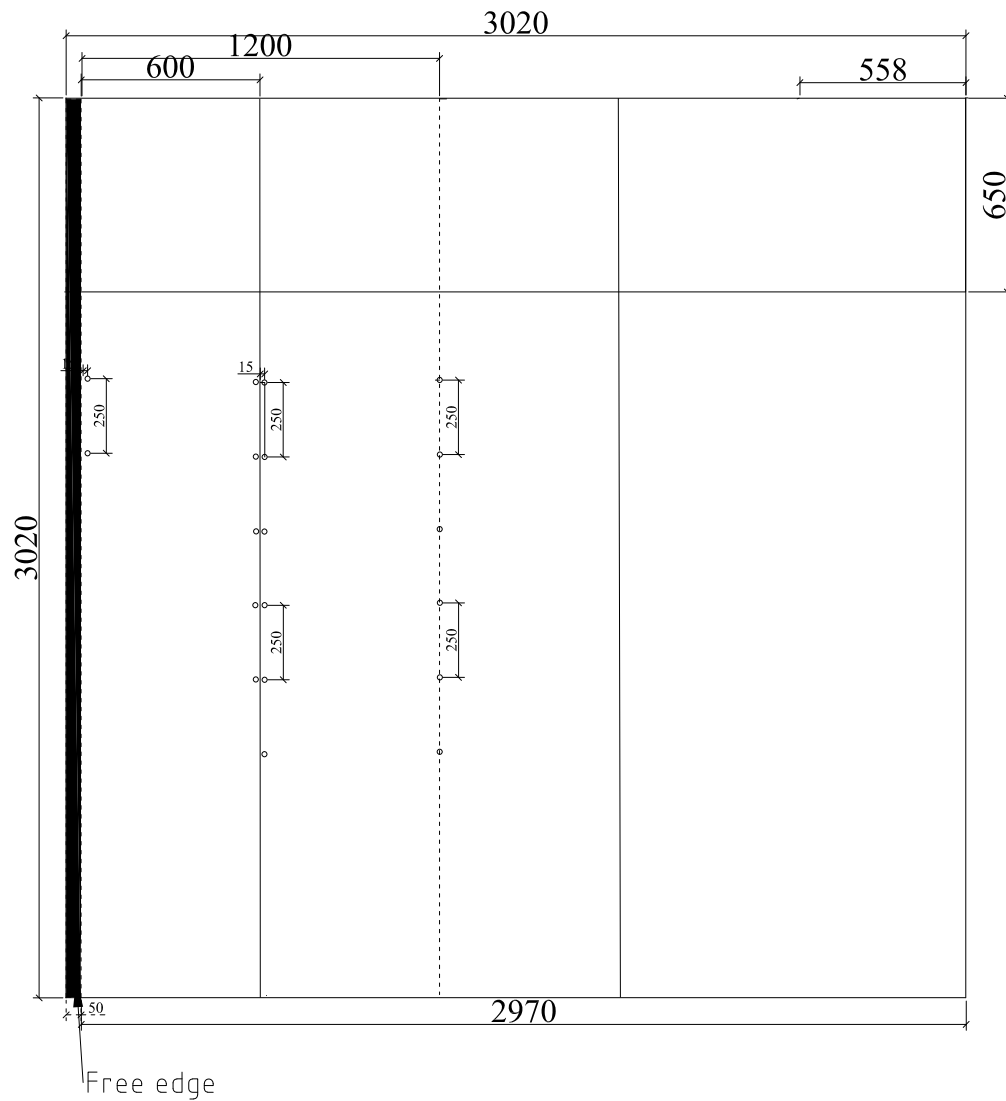


- Free edge

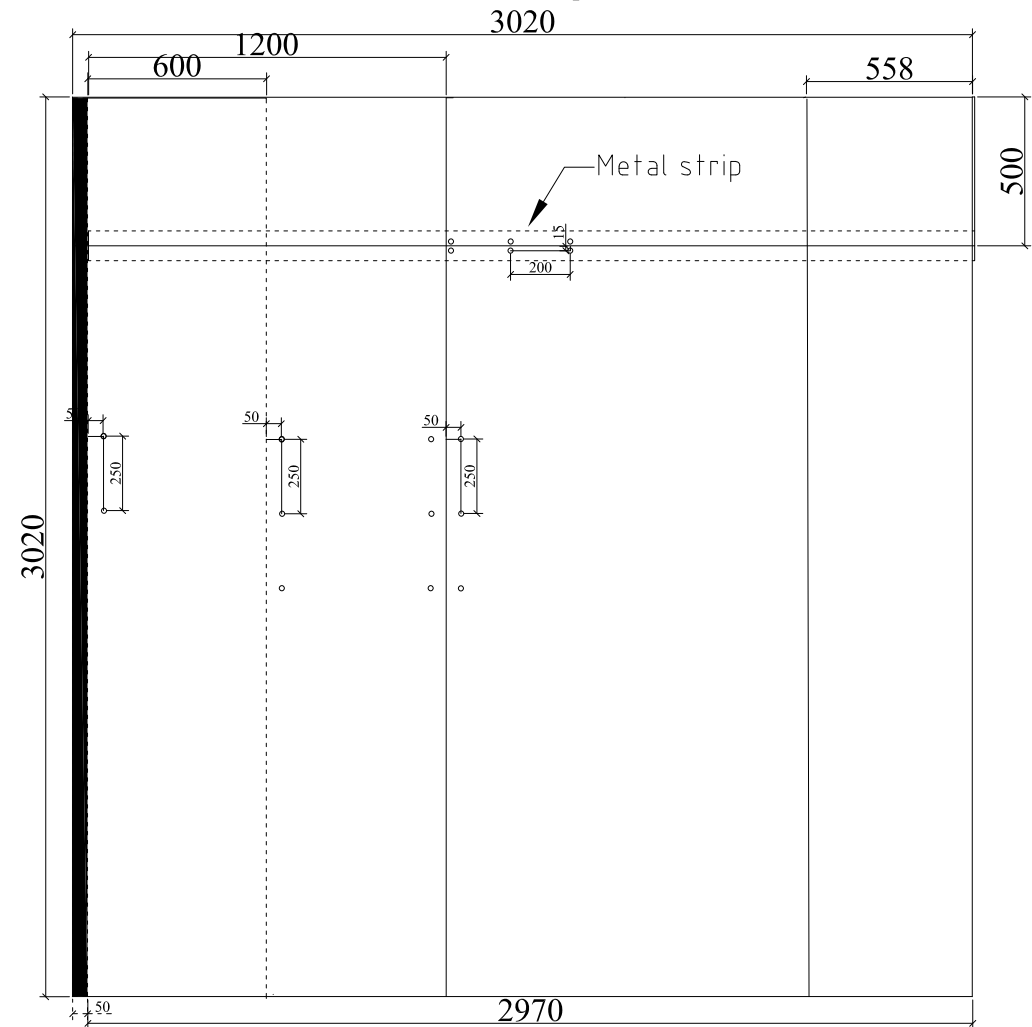
Outer layer



Exposed side
Inner layer

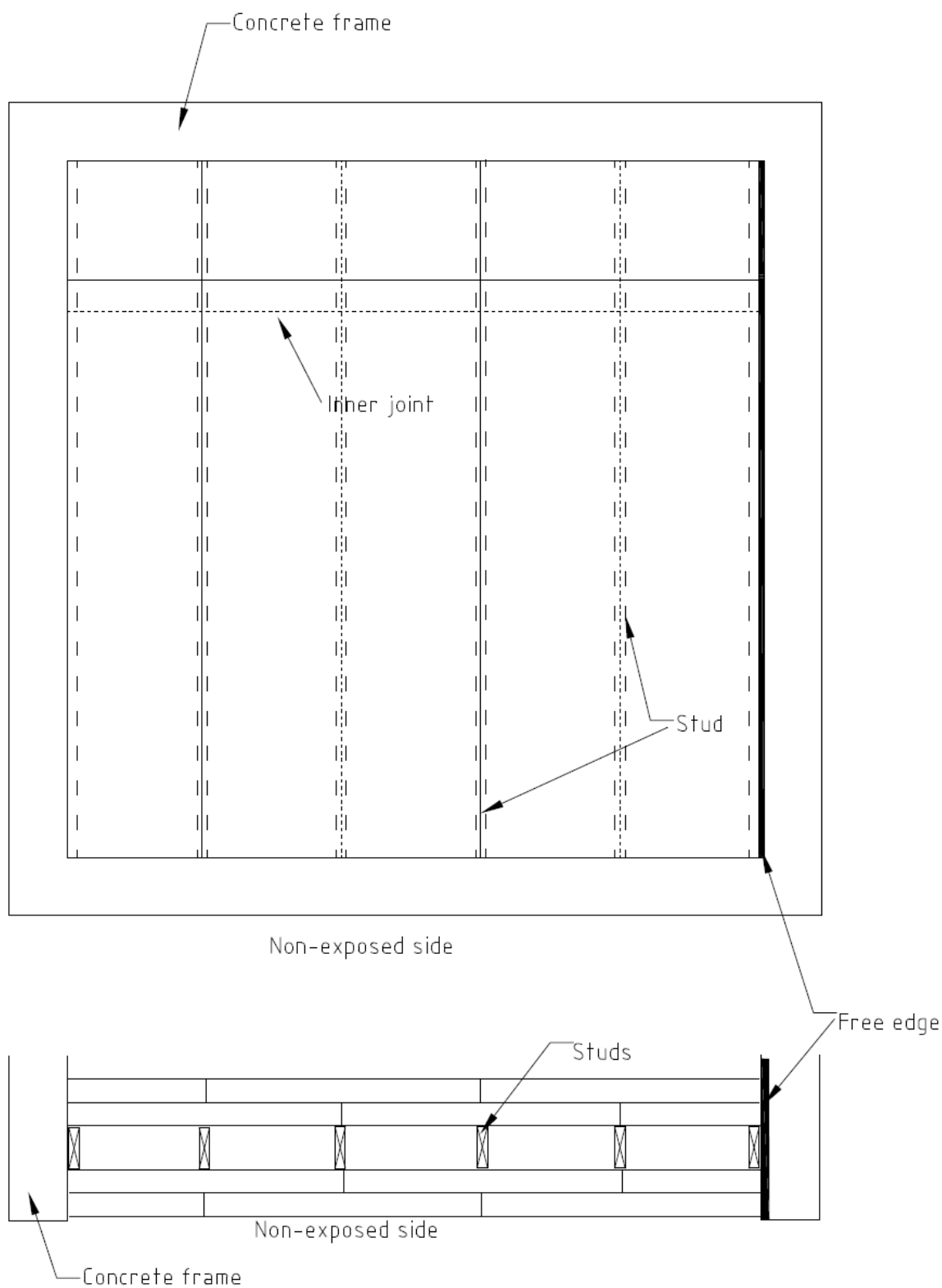


Outer layer



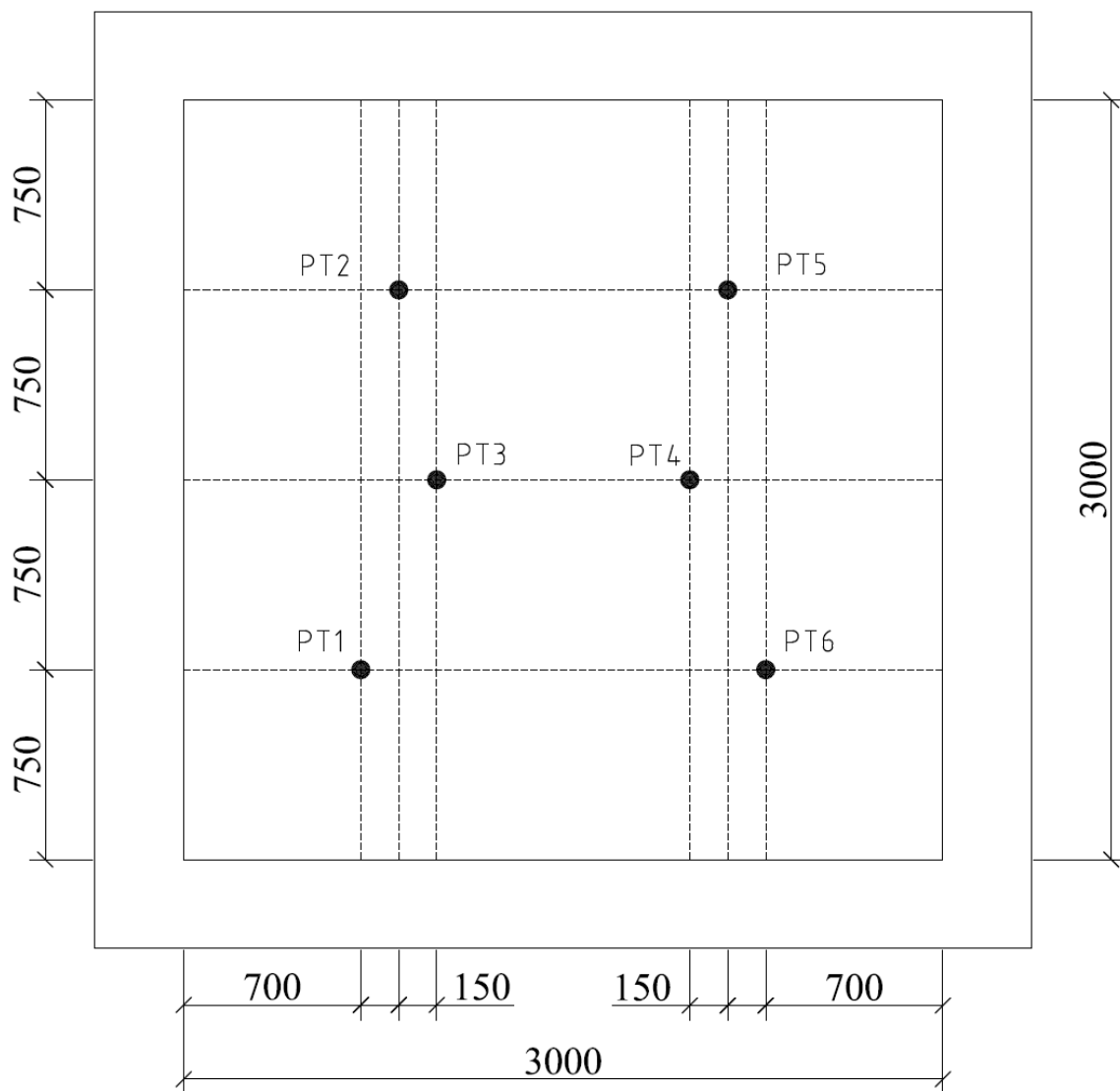
Appendix 2

Test setup



Appendix 3

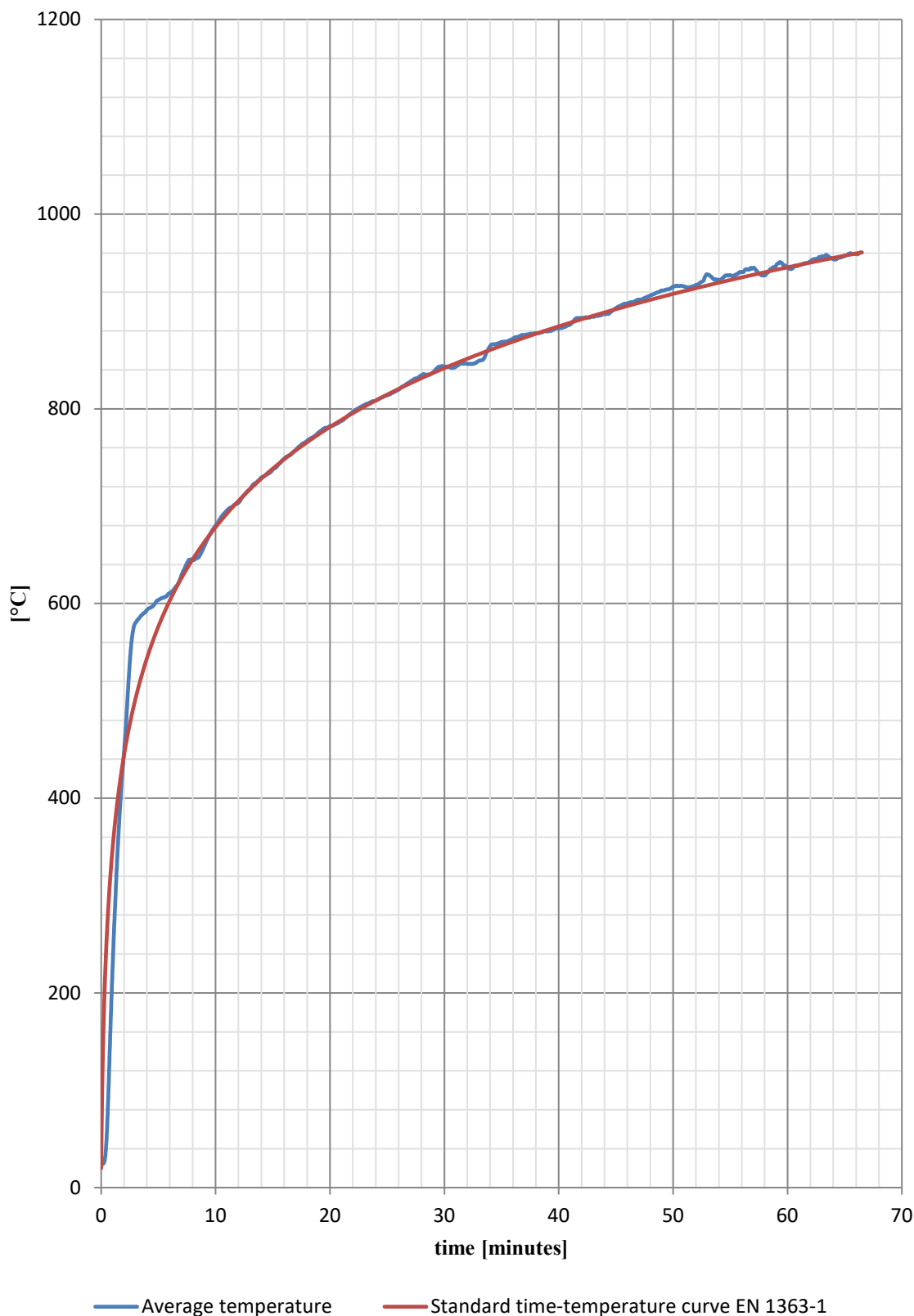
Position of the thermocouples in the furnace



● PT1-PT6: Thermocouples in the furnace

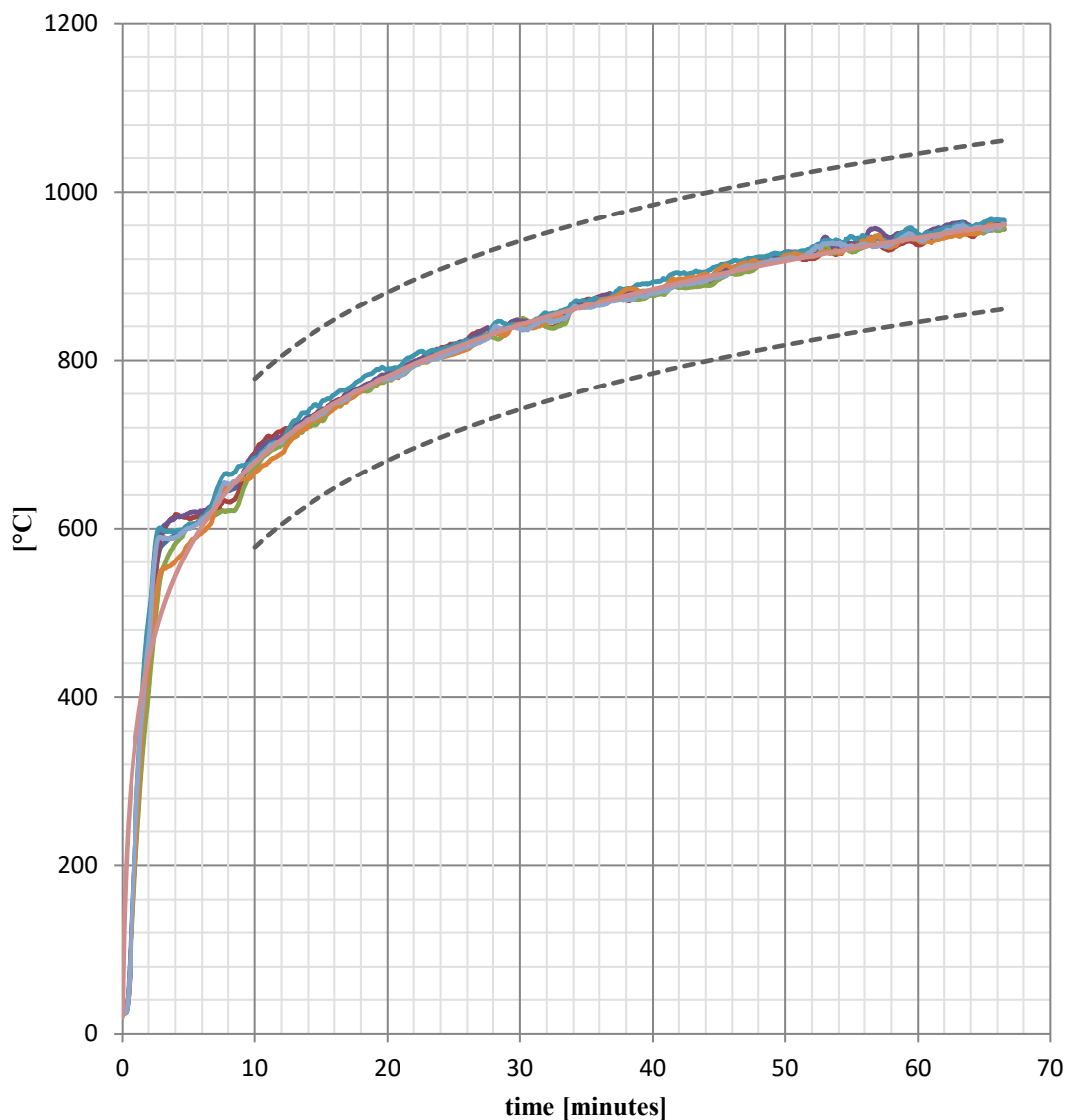
Appendix 3

Test condition: The average temperature in the furnace



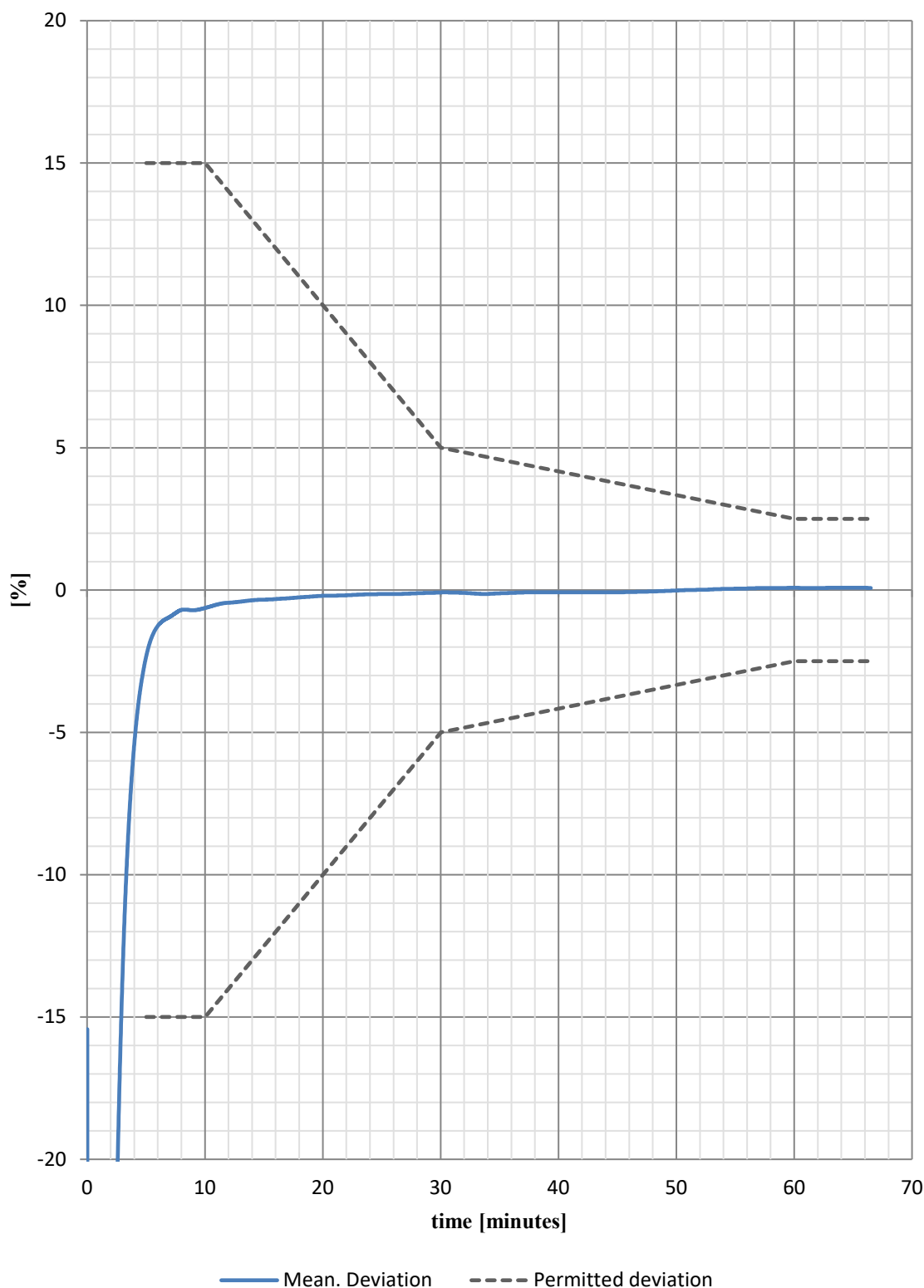
Appendix 3

Test condition: The temperature of each thermometer

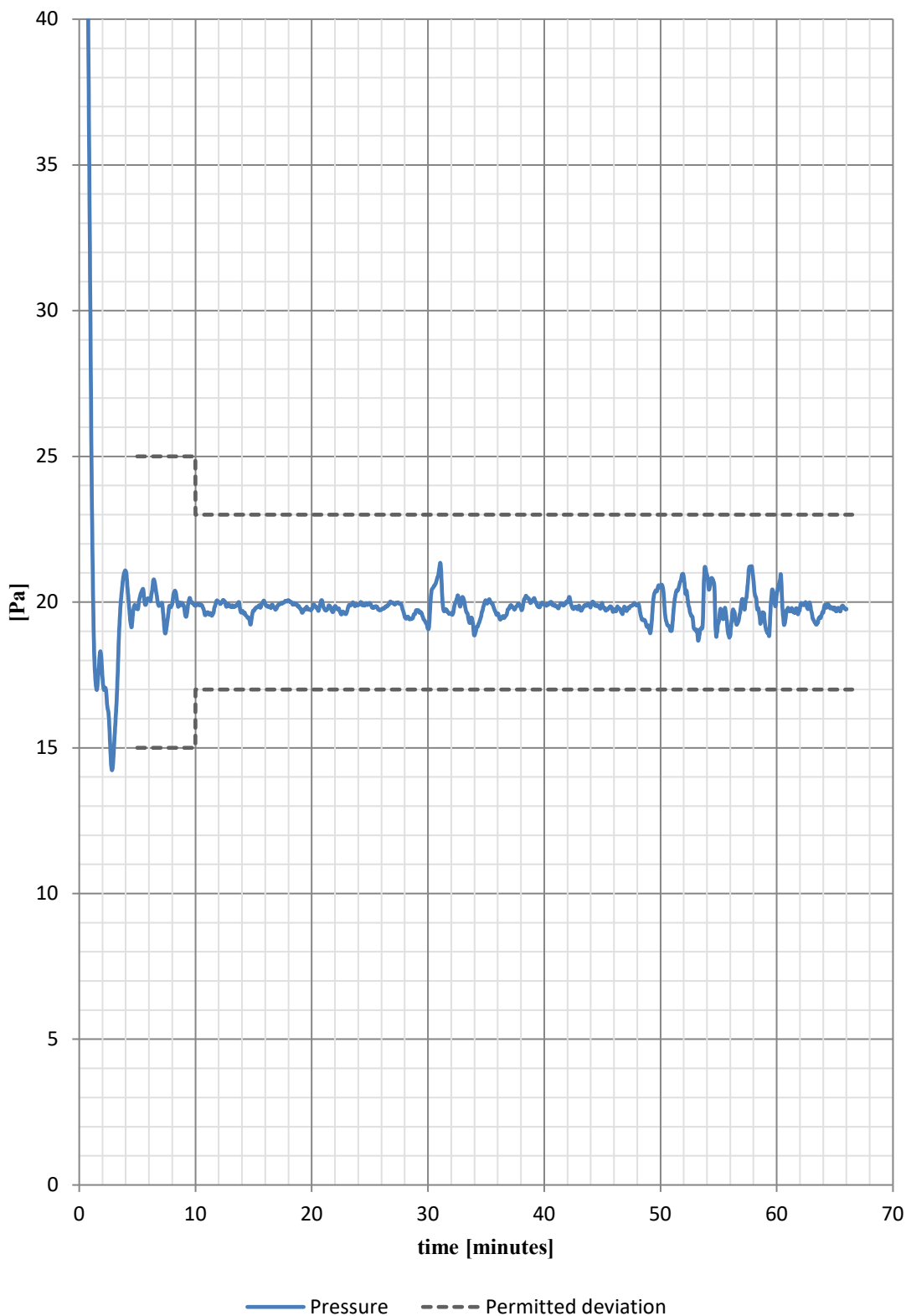


- Average temperature
- PT 1
- PT 2
- PT 3
- PT 4
- PT 5
- PT 6
- Standard time-temperature curve EN 1363-1
- Permitted deviation

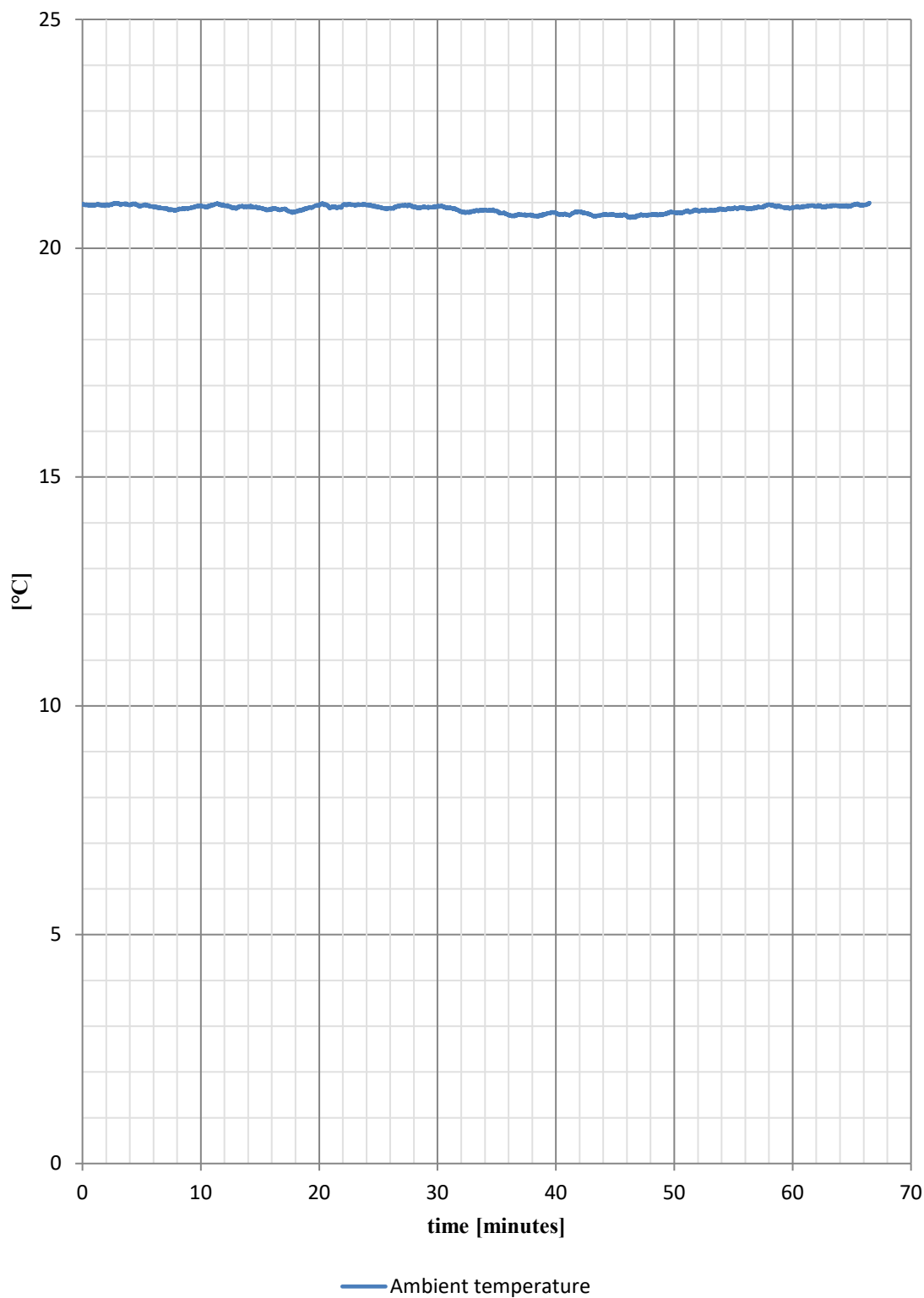
Appendix 3

**Test condition: The deviation in per cent of the furnace
time-temperature**

Appendix 3

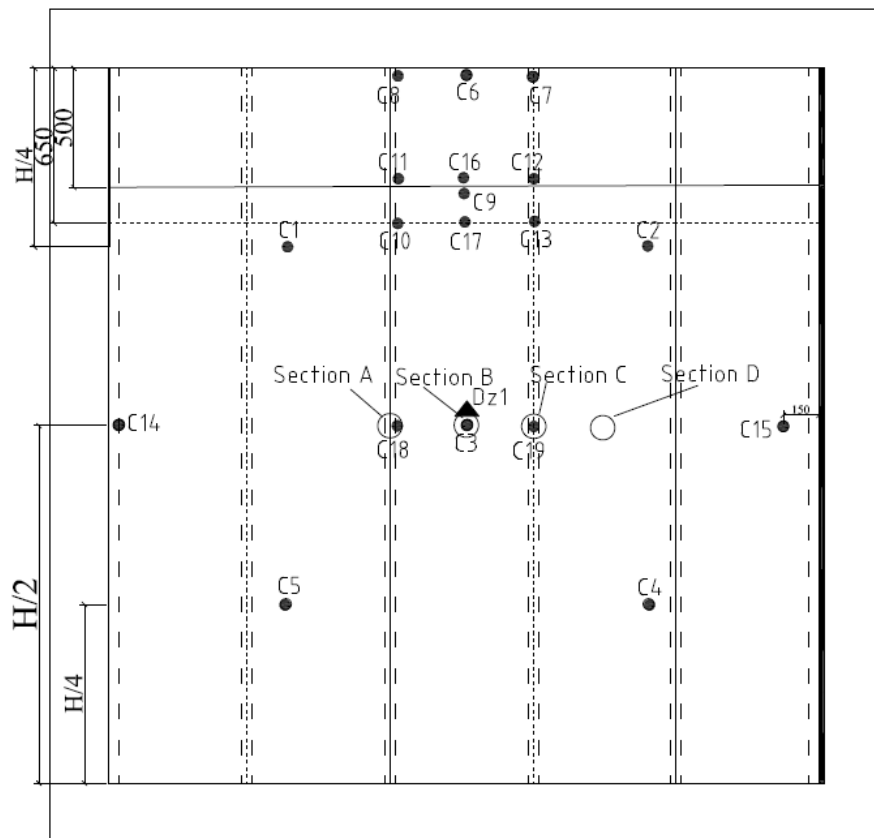
Test condition: The calculated furnace pressure on the height of the level of requirement

Appendix 3

Test condition: The ambient air temperature during the test

Appendix 4

Instrumentation of test specimen

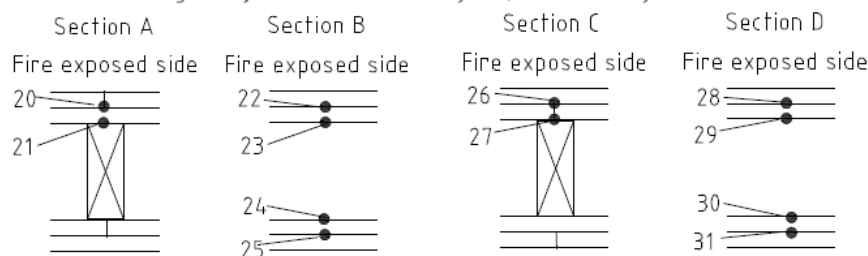


Non-exposed side

Dz1 Measuring point of deflection in the centre

Thermocouple

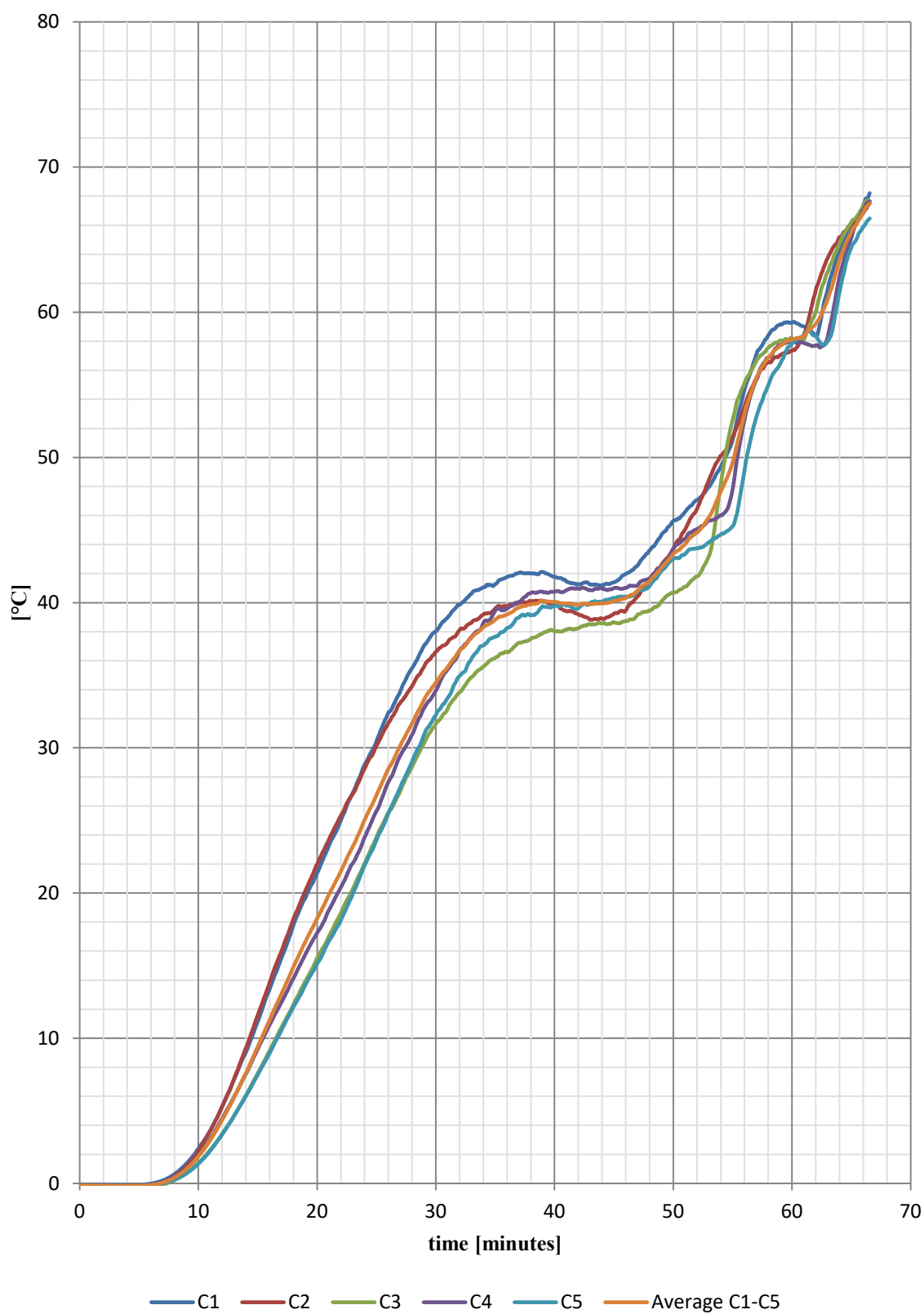
- C1-5 Average temperature, 50mm from joint (EN 1364-1 9.1.2.2)
- C6 At the top of the specimen at mid-width, 20mm from the top edge (EN 1364-1 9.1.2.3 a)
- C7-8 At the top of the specimen in line with a stud, 20mm from the top edge (EN 1364-1 9.1.2.3 b)
- C9-13 At the junction of a stud and a rail, or at the junction of horizontal and vertical joints, 20mm from the visible joint (EN 1364-1 9.1.2.3 c)
- C14 At mid height of the fixed edge, 20mm from the edge (EN 1364-1 9.1.2.3 d)
- C15 At mid height of the free edge, 150mm in from the edge of the specimen (EN 1364-1 9.1.2.3 e)
- C16-17 At mid width adjacent to a horizontal joint, 20mm from visible joint (EN 1364-1 9.1.2.3 f)
- C18-19 At mid height adjacent to a vertical joint, 20mm from joint (EN 1364-1 9.1.2.3 g)



C20-31 Additional thermocouples

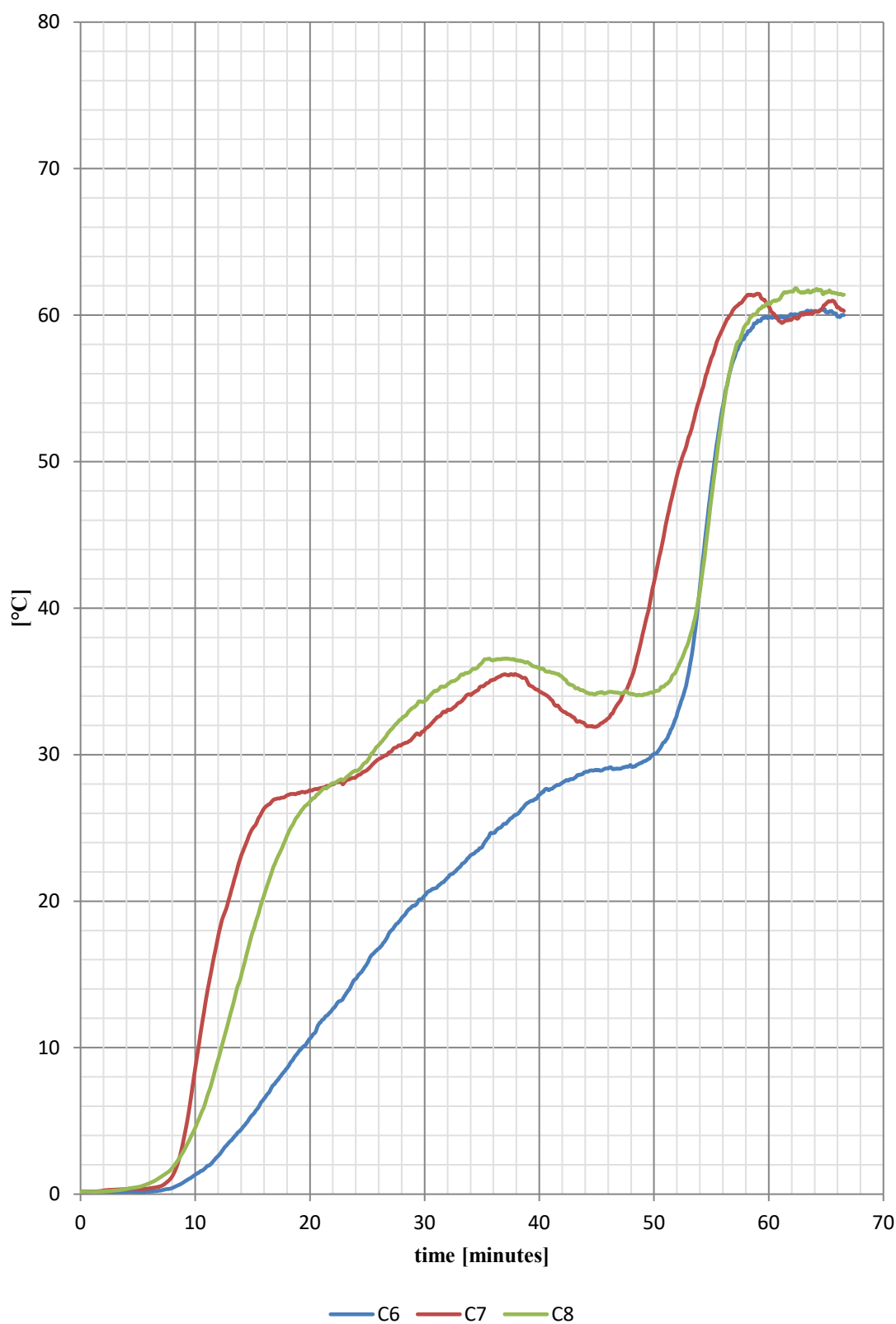
Appendix 4

Temperature rises on test specimen: Graph



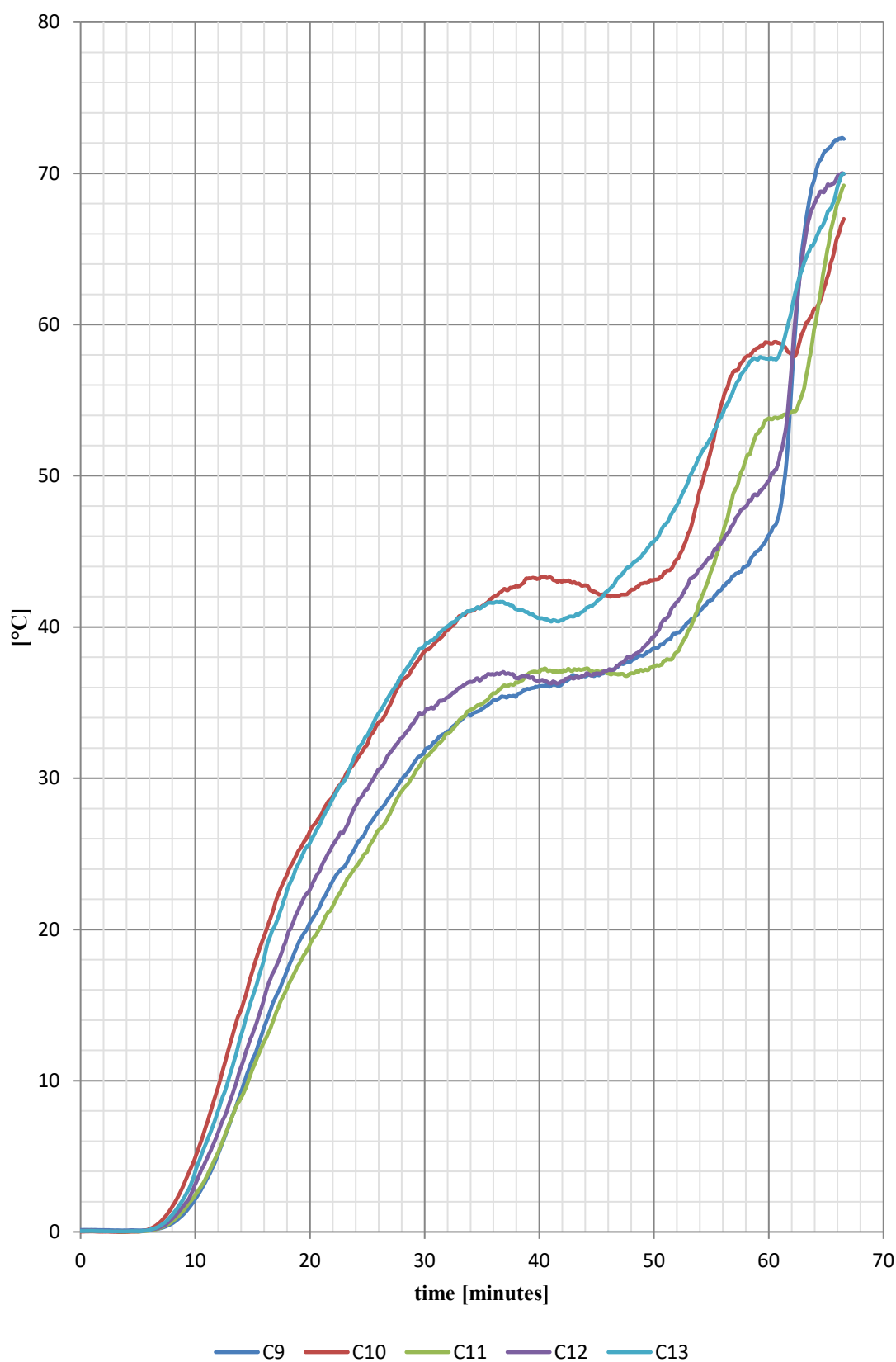
Appendix 4

Temperature rises on test specimen: Graph



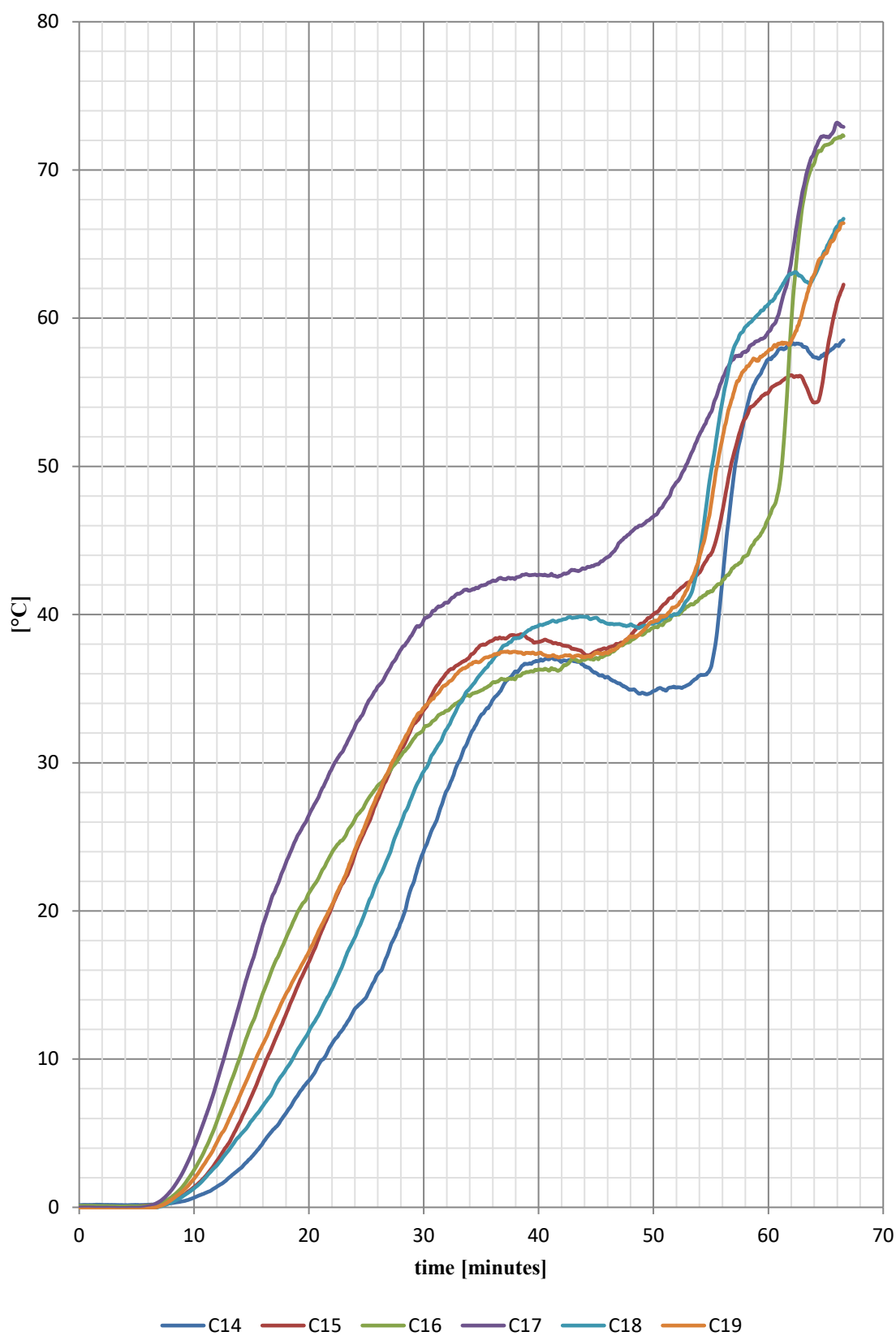
Appendix 4

Temperature rises on test specimen: Graph



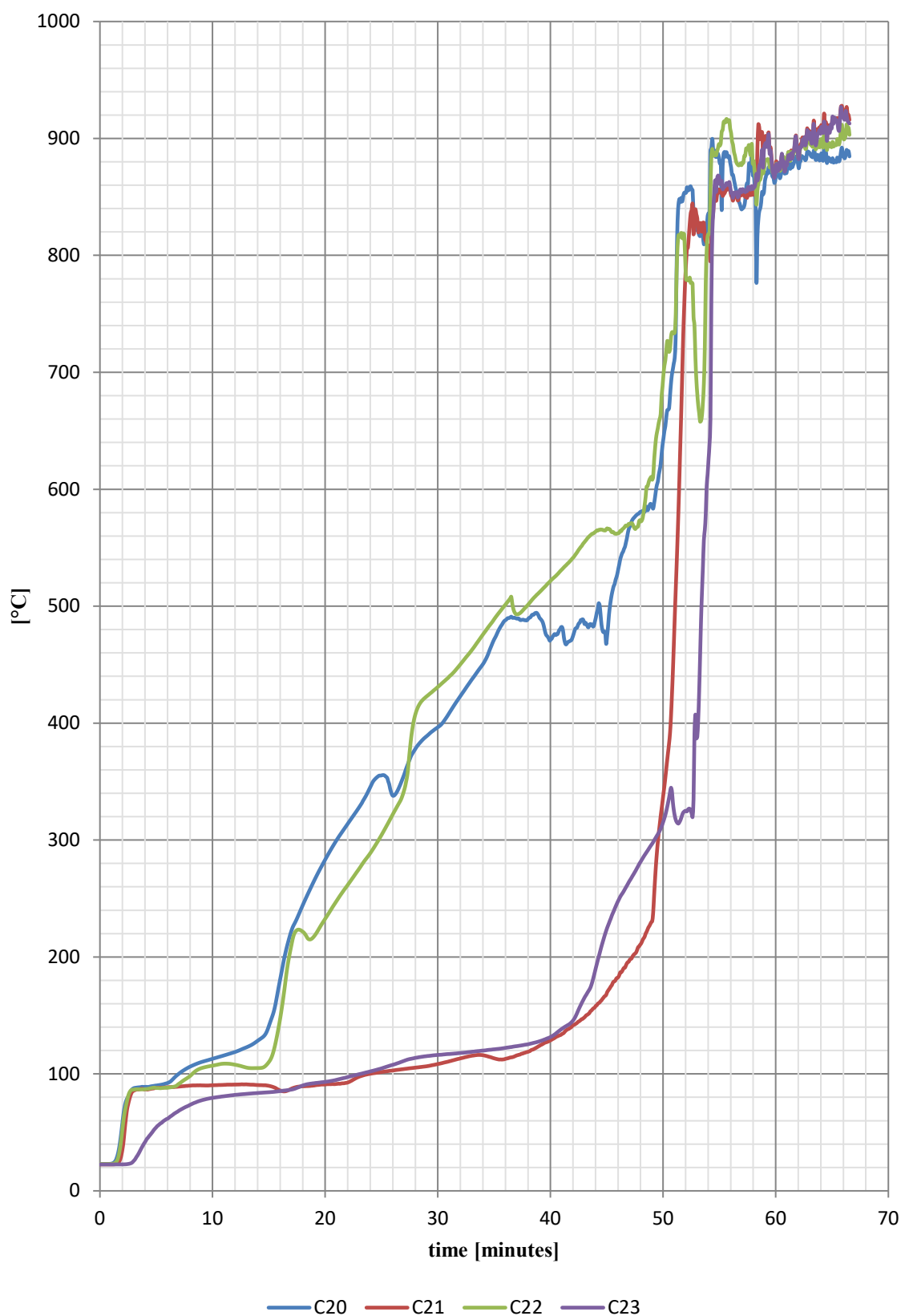
Appendix 4

Temperature rises on test specimen: Graph



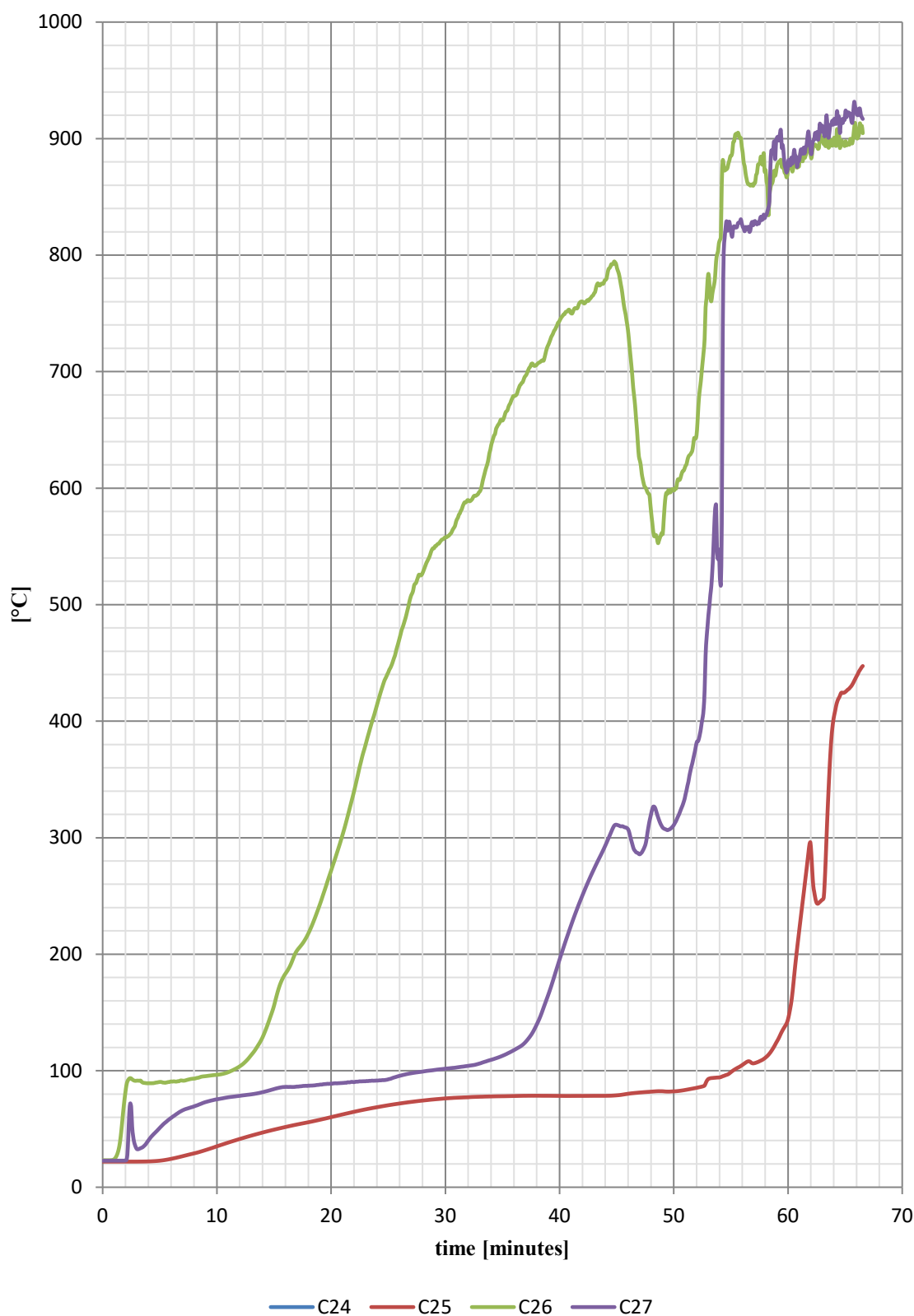
Appendix 4

Temperature rises on test specimen: Graph



Appendix 4

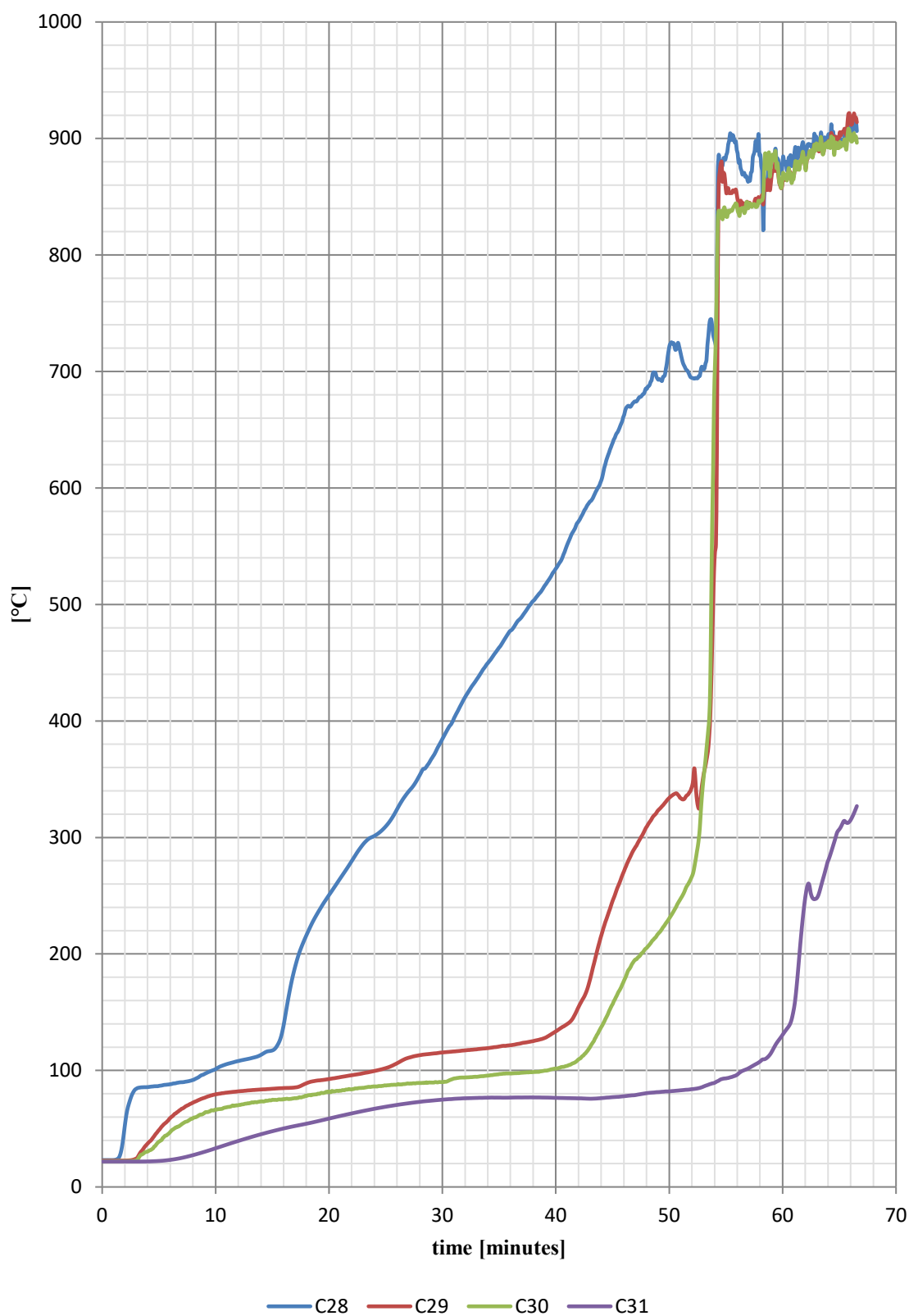
Temperature rises on test specimen: Graph



Thermocouple C24 was out of order during the test.

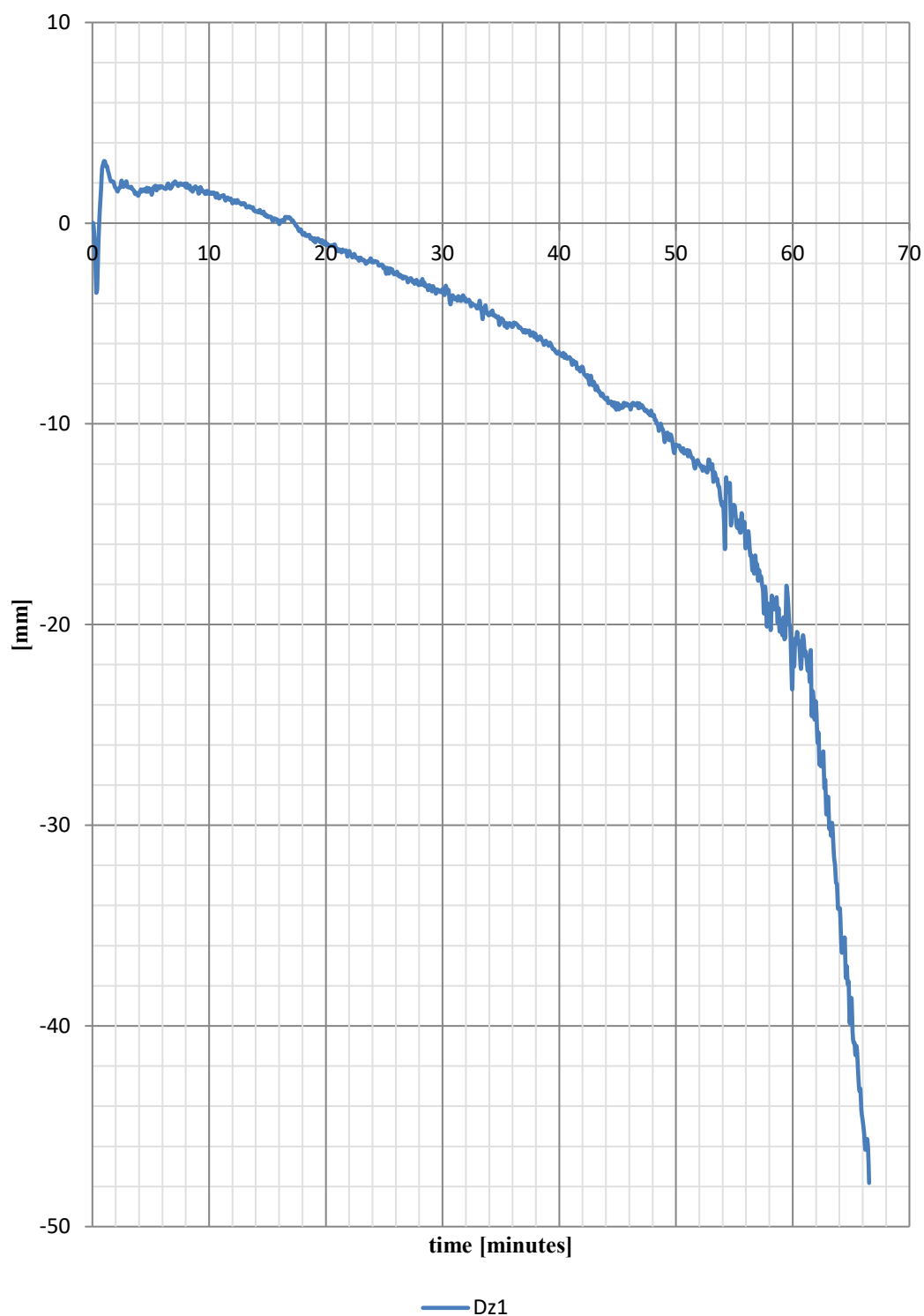
Appendix 4

Temperature rises on test specimen: Graph



Appendix 4

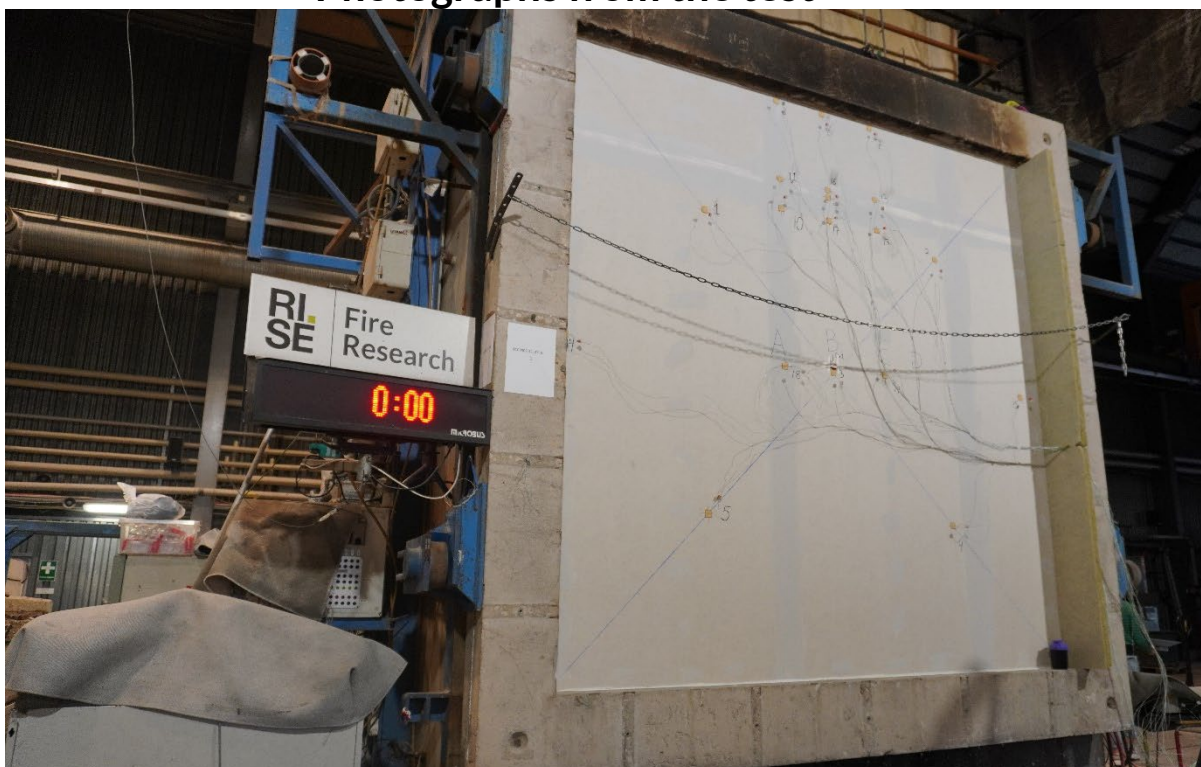
Deflection



Positive values are deformation towards the furnace.

Appendix 4

Photographs from the test



The test specimen at the commencement of the test.



Test specimen after 66 minutes of the test.

Appendix 4

Photographs from the test



The fire exposed side of the specimen after the test.



Ewes Soundfastener screw.

Verifikat

Transaktion 09222115557503019042

Dokument

O100402-1213768-1 Rapport

Huvuddokument

31 sidor

Startades 2023-10-19 15:38:51 CEST (+0200) av Michaela Ljungdahl (ML)

Färdigställt 2023-10-20 09:49:08 CEST (+0200)

Signerare

Michaela Ljungdahl (ML)

RISE Research Institutes of Sweden AB

Personnummer 19860729-3589

Org. nr 556464-6874

michaela.ljungdahl@ri.se

+46 10 722 33 94

Signerade 2023-10-19 15:38:53 CEST (+0200)

Pär Johansson (PJ)

RISE

par.johansson@ri.se



Signerade 2023-10-20 08:23:16 CEST (+0200)

Malin Mollsjö (MM)

RISE

malin.mollsjo@ri.se



Signerade 2023-10-20 09:49:08 CEST (+0200)

Detta verifikat är utfärdat av Scrive. Information i kursiv stil är säkert verifierad av Scrive. Se de dolda bilagorna för mer information/bevis om detta dokument. Använd en PDF-läsare som t ex Adobe Reader som kan visa dolda bilagor för att se bilagorna. Observera att om dokumentet skrivs ut kan inte integriteten i papperskopien bevisas enligt nedan och att en vanlig papperutskrift saknar innehållet i de dolda bilagorna. Den digitala signaturen (elektroniska förseglingen) säkerställer att integriteten av detta dokument, inklusive de dolda bilagorna, kan bevisas matematiskt och oberoende av Scrive. För er bekvämlighet tillhandahåller Scrive även en tjänst för att kontrollera dokumentets integritet automatiskt på: <https://scrive.com/verify>

