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Fire resistance test in accordance with B.S. 476 : Part 22 : 1987 on a plasterboard ceiling membrane incorporating a Fire Proofing Services Ltd. single-leaf access panel.

Prepared for:
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24th February 2011

Test report number 265024

UKAS TESTING

0578

Protecting People, Property and the Planet

Fire resistance test on a Fire Proofing Services Ltd. access panel in a plasterboard ceiling membrane.

Prepared on behalf of BRE Global by

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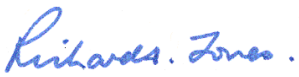
Date 24th February 2011

Signature 

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SUMMARY

A ceiling membrane constructed from a steel framework, with three layers of 15mm-thick Knauf Fireshield plasterboard fixed on the underside, incorporating a Fire Proofing Services Ltd. single-leaf access panel, was submitted to a fire resistance test in accordance with B.S. 476 : Part 22 : 1987 (Method 9 for ceiling membranes) on 24th August 2010. The ceiling membrane was of overall dimensions 3.5m x 4.15m with the access panels installed in a structural opening, nominally 1010mm x 1010mm.

The ceiling, incorporating the access panel (opening towards the furnace) achieved the following fire resistance:

Integrity:	106 minutes
Insulation:	13 minutes

1 OBJECTIVE

To determine, at the request of Fire Proofing Services Ltd., the fire resistance of a plasterboard ceiling membrane incorporating a single-leaf access panel, when tested in accordance with B.S. 476 : Part 22 : 1987 (Method 9 for ceiling membranes).

2 TEST CONSTRUCTION

2.1 General

The ceiling membrane and access panel were installed within the 3.5m x 4.15m aperture of a heavily reinforced concrete test frame during the week commencing 16th August 2010. The access panel opened towards the furnace.

The construction is shown in attached Figures and Photographs.

2.2 Ceiling Components

2.2.1 Knauf MF perimeter channel

Knauf MF perimeter channel was a 19.5mm x 26mm x 28mm C-section channel, formed from approximately 0.46mm-thick steel.

2.2.2 Knauf MF primary support channel

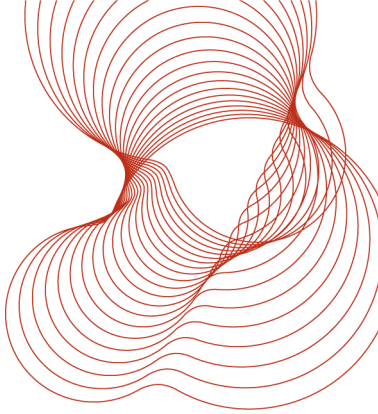
Knaug MF primary support channel was a 14mm x 45mm x 14mm C-section channel, formed from approximately 1.2mm-thick steel.

2.2.3 Knauf MF ceiling channel

Knauf MF ceiling channel was a splayed top-hat section, nominally 25mm deep. The narrow (top) part of the top hat section was 54mm wide, the sides extending outwards to a width of 60mm. The base of each side comprised a nominally 10mm flange, with a 3mm upturned lip.

2.2.4 Knauf Fireshield plasterboard

Knauf Fireshield was a 15mm-thick Type 5 wall board, supplied to the laboratory as taper-edged sheets, 1200mm wide x 3000mm long. The boards, pink on the visible faces, were stated to consist of a gypsum plaster core with glass fibres and fillers.



2.3 Ceiling construction

Perimeter channel was fixed around all four edges of the test frame as follows: Tabs, nominally 50mm-wide were cut in the 19.5mm side of the perimeter channel at 600mm centres and bent upwards to provide a means of fixing the channel to the test frame using 6mm x 40mm steel Rawl fixings.

Primary channels spanned the width of the test frame at 910mm centres, being supported on the perimeter channels, with some of the channels being additionally suspended from three I-section beams spanning the length of the test frame. MF ceiling channels spanning the length of the ceiling were then located at nominally 450mm centres, being attached to the primary channels and perimeter channel.

One structural opening, 1010mm x 1010mm, was provided in the ceiling for the access panel. The opening was formed using lengths of perimeter channel. This was supported along two edges via lengths of primary channel, the perimeter channel being attached directly to the MF ceiling channel along the other two edges. The opening was lined with one layer of 15mm-thick Knauf Fireshield plasterboard. Further details are given in the Figures.

The first layer of plasterboard was attached to the ceiling using 32mm drywall screws, the second layer being attached using 42mm screws, and the third layer using 60mm drywall screws, all at nominally 250mm centres. Joints between the layers were staggered, with joints between boards on the exposed face being sealed with British Gypsum Gyproc ready-Mix Joint Cement and 50mm mesh scrim tape.

2.4 Access Panel

The access panel incorporated a 0.9mm-thick door tray on the exposed face, with a 12.5mm -thick layer of Megadeco plasterboard on the unexposed face.

Full details of the panel are given in the Figures.

3 CONDITIONING

At the time of construction a representative sample of plasterboard was taken and placed in an oven at 50°C to determine it's free moisture content by weight loss technique. The plasterboard was found to have a free moisture content of 0.4% by oven dry weight.

4 TEST PROCEDURE

4.1 General

The test was carried out on the 24th August 2010 in accordance with B.S. 476 : Part 22 : 1987 (method 9 for ceiling membranes) and was witnessed by Mr. R. Stokes representing the sponsor.

The ambient temperature at the start of the test was 18°C.

4.2 Furnace control

The furnace temperature was measured using ten bare-wire chromel/alumel thermocouples arranged symmetrically in the furnace, with their measuring junctions 100mm below the exposed face of the ceiling and access panel. The furnace was controlled so that the mean of these thermocouple readings followed the time/temperature relationship of B.S. 476 : Part 20 : 1987.

A pressure-sensing head was located in the furnace 100mm below the ceiling. The pressure conditions within the furnace were maintained at 18Pa, in accordance with Section 3.2 of B.S. 476 : Part 20 : 1987.

4.3 Temperature measurements on specimen

The temperatures of the unexposed face of the ceiling and access panel were measured using twenty six chromel / alumal thermocouples fixed to the surface and covered with an insulating pad. The location of the thermocouples is given in the following table.

Thermocouple number	Location
*1	At the centre of the top left quarter of the ceiling.
2	On a ceiling channel, 300mm away from thermocouple number 1.
*3	At the centre of the top right quarter of the ceiling.
4	On a ceiling channel over a joint in the plasterboard ceiling.
5	On the plasterboard ceiling, adjacent to a joint in the plasterboard.
*6	At the centre of the ceiling.
*7	At the centre of the bottom left quarter of the ceiling.
*8	At the centre of the bottom right quarter of the ceiling.
9	On the steel channel around the perimeter of the opening in the ceiling for the access panel.
10	On the plasterboard used to line the opening in the ceiling.

Thermocouple number	Location
11	On the access panel frame (adjacent to opening edge of panel) at mid width.
12	On the top right hand side corner of the access panel frame (opening edge).
13	On the steel of the access panel leaf at the top left corner (opening edge).
14	On the steel at the top edge of the access panel leaf at mid width (opening edge).
15	On the megadeco board of the panel leaf, at the top right corner (opening edge).
16	Near the centre of the top left quarter of the access panel leaf.
17	Near the centre of the top right quarter of the access panel leaf.
18	On the left hand side access panel frame at mid length.
19	On the access panel, over the central stiffener, adjacent to a screw.
20	On the right hand side access panel frame at mid length.
21	Near the centre of the bottom left quarter of the access panel leaf.
22	Near the centre of the bottom right quarter of the access panel leaf.
23	On the bottom left corner of the access panel frame (hinged edge).
24	On the steel at the edge of the access panel frame at mid width (hinged edge).
25	On the steel at the edge of the leaf at the bottom right corner (hinged edge).
26	On the bottom edge of the access panel frame, at mid width (hinged edge).

* These thermocouples were used to determine the mean surface temperature of the ceiling.

5 RESULTS

5.1 Observations

Observations made during the test are given in the following table and unless stated refer to the unexposed face.

Time minutes	Observation
0	Start test.
10	Smoke is coming from the leaf / frame joint, especially at the right hand hinged corner.
12	The surface coating on the access panel leaf is blistering.
16	Smoke is now coming from both hinge corners of the access panel leaf, and from the left hand side corner of the latching edge.
18	Most of the jointing between the plasterboard sheets on the exposed face has fallen out.
19	Slight gaps of approximately 2mm have formed at some board joints on the exposed face.
31	Smoke from the leaf / frame joints on the access panel has now almost ceased. Smoke is now coming from the frame / plasterboard perimeter interface.
34	All boards are intact on the exposed face, with gaps between boards now up to a maximum of approximately 5mm to 8mm.
39	The surface coating on the access panel leaf has cracked and charred along the crack.
44	Gaps at joints between sheets of plasterboard on the exposed face are now up to a maximum of approximately 10mm between screw locations.
57	The board on the unexposed face of the access panel leaf has cracked. The crack is approximately 500mm long. No failure by cotton pad.
64	Some of the plasterboard on the exposed face is sagging by approximately 10mm at locations remote from the access panel.
70	The surface of the access panel has darkened considerably as it heats up.
73	A piece of plasterboard approximately 1.2m x 0.5m has fallen from the exposed face of the ceiling in a location remote from the access panel.
76	Pieces of plasterboard on the exposed face are hanging away from the ceiling.
81	More plasterboard is hanging away from the exposed face of the ceiling.

Time minutes	Observation
88	Approximately 25% of the exposed face layer of plasterboard has fallen from the ceiling. All plasterboard around the access panel is still intact on the exposed face.
97	Gaps of approximately 10mm have formed between sheets of plasterboard in the second layer on the exposed face. Some pieces of board in the first layer, adjacent to the access panel are now hanging away from the ceiling.
103	Large pieces of the second layer of plasterboard remote from the access panel are falling from the ceiling. The access panel is still intact, and is glowing red hot at the corners of the leaf. One of the hinged edge corners of the leaf was observed to have dropped by approximately 5mm.
106	**Failure of integrity** using the cotton pad over a joint in the third layer of plasterboard where the second layer has fallen from the exposed face. This location is remote from the access panel.
108	Flaming from the unexposed face of the plasterboard remote from the access panel.
111	Several areas of the ceiling are now glowing as the paper facing on the plasterboard chars. Failure of integrity using the 6mm gap gauge at some of the plasterboard joints.
122	Test stopped.

The ceiling failed integrity after 106 minutes. However, there was no failure of the access panel (or the ceiling adjacent to the access panel) during the test.

5.2 Furnace temperature

The mean furnace temperature, together with the specified curve for comparison is given in the attached graphs.

5.3 Surface temperatures

The temperatures recorded on the unexposed face of the ceiling and access panel are given in the attached graphs.

The maximum temperature rise limit for insulation (180^{O}C rise) was first exceeded by thermocouple number 25 after 13 minutes.

The mean temperature rise limit for insulation (140^{O}C rise) was first exceeded on the ceiling membrane after 109 minutes.

6 PERFORMANCE CRITERIA

The standards state that a ceiling membrane is regarded as having a fire resistance (expressed in minutes) that is equal to the elapsed time (in completed minutes) between the commencement of heating and the termination of heating, or until failure to meet the integrity or insulation criteria occurs, whichever is the sooner.

Integrity : Failure is deemed to occur:

a) when collapse or sustained flaming for not less than 10s on the unexposed face occurs;

b) when cracks, gaps or fissures allow flames or hot gases to cause flaming or glowing of a cotton fibre pad;

c) when a 6mm-diameter gap gauge can penetrate through a gap into the furnace, other than at sill level in doorsets, and be moved in the gap for a distance of at least 150mm;

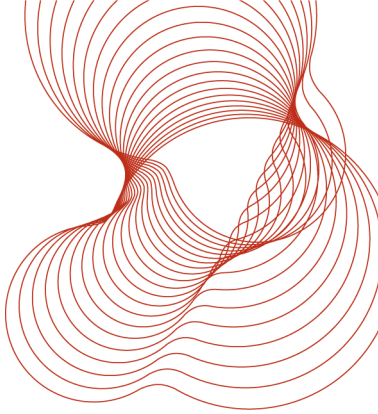
d) a 25mm-diameter gap gauge can penetrate through a gap into the furnace.

Insulation : Failure is deemed to occur:

a) when the mean non-fire face temperature increases by more than 140°C above its initial value;

b) when the temperature recorded at any position on the non-fire face is in excess of 180°C above the initial mean non-fire face temperature;

c) when integrity failure occurs.



7 CONCLUSION

A ceiling membrane, incorporating a Fire Proofing Services Ltd. single-leaf access panel, as described in this report, was tested in accordance with B.S. 476 : Part 22 : 1987 (Method 9 for ceiling membranes).

The ceiling, incorporating the access panel (opening towards the furnace) achieved the following fire resistance:

Integrity:	106 minutes
Insulation:	13 minutes

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty on measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

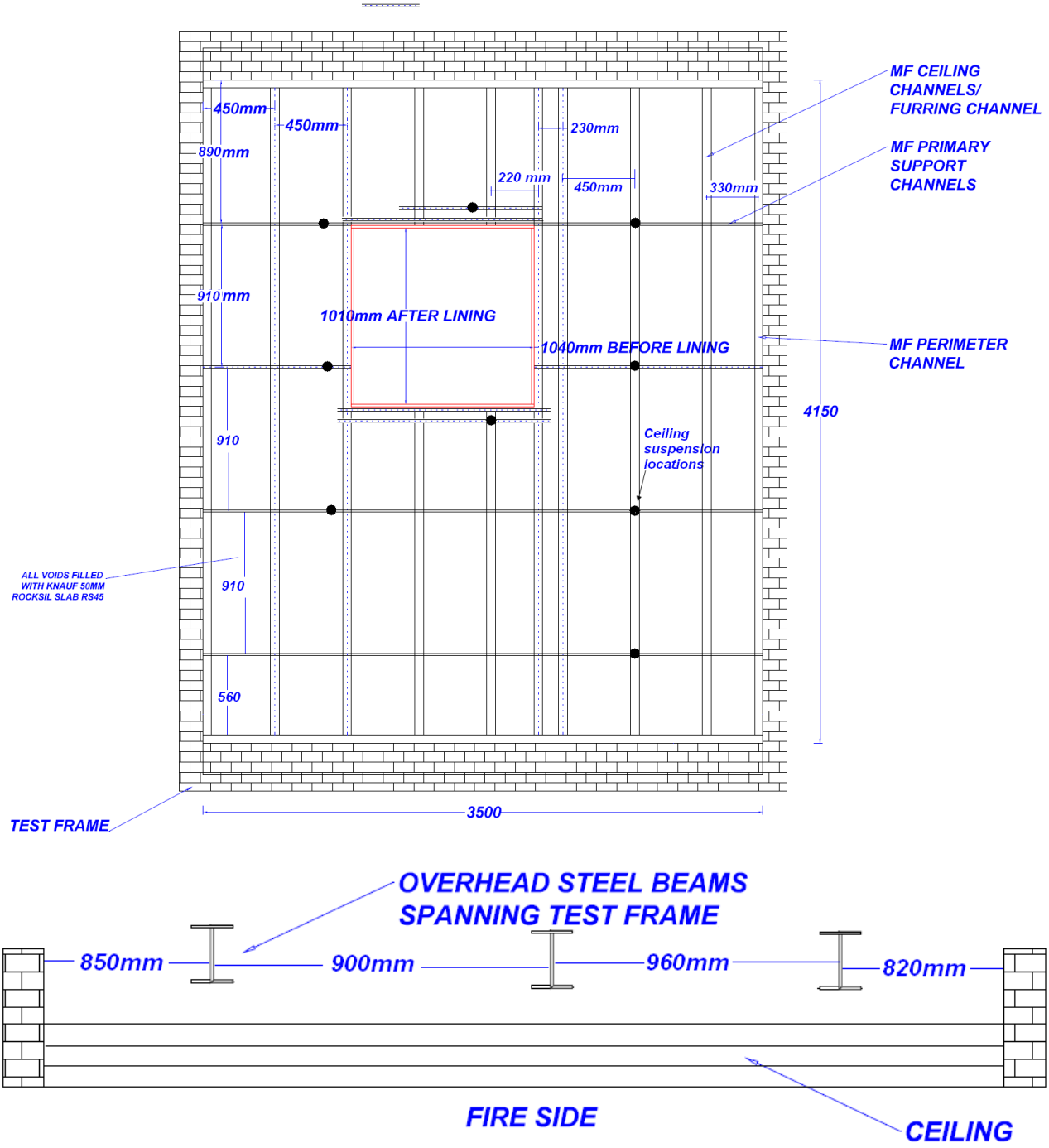
The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over 5 years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

The results only relate to the behaviour of the specimen of the element of construction under the particular conditions of test; they are not intended to be the sole criteria for assessing the potential fire performance of the element in use nor do they reflect the actual behaviour in fires.

8 REFERENCES

- Fire tests on building materials and structures. Part 22. Methods for determination of the fire resistance of non-loadbearing elements of construction. British Standard 476 : Part 22 : 1987. British Standards Institution, London, 1987.
- Fire tests on building materials and structures. Part 20. Method for determination of the fire resistance of elements of construction (general principles). British Standard 476 : Part 20 : 1987. British Standards Institution, London, 1987.

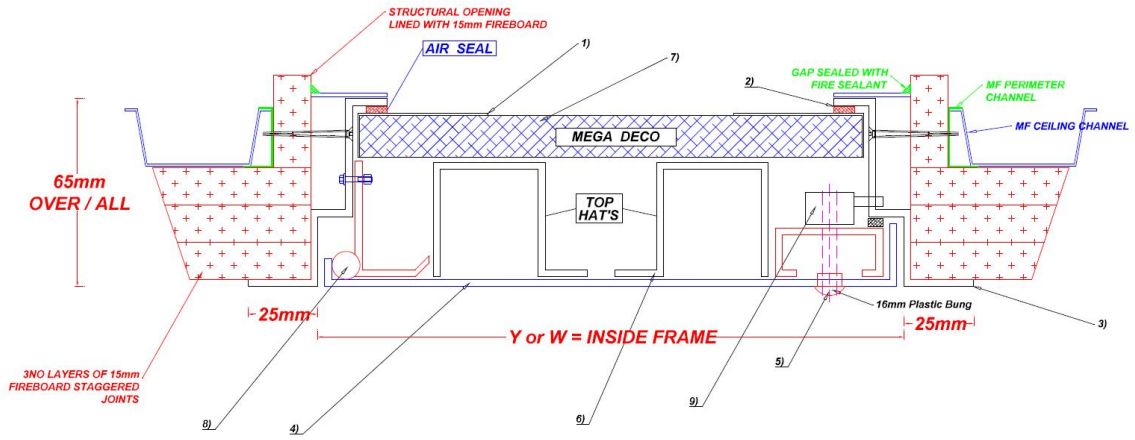
9 FIGURES



General arrangement of ceiling and locations of steel beams spanning the length of the test frame.

ISSUE No:	CHANGE DETAIL'S:

DRAWING KEY:	



F.P.S
Fire Proofing Services Ltd

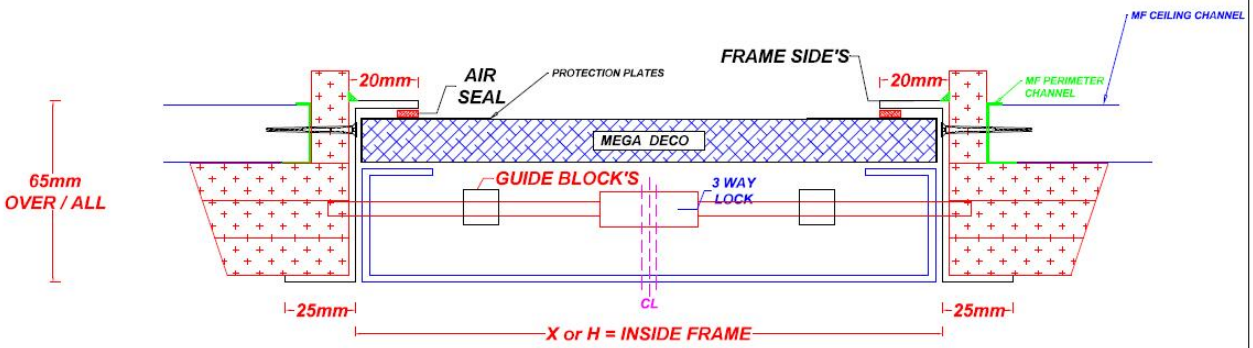
ADDRESS:	EVOLUTION HOUSE ASTON ROAD NUNEATON CV11 - 5EL	DESCRIPTION OF PANEL: 2 HR METAL FACED CEILING	MATERIAL : ZINTEC STEEL/MEGADECO
		ITEM OF PANEL: ASSEMBLY 1	B.S No:
		DATE DRAWN: 19/03/10 / DATE APPROVED: 19/03/10	GAUGE: 0.9mm and 12.5mm
DRAWING NUMBER: 2HRMFCPASS1	ISSUE NUMBER: 1	SIGNATURE :	PAINT SPEC: AS PER ORDER
			SCALE: NOT TO SCALE
LINEAR TOLERANCES : -0.5mm / +0.2mm		ANGULAR TOLERANCES : +/- 0.5 Degree	DRAWN BY: ROSS STOKES

1) 13mmx100mmx0.9mm thick rear protection plates running the perimeter of the megadeco board.
2) LSP90 6mmx8mm Poly Urethane polyester air seal to all closing sides of frame and mullion.
3) 1000X1000x1.2mm thick Zintec frame 65mm deep with 20mm closing edge for mounting air seal.
4) 896x896x49mm deep x 0.9mm thick door leaf.
5) 16mm Plastic bung to close lock hole off.
6) 20x48x100x48mm 0.9mm thick top hats in rear of door tray to support board.
7) 12.5mm thick Megadeco screw fixed to rear of door tray painted with Lafarge drywall sealer /10l ref 2760736 BS476 Part 4 1968
8) 1.5mm thick Gold and Wassell 1628S piano hinge bolted to access panel frame with M6 bolts, nuts and penny washers
9) 3 way locking system on door engaging through the frame sides.

Section view through access panel.

ISSUE No:	CHANGE DETAIL'S:

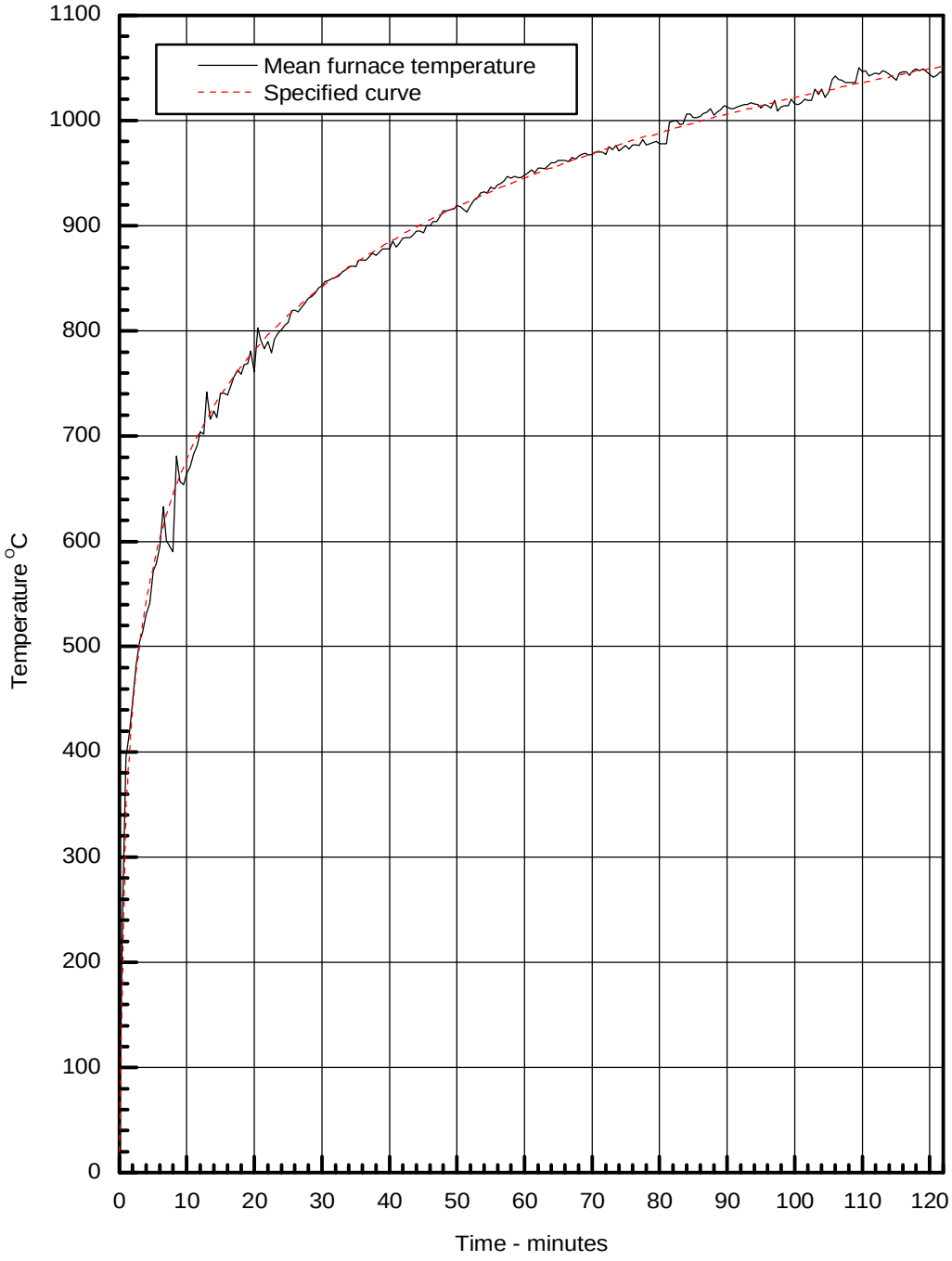
DRAWING KEY:	



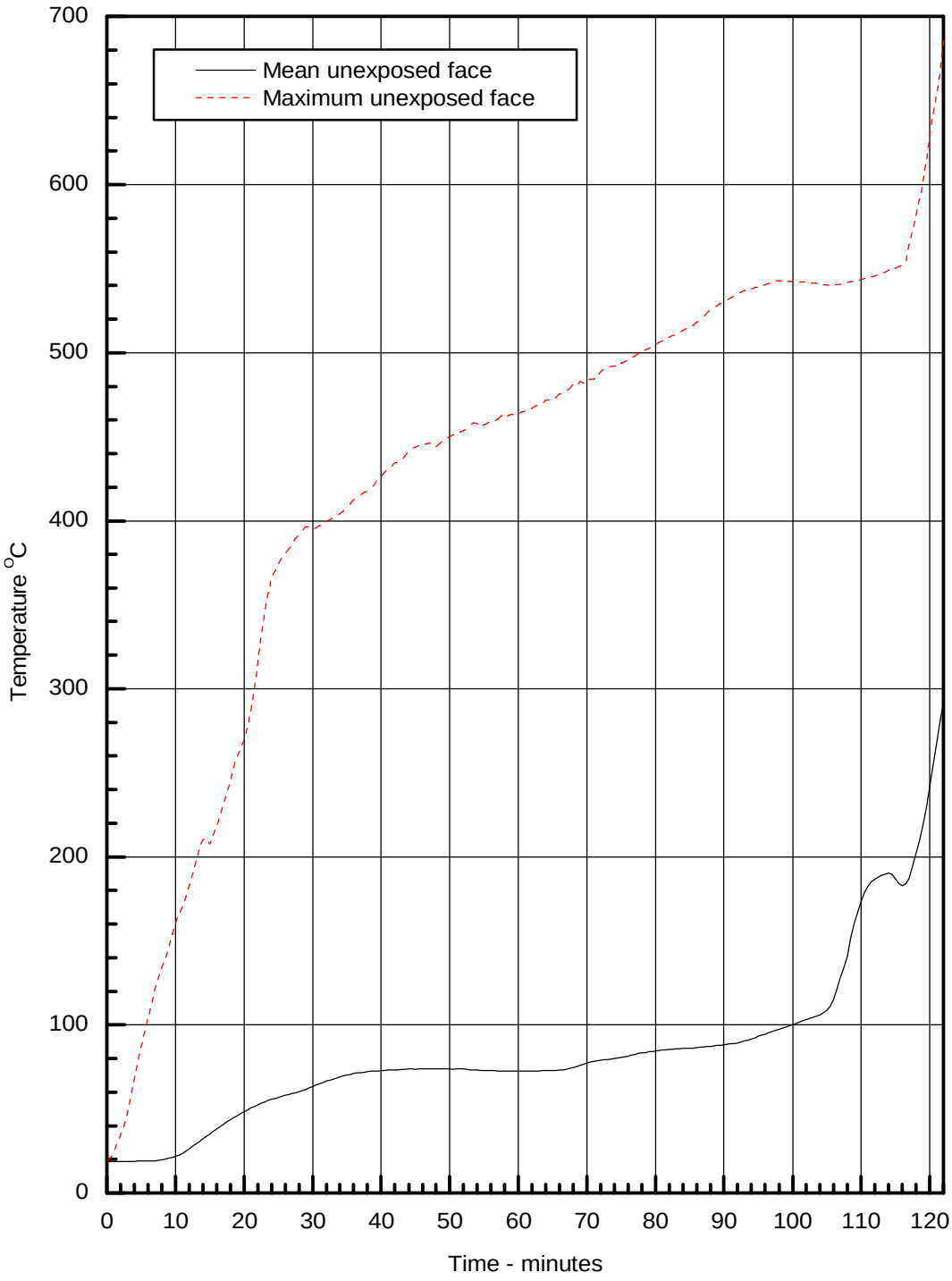
F.P.S Fire Proofing Services Ltd	ADDRESS: EVOLUTION HOUSE ASTON ROAD NUNEATON CV11 - 5EL		DESCRIPTION OF PANEL: 2 HR METAL FACED CEILING	MATERIAL :	ZINTEC STEEL/MEGADECO
			ITEM OF PANEL: ASSEMBLY 2	B.S No:	
			DATE DRAWN: 19/03/10 / DATE APPROVED: 19/03/10	GAUGE:	0.9mm and 12.5mm
	DRAWING NUMBER: 2HRMFCPASS2	ISSUE NUMBER: 1	SIGNATURE :	PAINT SPEC:	AS PER ORDER
				SCALE:	NOT TO SCALE
	LINEAR TOLERANCES : -0.5mm / +0.2mm		ANGULAR TOLERANCES : +/- 0.5 Degree	DRAWN BY:	ROSS STOKES

Opposite section view (to last figure) through access panel.

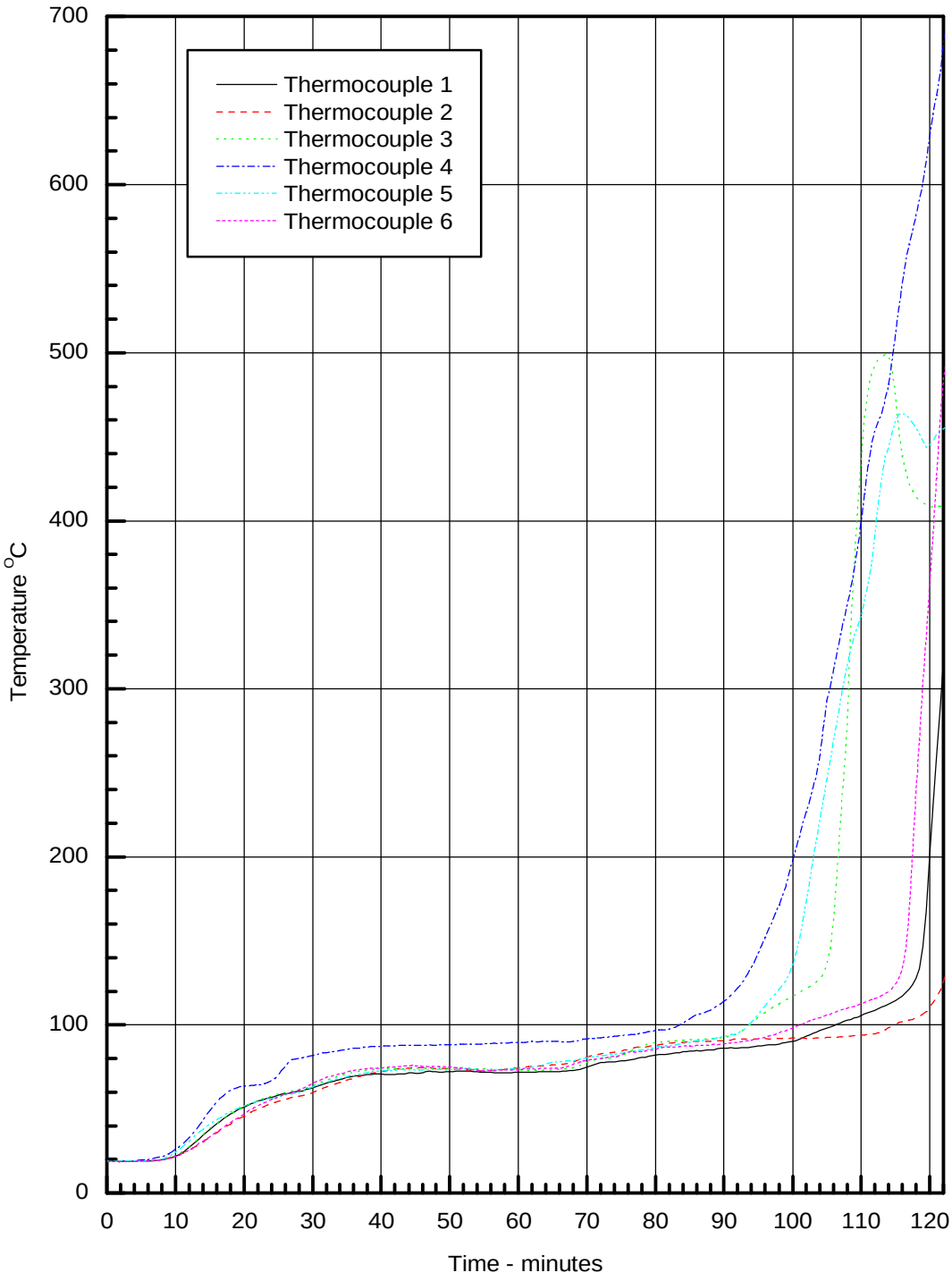
10 GRAPHS



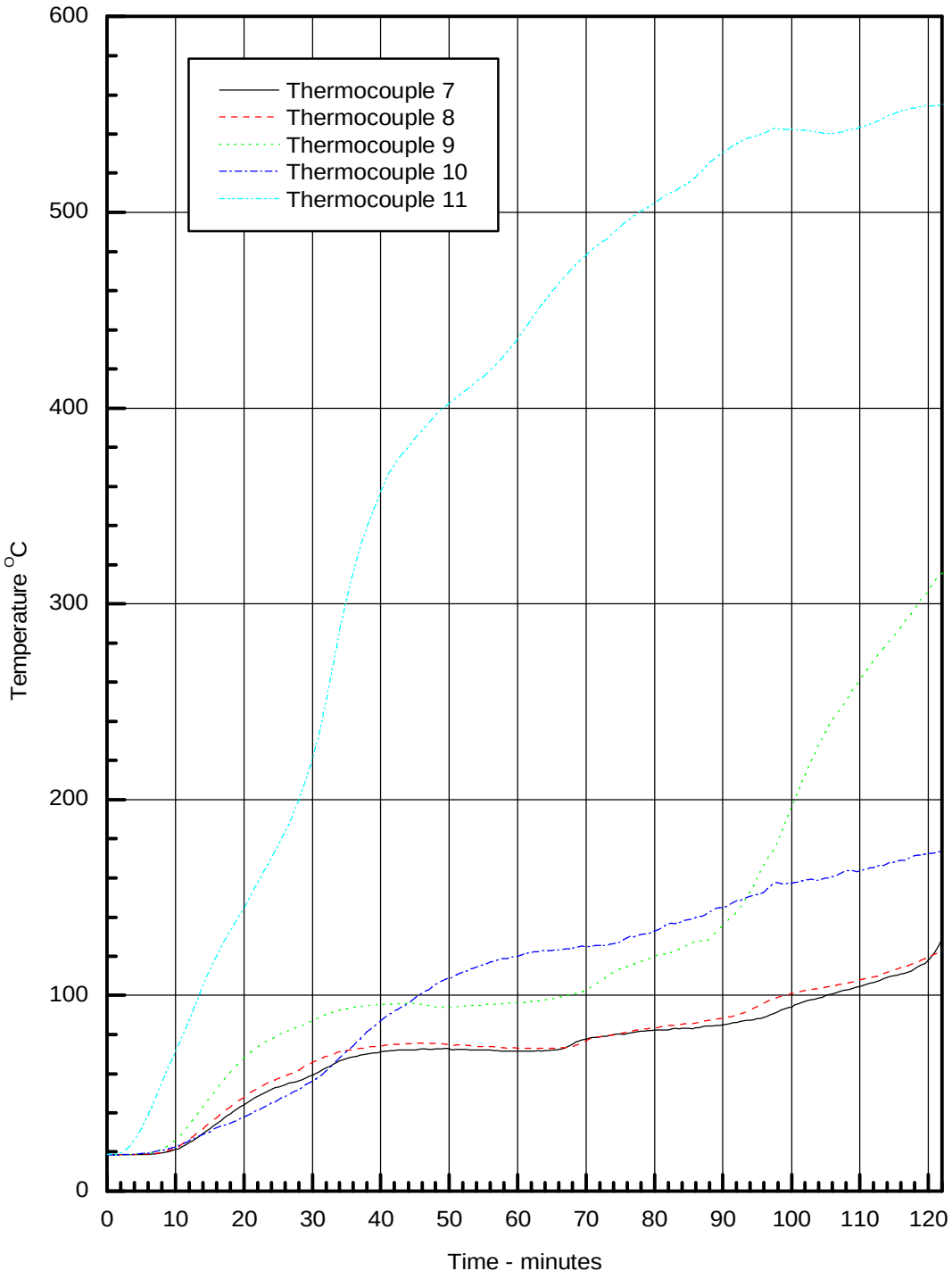
Mean furnace temperature with specified curve for comparison.



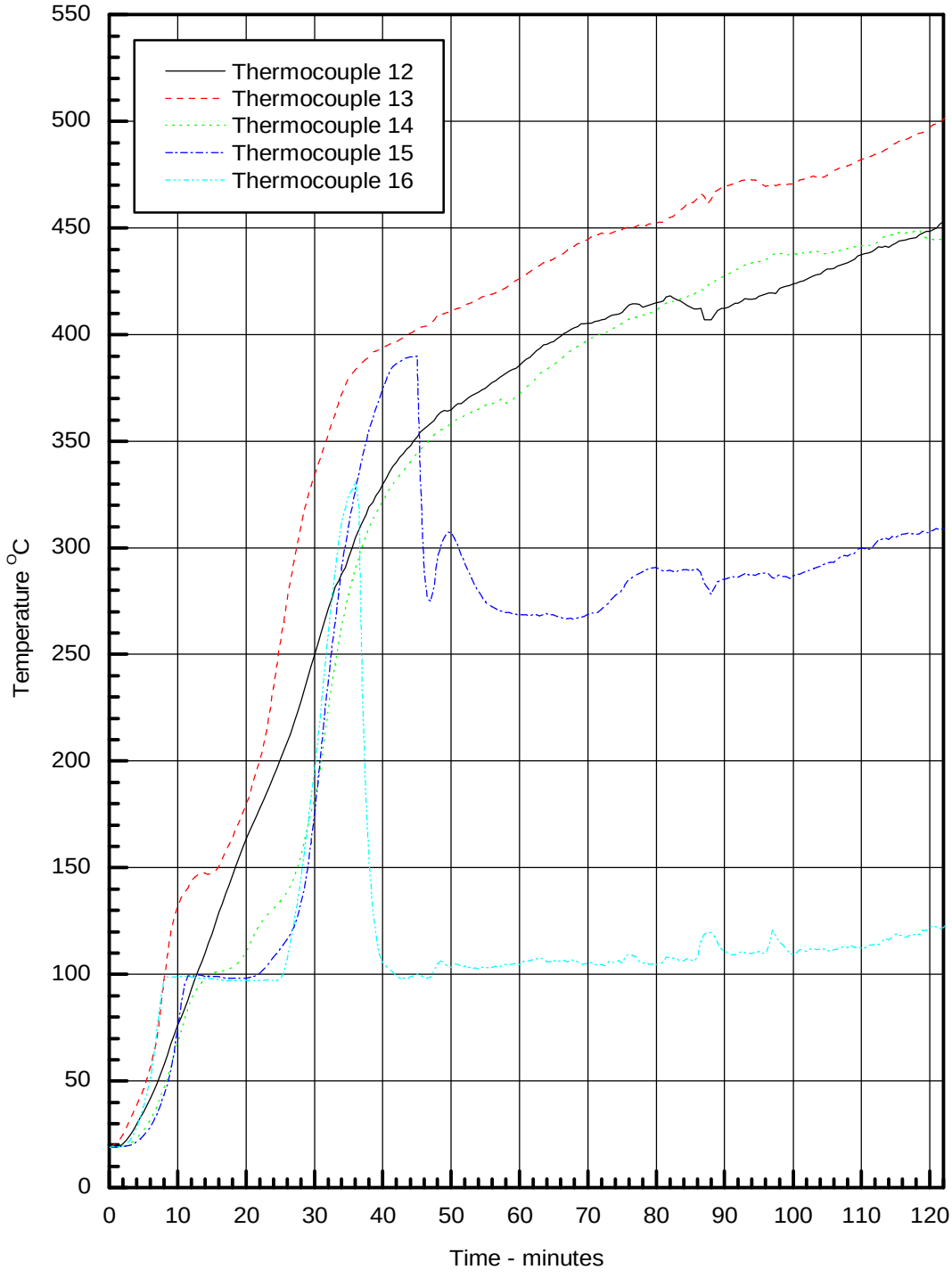
Mean and maximum temperatures recorded on the unexposed face.



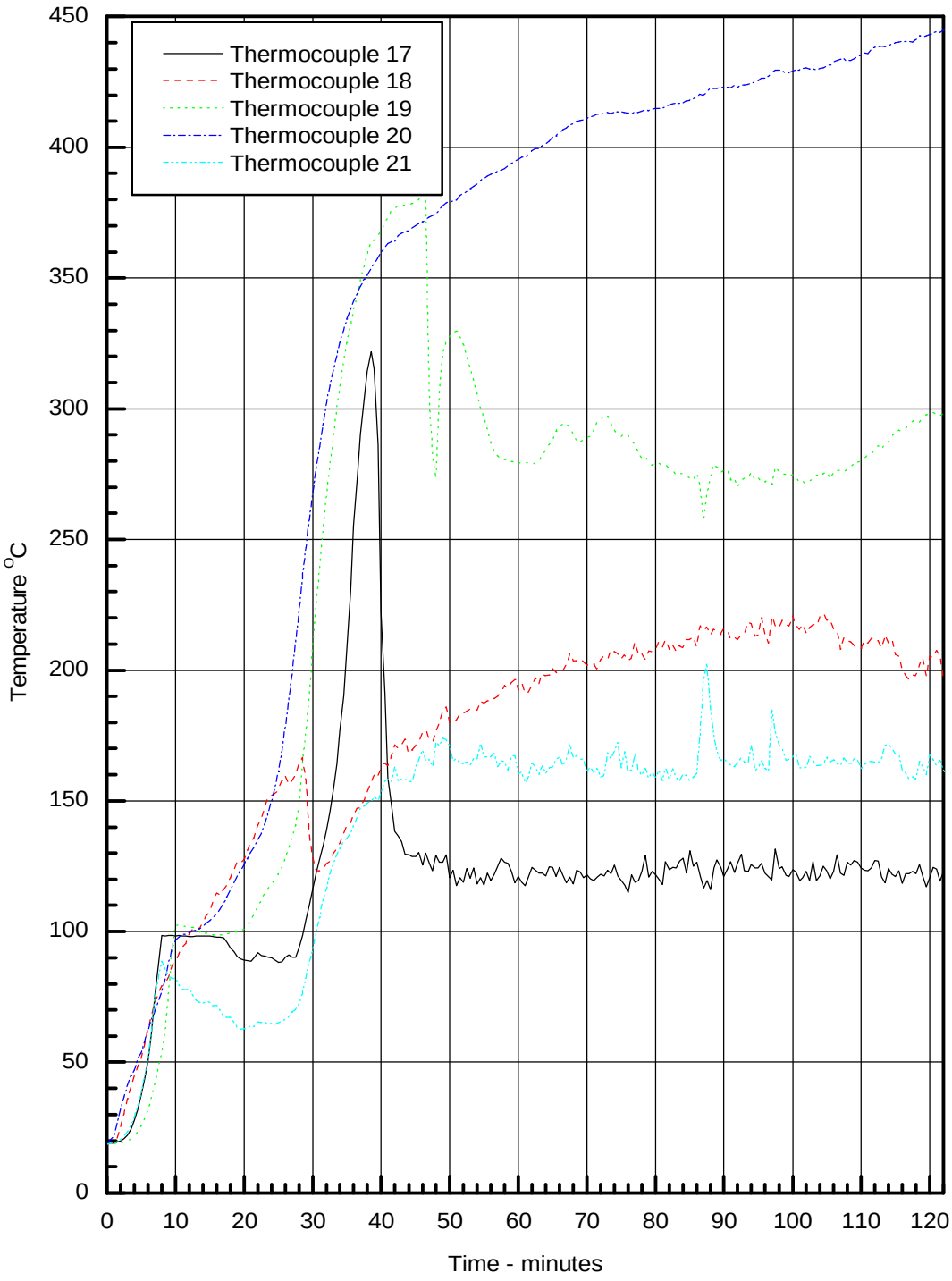
Temperatures recorded on the unexposed face by thermocouples 1 to 6.



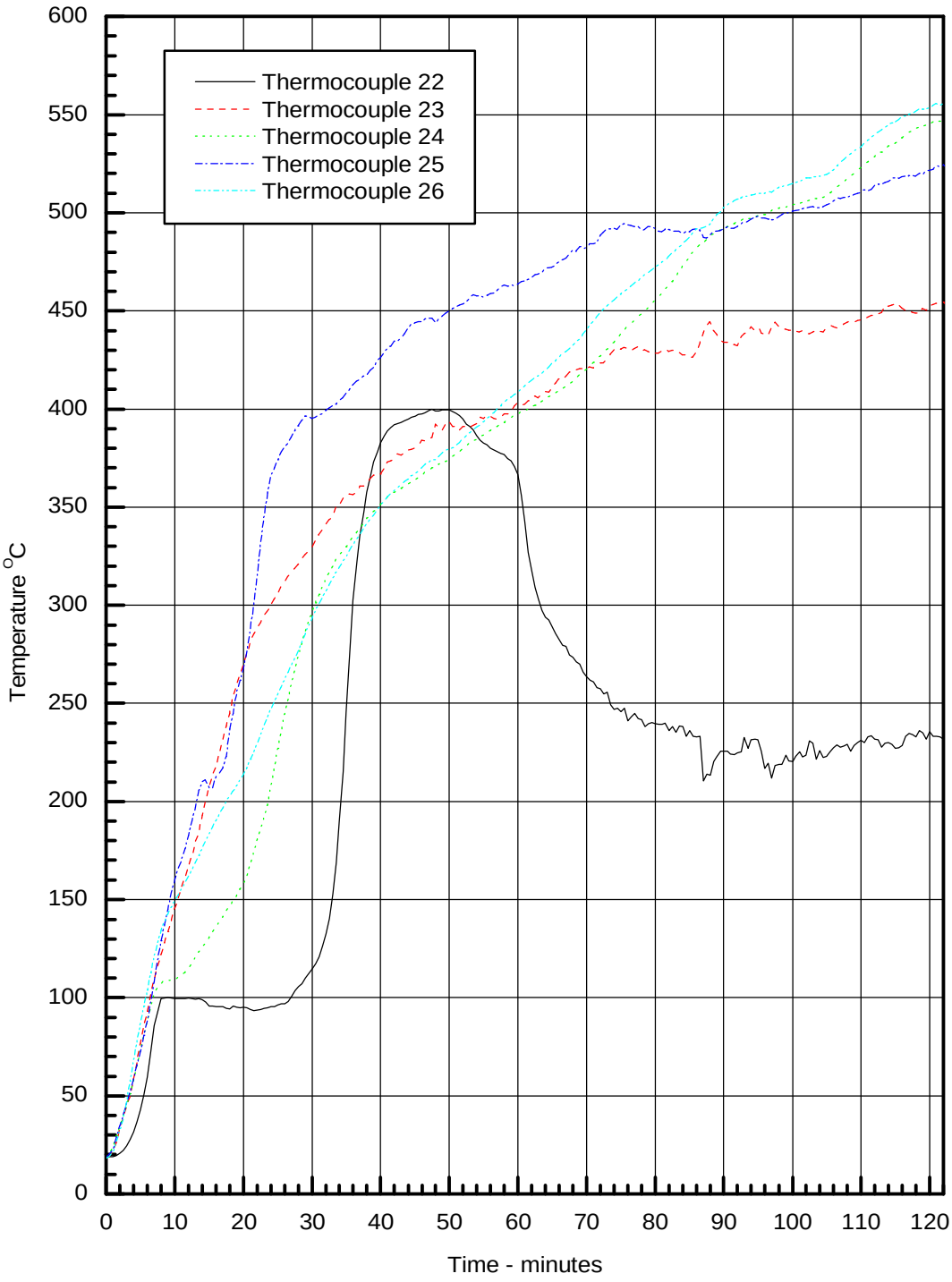
Temperatures recorded on the unexposed face by thermocouples 7 to 11.



Temperatures recorded on the unexposed face by thermocouples 12 to 16.



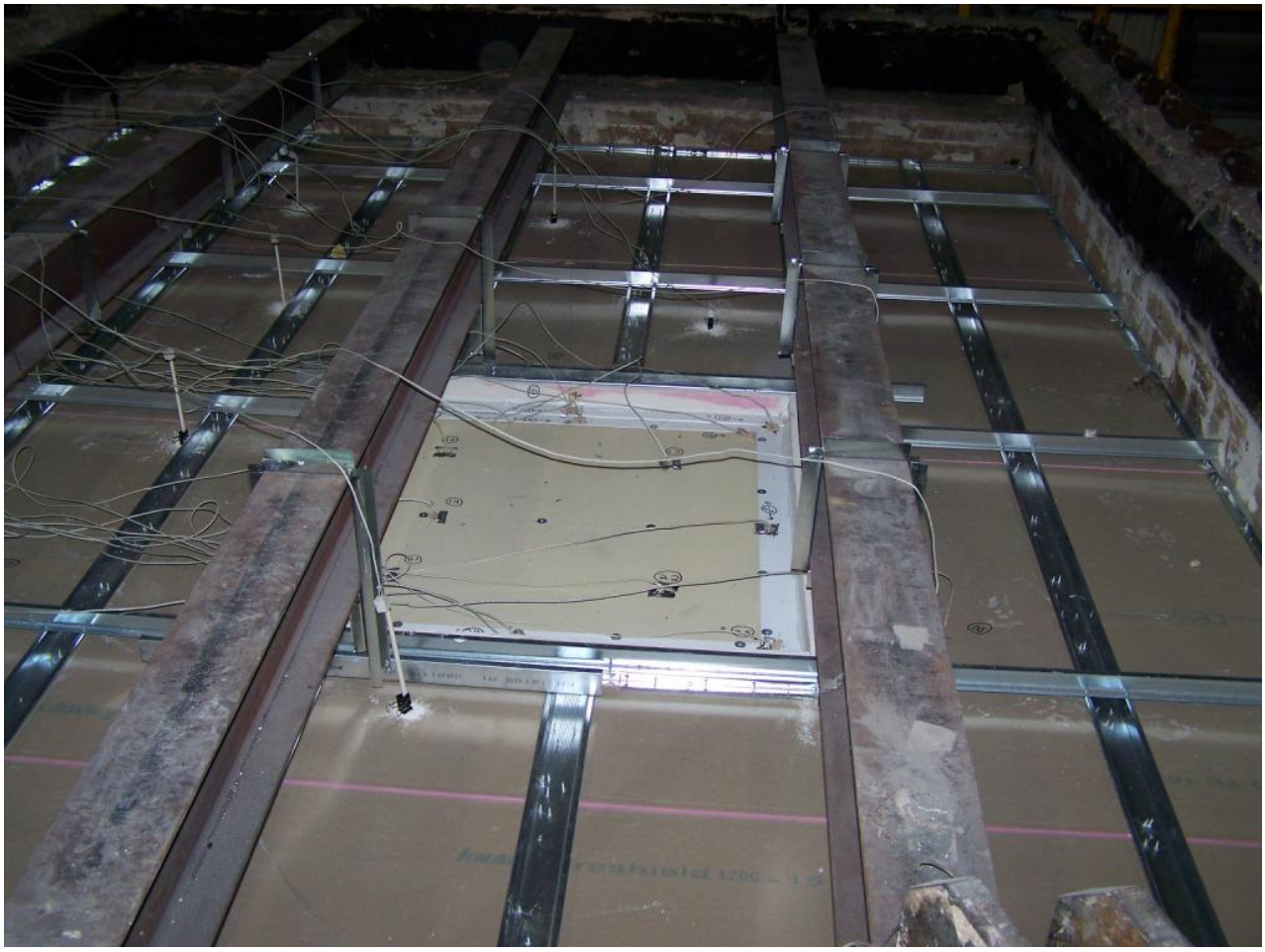
Temperatures recorded on the unexposed face by thermocouples 17 to 21.



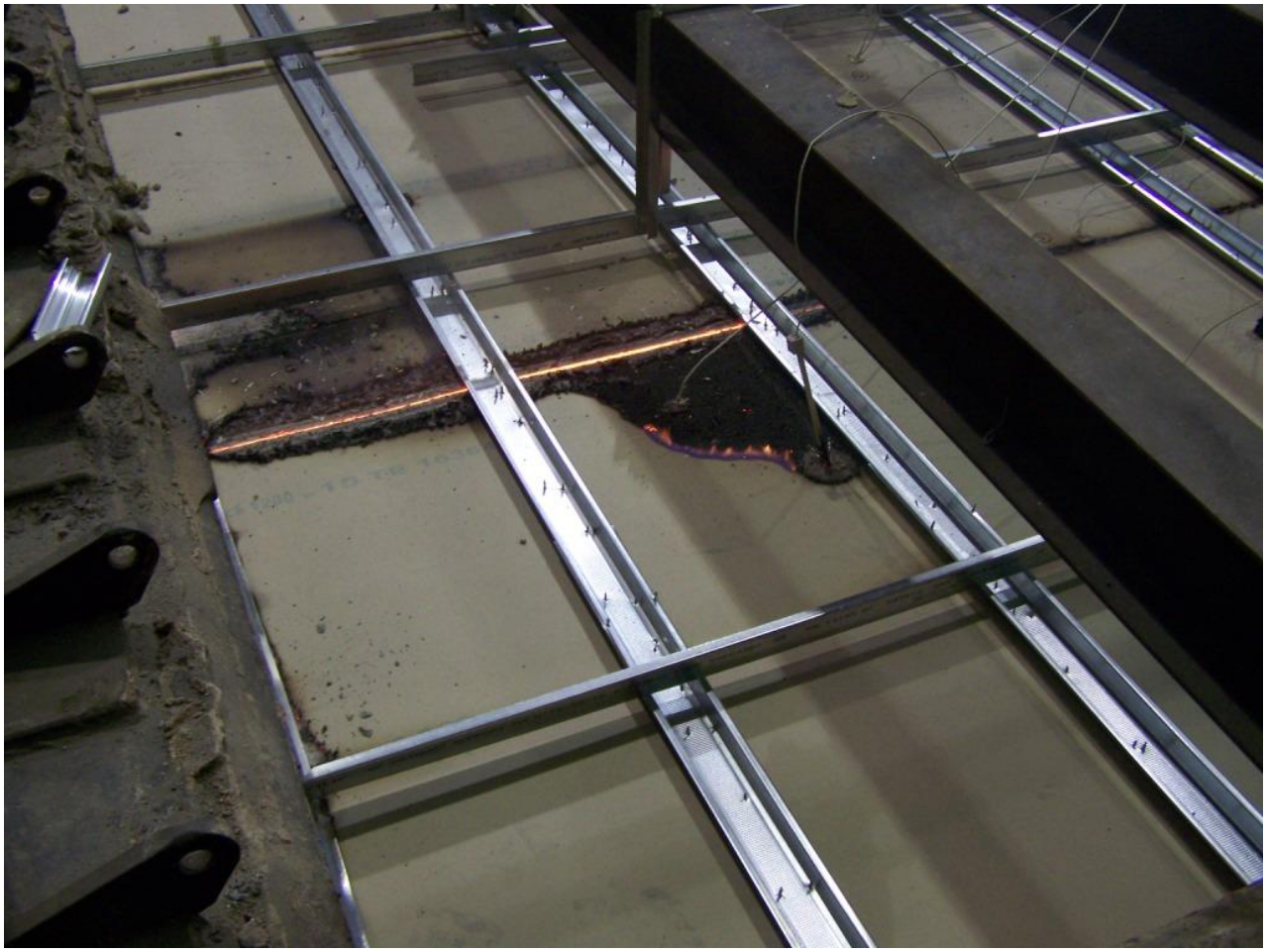
Temperatures recorded on the unexposed face by thermocouples 22 to 26.

11 PHOTOGRAPHS

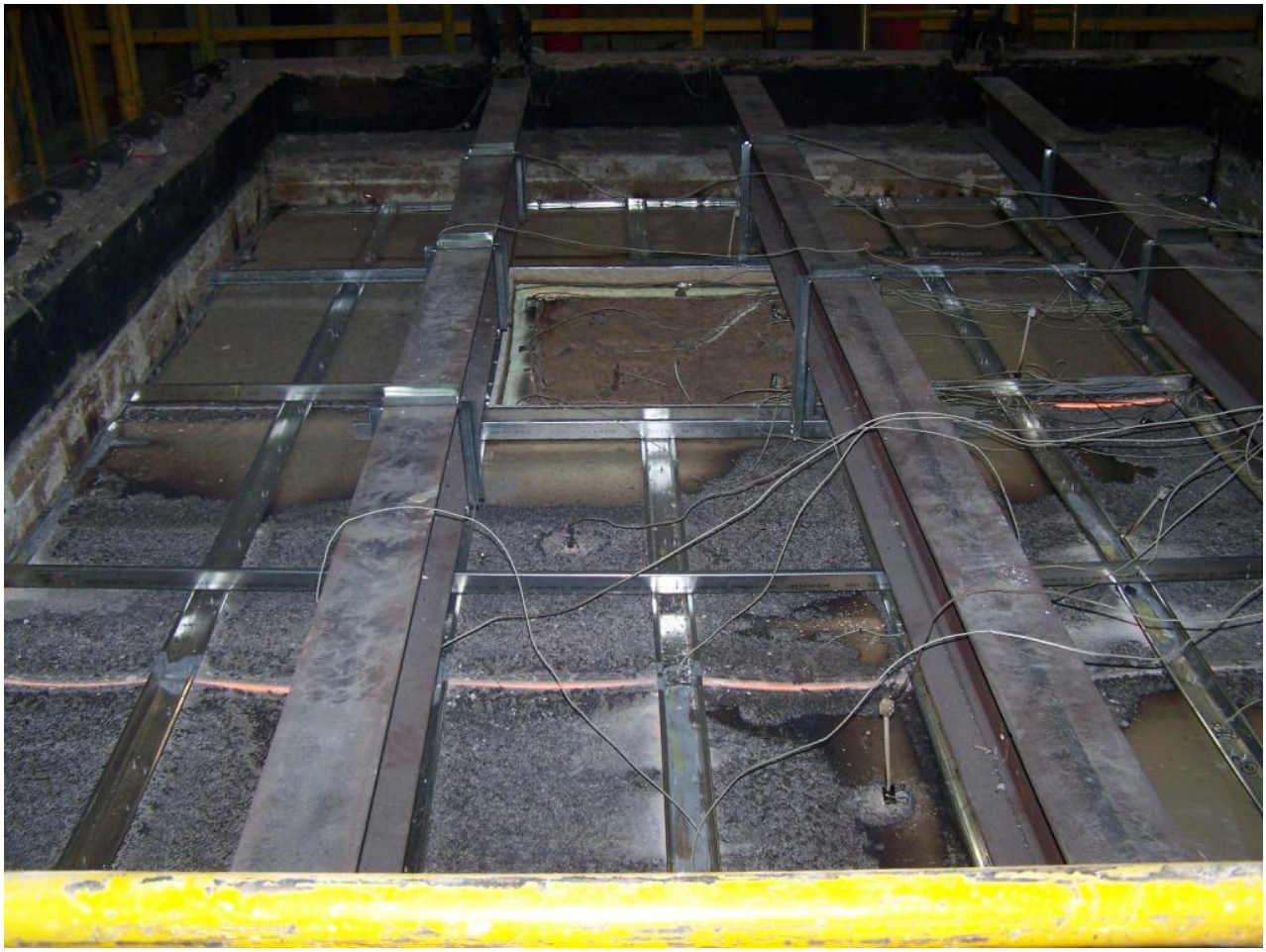
Exposed face of ceiling before test.



Unexposed face of ceiling before test.



Location of first integrity failure.



Unexposed face at end of test.

Exposed face after test.

==========REPORT ENDS==========