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TE 94529

TEST REPORT

Title: Fire resistance test in accordance with B.S. 476 : Part 22 : 1987 on a single-leaf access panel incorporated in a steel stud plasterboard partition.

Client: Fire Proofing Services Ltd.,
13 Shilton Road,
Barwell,
Leicestershire,
LE9 8NB.

Date: 3 July 2000

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SUMMARY

A single-leaf steel/plasterboard access panel incorporated in a steel-framed plasterboard partition, was subjected to a fire resistance test, in accordance with B.S. 476 : Part 22 : 1987 (Method 6) on 31 March 2000.

The access panel comprised a door leaf, nominally 2m high x 900mm wide x 45mm thick, consisting of a polyester powder coated 1mm-thick steel skin on one side and 12.5mm-thick Megadeco plasterboard on the other side with 30mm thick mineral wool between the faces. The panel leaf was hung in a steel frame incorporating a smoke seal, the leaf opening towards the furnace.

The access panel was incorporated in a steel-frame partition comprising one layer of 12.5mm-thick Lafarge Firecheck plasterboard followed by one layer of 12.5mm-thick Lafarge Megadeco plasterboard on each face of the partition. The specimen when tested in the orientation described was found to have the following fire resistance:

Insulation: 11min
Integrity: 57min

1 OBJECTIVE

To determine, at the request of Fire proofing Services Ltd., the fire resistance of a single-leaf access panel when installed in a plasterboard partition and tested in accordance with Method 6 of B.S. 476 : Part 22 : 1987[1].

2 CONSTRUCTION

2.1 Supporting construction

A Lafarge Drywall partition was constructed within the opening (nominally 3m x 3m) of a steel reinforced concrete test frame as follows:

Galvanised steel track, 50mm wide x 50mm deep, was secured to the test frame on three edges using 38mm Drywall screws and plugs at nominally 600mm centres. Vertical galvanised steel studs, 50mm wide x 50mm deep, were located at nominally 600mm centres across the partition. The vertical studs fitted tightly into the perimeter channel, with no other fixing being used.

Each side of the partition was clad with one layer of 12.5mm Firecheck plasterboard, followed by one layer of 12.5mm thick Megadeco plasterboard. All boards were screwed to the studs at nominally 300mm centres using 25mm long Drywall screws on the inside layer of boards, and 38mm long Drywall screws on the outer layer. The boards were arranged so that the joints in each layer of board on each face were staggered other by a minimum of 600mm.

One vertical edge of the partition was unrestrained (i.e. not attached to the test frame).

2.2 Specimen construction

The sponsor provided the following descriptions of the specimen. Surface detail and dimensions were verified by the LPC before the test.

2.2.1 Panel door tray

This was a 1.0mm-thick Zintec steel skin, which was polyester powder-coated in Ral9010 20% gloss with pre-formed 1.2mm-thick top-hat section stiffeners welded to the sides and middle section of the door tray. The voids within the door tray were filled with a rock wool insulation (type and density not stated by the sponsor). A 12.5mm-thick sheet of Lafarge Megadeco wallboard was fixed to the rear face of the door tray using 32mm drywall screws. The panel had a fire retardant smoke seal attached to the frame perimeter and was fitted to M6 bolts welded to the door tray and fixed to the frame using nuts and washers to M6 bolts welded to the frame at 150mm in from the edges and 300mm centres thereafter. The panel was locked by three budget locks, one lock positioned approximately 200mm in from each end, top and bottom, with one lock central.

2.2.2 Panel frame

This consisted of a 1.2mm-thick Zintec steel section with M6 bolts welded to the hinge side. The 25mm-wide front picture frame flange was mitred at each corner. The frame was polyester powder coated to Ral9010 20% gloss.

2.2.3 General

The actual overall panel dimensions, not including the picture frame surround were 2000mm high x 900mm wide, with a 25mm-wide picture frame surround mitred at each corner. The three budget lock holes on the front face of the panel door were each fitted with a removable metal screw bung. Plastic spacer plugs were also fitted in the edge of the door tray, two top and bottom with two on the opening side.

Full details of the specimen construction are shown in Figures 1 to 4 and the completed construction is shown before the test in Plates 1 and 2.

3 TEST PROCEDURE

3.1 General

The test was carried out on 31 March 2000 and was witnessed by Messrs P. Carpenter, I. Wheeler, K. Judge, T. Beasley, B. Blenkinsopp, R. Harrison, and G. Castledine representing the sponsor, and Mr. C. Walker from Lafarge Plasterboard. The ambient temperature at the start of the test was 12°C.

3.2 Furnace control

The furnace temperature was measured by means of sixteen bare-wire chromel/alumel thermocouples arranged symmetrically in the furnace in four rows of four with their measuring junctions 100mm away from the exposed face of the specimen. The furnace was controlled so that the average temperature followed the time temperature relationship specified in B.S. 476 : Part 20 : 1987[1]. After the first 5min of the test the pressure in the furnace was maintained in accordance with B.S. 476 : Part 22 : 1987, so that a neutral pressure plane existed 1m above the bottom of the partition.

3.3 Specimen temperature

The temperature on the unexposed face of the specimen was measured using twenty-three chromel/alumel (K-type) thermocouples each soldered to a copper disc and covered with an insulating pad, 30mm x 30mm x 2mm thick, as described in B.S. 476 : Part 20 : 1987[1].

The location of the thermocouples is given in Table 1 below. Thermocouples attached to the supporting construction were for information only, as requested by a Lafarge representative.

Table 1 Locations of surface thermocouples

Thermocouple number	Location
1	On the top perimeter of the supporting construction, next to a screw.
2	On the top perimeter of the supporting construction, next to a joint in the Megadeco board.
3	Over an internal stud on the right hand side of the supporting construction, approximately 200mm from top.
4	On the supporting construction, adjacent to the top left hand corner of the opening for the access panel.
5	On the supporting construction, centrally above the opening for the access panel.
6	Next to a corner joint in the Megadeco boards to the top left of the supporting construction.
7	On the access panel frame, centrally above the panel leaf.
8	On the right hand perimeter of the supporting construction.
9	In the centre of the top left quarter of the supporting construction.
10	On the access panel leaf, in the top left hand corner.
11	In the centre of the top right quarter of the supporting construction.
12	Near the top of the access panel leaf, adjacent to a fixing washer on the leaf.
13•	In the centre of the top left hand quarter of the access panel leaf.
14•	In the centre of the top right hand quarter of the access panel leaf.
15	In the centre of the access panel leaf, over an internal "top hat" member of the leaf.
16•	In the nominal centre of the access panel leaf.
17	On the left hand side of the access panel frame, at mid height.
18	On the right hand side of the access panel frame, at mid height.
19•	In the centre of the bottom left hand quarter of the access panel leaf.
20•	In the centre of the bottom right hand quarter of the access panel leaf.
21	In the centre of the bottom left hand quarter of the supporting construction.
22	In the centre of the bottom right hand quarter of the supporting construction.
23	On the supporting construction, near the top right hand side of the access panel opening, next to a screw.

• Used to determine the mean surface temperature of the access panel leaf.

3.4 Deflection

A transducer activated by a fine taut wire was attached to the top left corner of the access panel leaf to continuously monitor deflection at this point throughout the test. The deflection at this height was also recorded using a steel rule at four other locations (given in section 4.3) across the specimen and supporting construction, by reference to a taut fixed wire.

3.5 Irradiance

A radiometer was located horizontally 3m from the centre of the specimen to record irradiance during the test.

4 RESULTS

4.1 Observations

The observations made during the test are given in Table 2. All observations are of the unexposed face.

Table 2 Observations

Time min : s	Observation.
0:00	Test started.
5:00	Smoke is issuing from between the access panel leaf and frame at the top right hand side.
10:00	Some yellow colouration is forming on the right hand side of the panel leaf for approximately 400mm above mid height of the leaf.
13:00	The area referred to at 10min is now turning a brown colour as more heat passes through the specimen.
17:00	The edge of the panel leaf is charring (a black colour) for approximately 50mm from the right hand side of the leaf, and also across the top of the leaf.
19:00	The coating on the panel frame is charring and bubbling. The charring on the leaf referred to at 17 min now extends around the perimeter of most of the leaf.
22:00	A maximum temperature of 80°C was recorded on the access panel leaf using the roving thermocouple.
27:00	A slight glow from the paper coating on the Megadeco board of the panel leaf can be seen towards the right hand side of the leaf. A small gap (approx. 2mm) has formed between the board and tray of the panel leaf.
30:00	The supporting partition above the right hand side of the access panel is scorching a brown colour.

Table 2 Observations (continued)

Time min : s	Observation.
32:00	The surface of the panel leaf is scorching a brown colour along three vertical strips, which correspond to the internal "top hat" sections within the leaf. The paper on the Megadeco board near the top of the leaf is glowing and charring with pieces of ash falling from the leaf.
42:00	The paper has charred to ash up to the first internal "top hat" at each side of the leaf (approx. 150mm), the top 400mm of the leaf, and between 300mm and 400mm up from the bottom of the leaf.
49:00	The paper has now charred around each location of the bolts and washers on the surface of the leaf.
56:00	The whole surface of the panel leaf has turned a dark brown colour, and the paper continues to glow steadily over the surface.
57:00	Integrity failure by sustained flaming on surface of panel leaf.
62:00	Flaming on the panel leaf has ceased.
73:00	A gap of approximately 7mm has formed between the outer board of the panel leaf and the panel tray. This gap does not pass into the furnace, and is not causing a failure of integrity (gaps).
90:00	The gap referred to at 73min is now approximately 10mm wide.
104:00	A piece of Megadeco board (approx. 800mm x 400mm) inside the furnace has fallen from near the bottom of the supporting construction.
132:00	Test stopped.

The specimen is shown after two hours and after the test in Plates 3 and 4.

4.2 Temperature measurements

4.2.1 Furnace temperature

The mean furnace temperature is plotted against time in Figure 5 with the specified curve for comparison.

4.2.2 Temperature measurements on the unexposed face

The mean (recorded by thermocouples 13, 14, 16, 19, and 20) and maximum temperatures recorded on the access panel leaf are plotted against time in Figure 6. Individual surface temperatures recorded on the supporting partition are given in Figures 7 and 8. Individual temperatures recorded on the access panel frame and leaf are shown in Figures 9 to 11.

The limit for maximum temperature rise (180°C) was first exceeded on the access panel frame after 11min by thermocouple number 7. The limit for the rise in mean temperature on the door leaf (140°C) was exceeded after 48min.

4.3 Deflection measurements

The deflection recorded at the location described in section 3.4 is shown plotted against time in Figure 12. Manual deflection measurements made across the construction are given in Table 3. Position A was located 500mm from the left hand (unrestrained) edge of the supporting construction, B was located 100mm from the left hand side of the panel leaf, C was located in the centre of the panel leaf, and D was located 100mm from the right hand side of the panel leaf.

Table 3 Manual deflection measurements (mm)

All deflection was towards the furnace.

Time min	Deflection point A	Deflection point B	Deflection point C	Deflection point D
0	0	0	0	0
9	11	23	38	25
18	15	26	45	24
30	15	24	43	24
45	29	34	49	34
73	55	82	93	74
90	65	104	103	84

4.4 Irradiance measurements

The irradiance recorded 3m from the centre of the specimen is plotted against time in Figure 13.

5 PERFORMANCE CRITERIA

The standards[1,3] state that a door / shutter assembly is regarded as having a fire resistance (expressed in minutes) that is equal to the elapsed time (to the nearest completed minute) 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) a 6mm-diameter gap gauge can penetrate through a gap into the furnace except at sill level, 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 unexposed face temperature increases by more than 140°C above its initial value;

b) when the temperature recorded at any positions on the unexposed face is in excess of 180°C above the initial mean unexposed face temperature;

c) when integrity failure occurs.

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.

6 CONCLUSION

A single-leaf access panel incorporated in a plasterboard partition, as described in this report, when tested in accordance with B.S. 476 : Part 22 : 1987 was found to have the following fire resistance:

Insulation: 11min
Integrity: 57min

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.

7 REFERENCES

1 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.

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

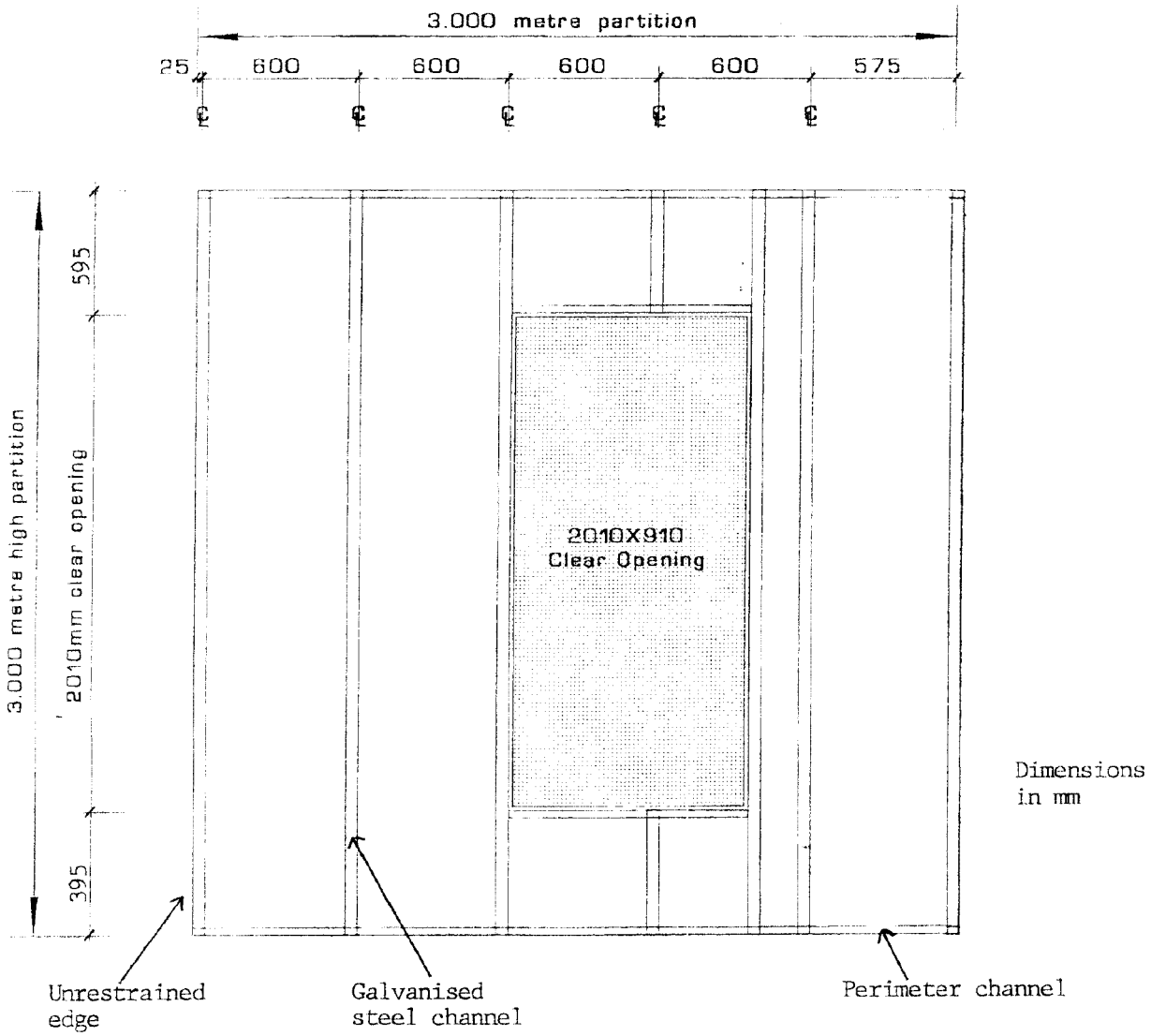

Figure 1 Supporting construction showing location of access panel opening

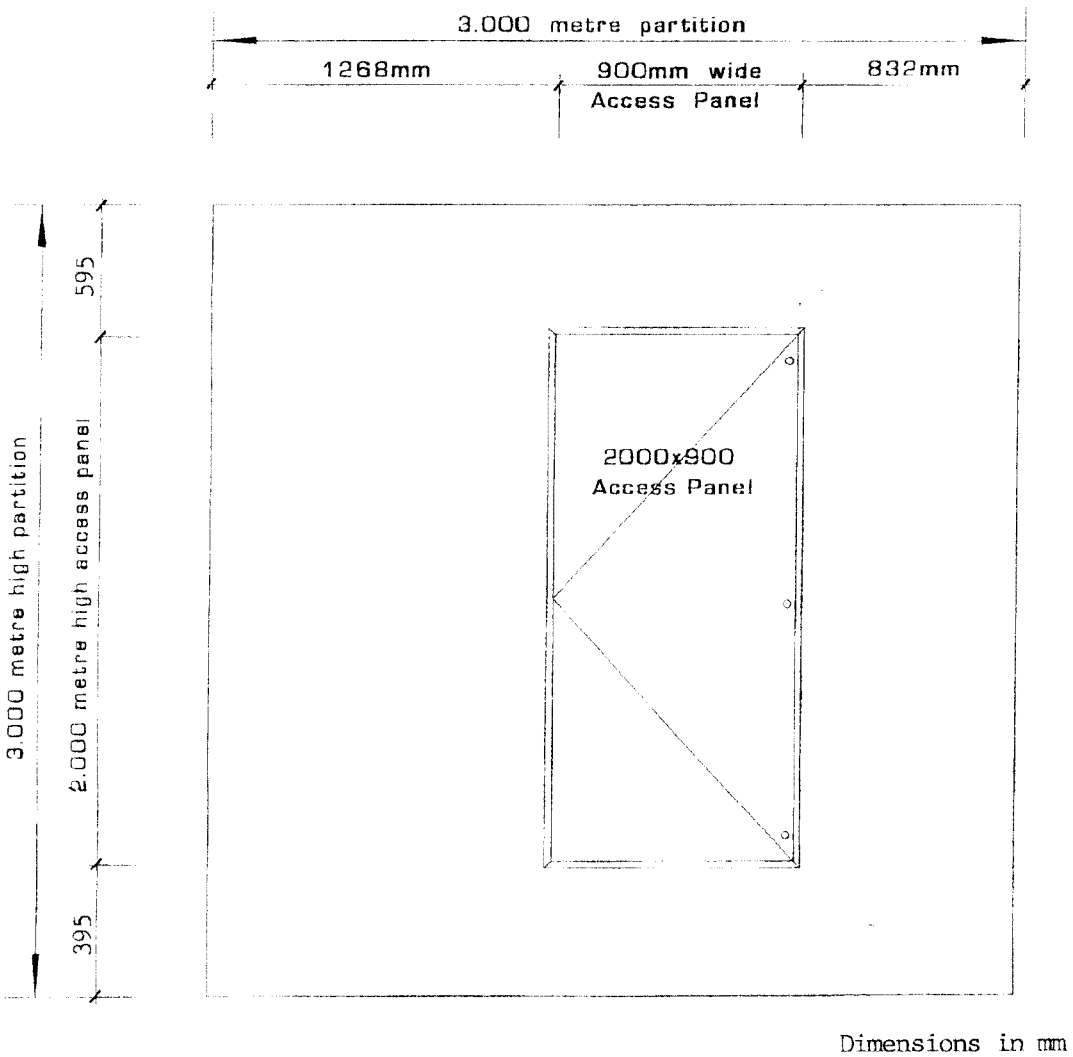

Figure 2 Front elevation showing access panel position

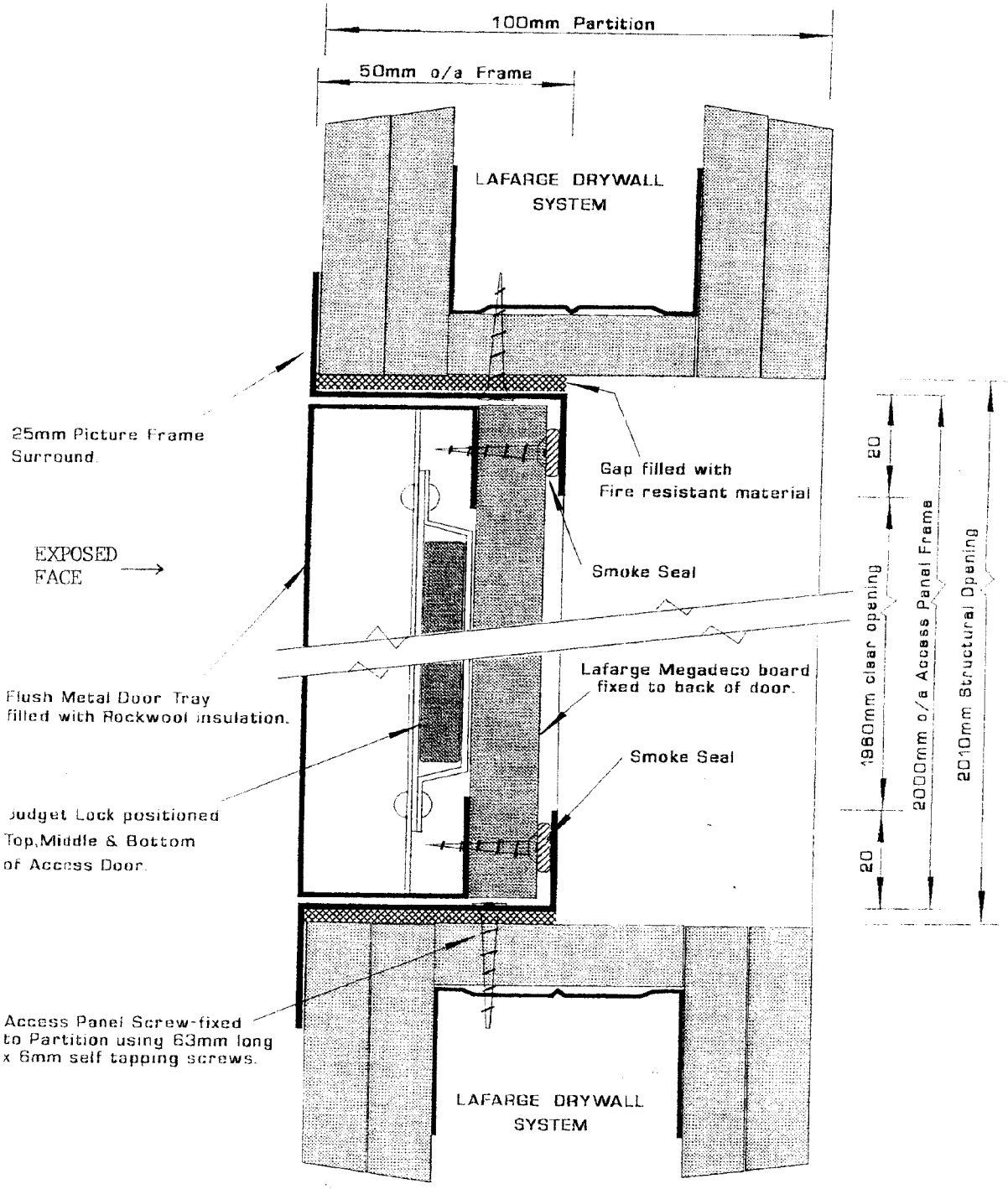

Figure 3 Vertical section through partition and access panel

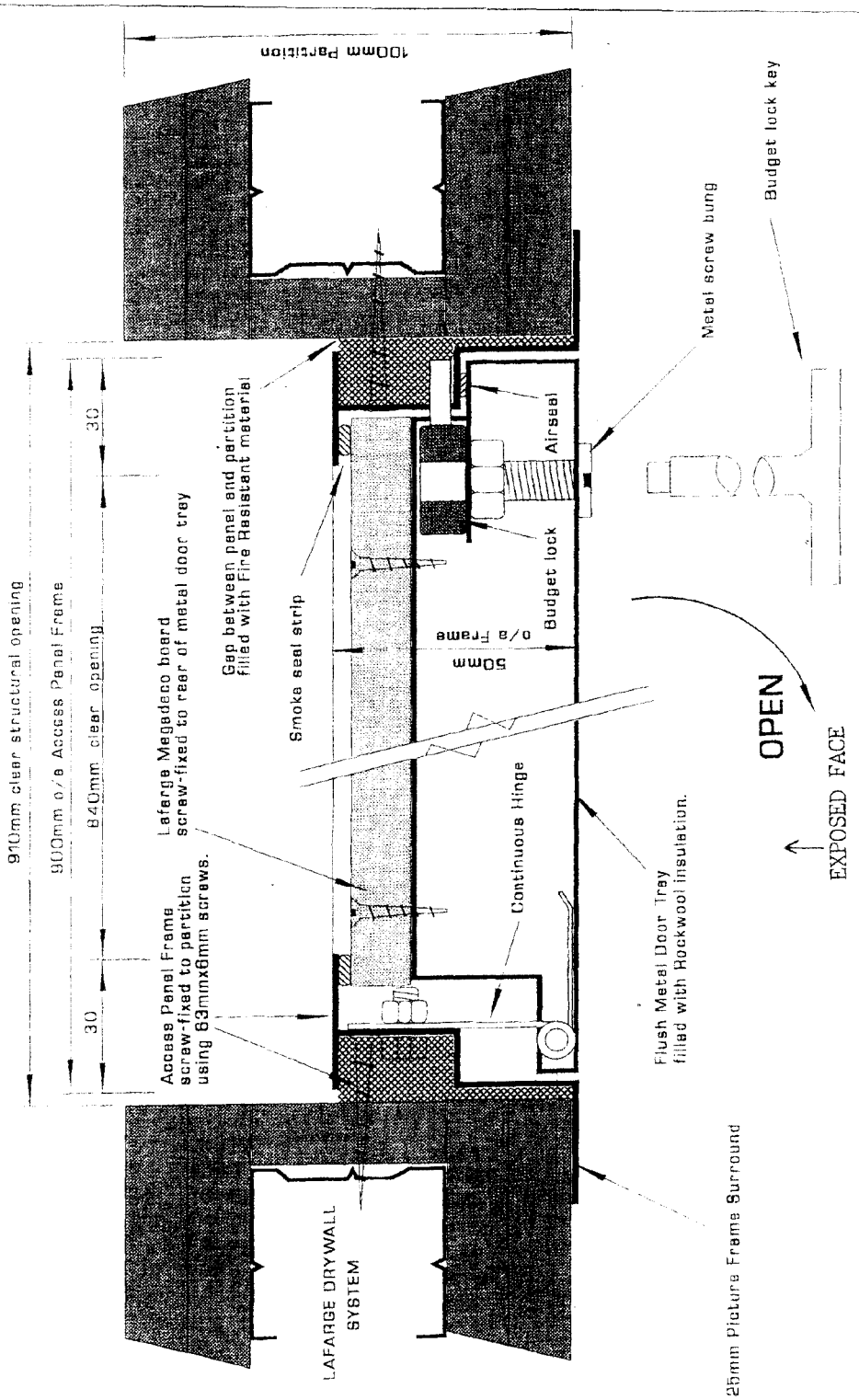

Figure 4 Vertical section through partition and access panel

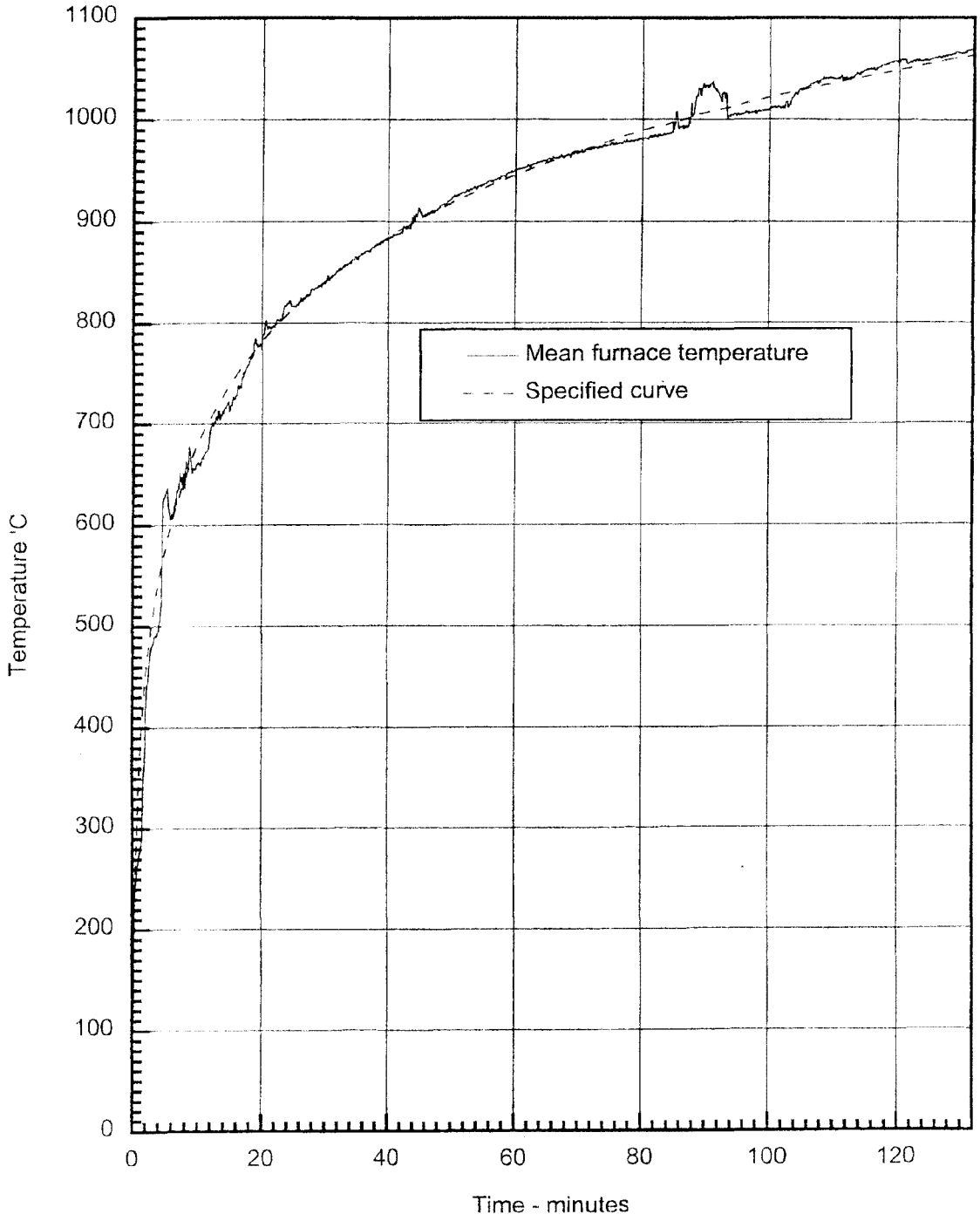

Figure 5 Mean furnace temperature with specified curve for comparison

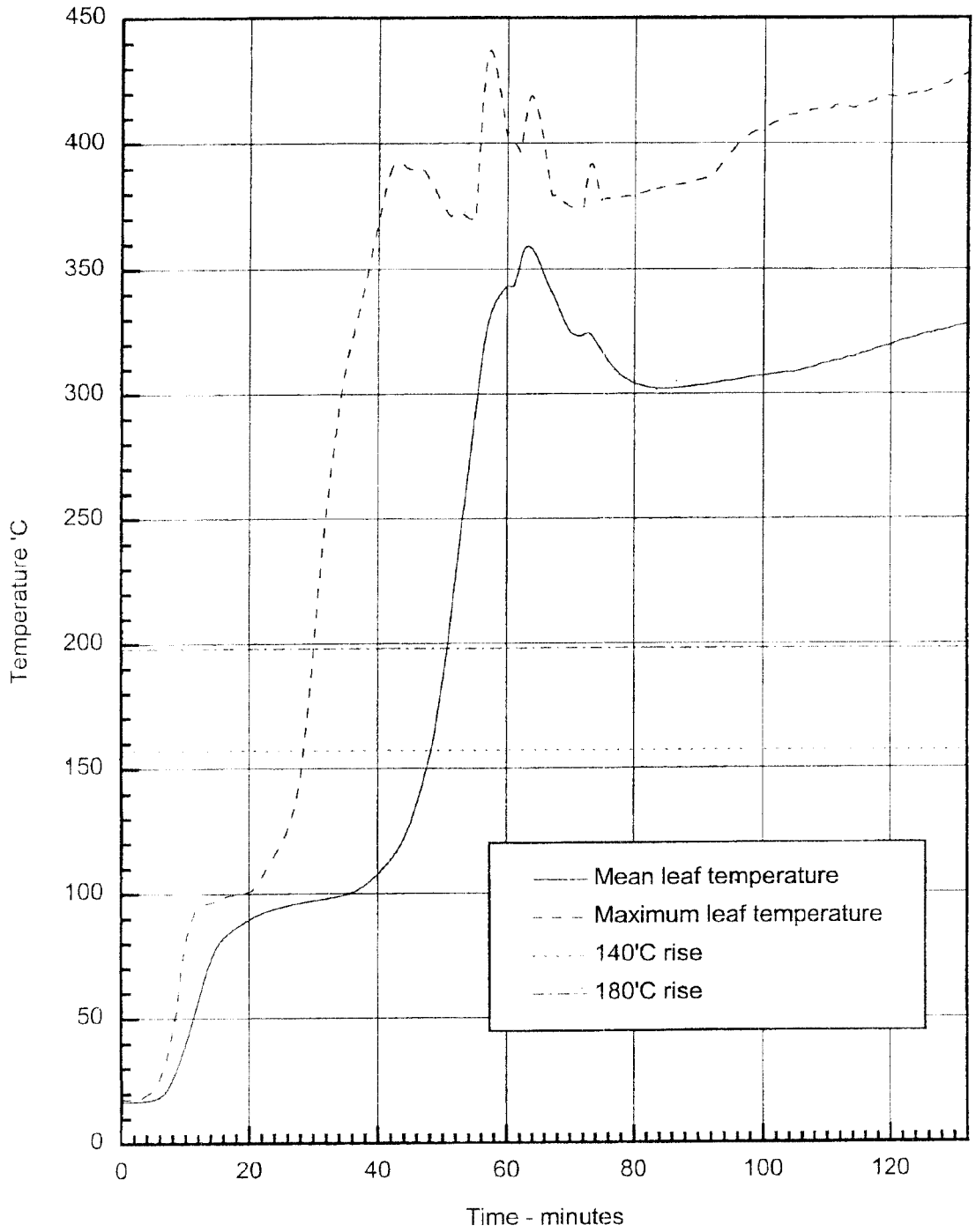

Figure 6 Mean and maximum temperatures recorded on unexposed face of access panel leaf

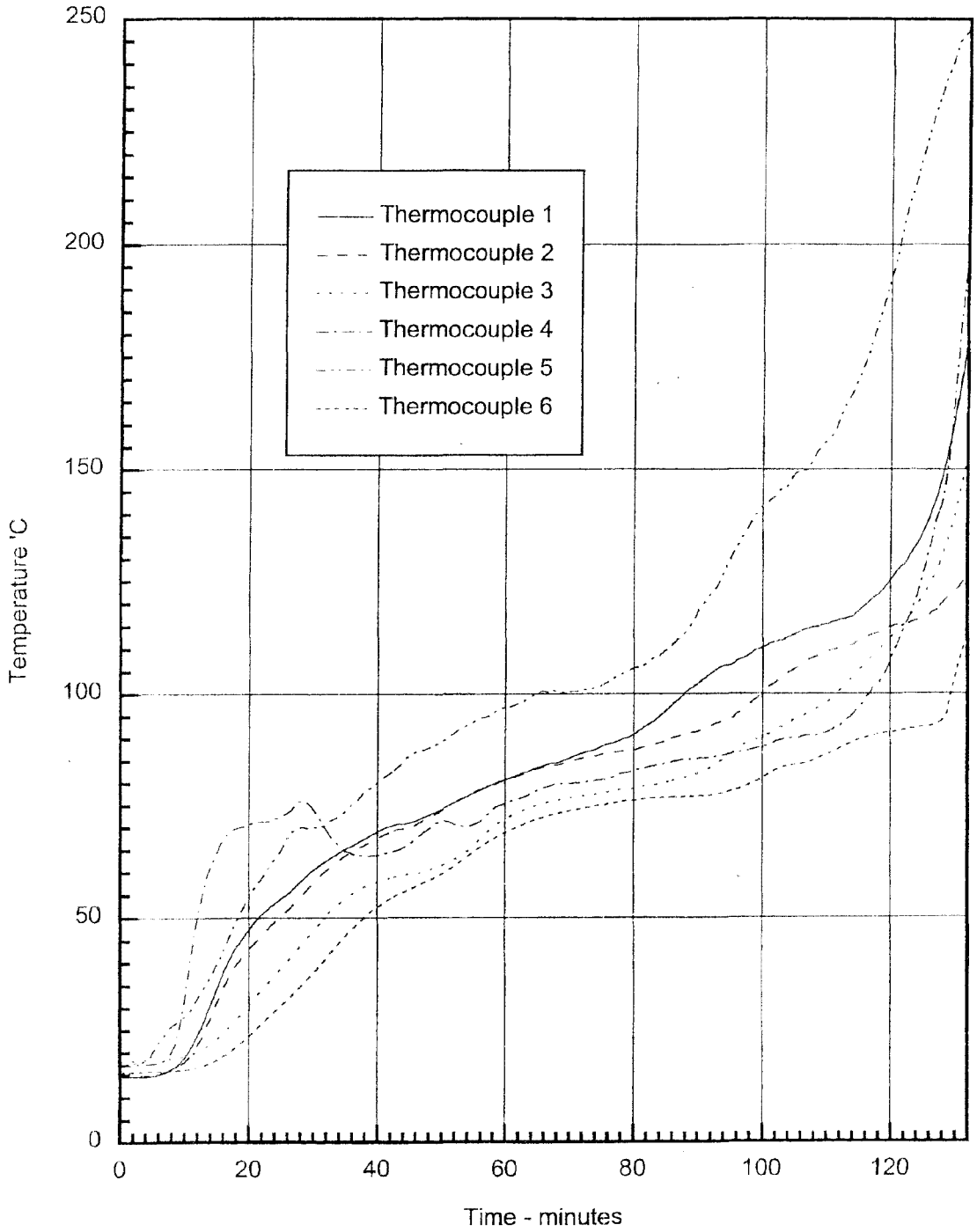

Figure 7 Temperatures recorded on the unexposed face of the supporting construction by thermocouples 1 to 6

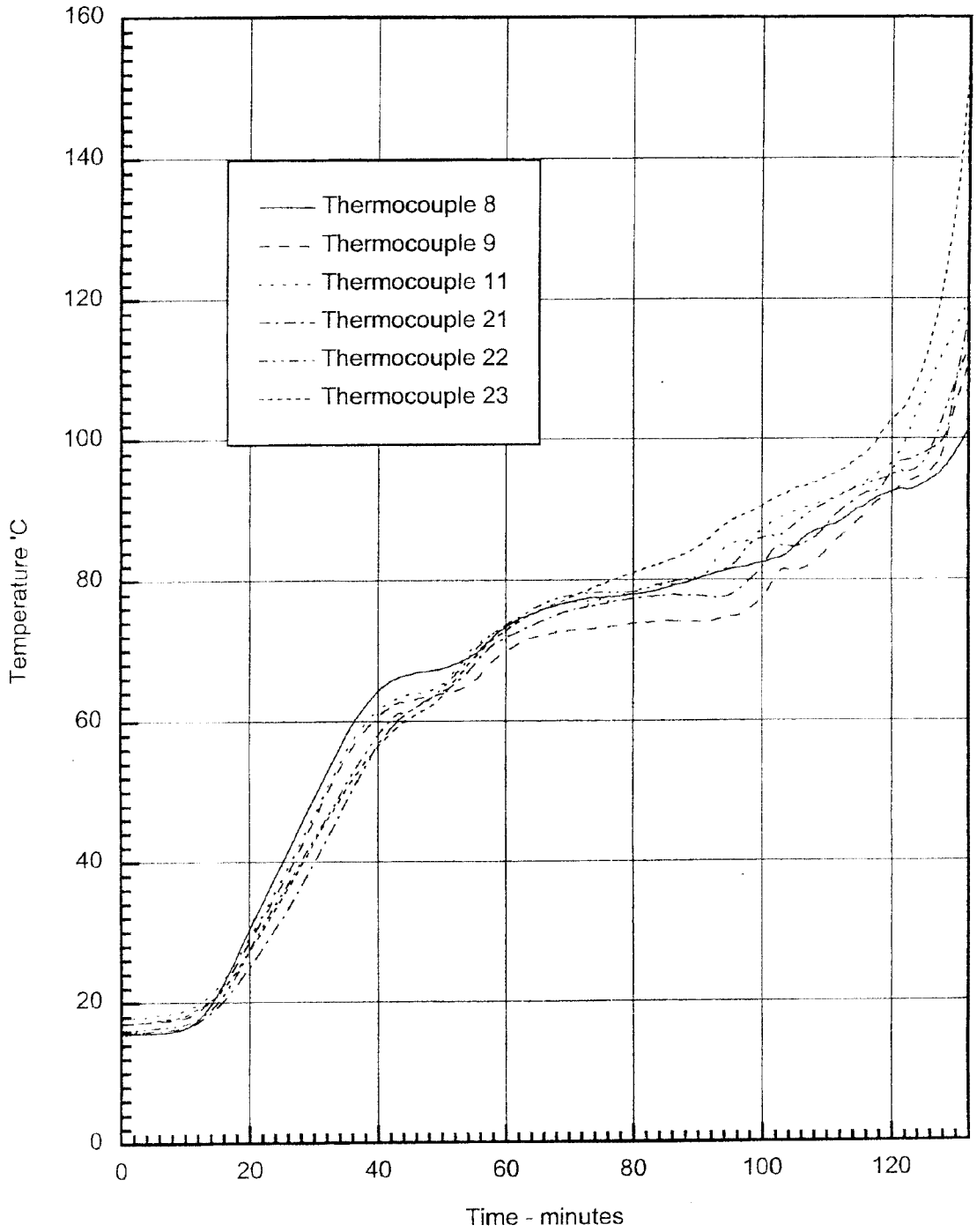

Figure 8 Temperatures recorded on the unexposed face of the supporting construction by thermocouples 8,9,11 and 21 to 23

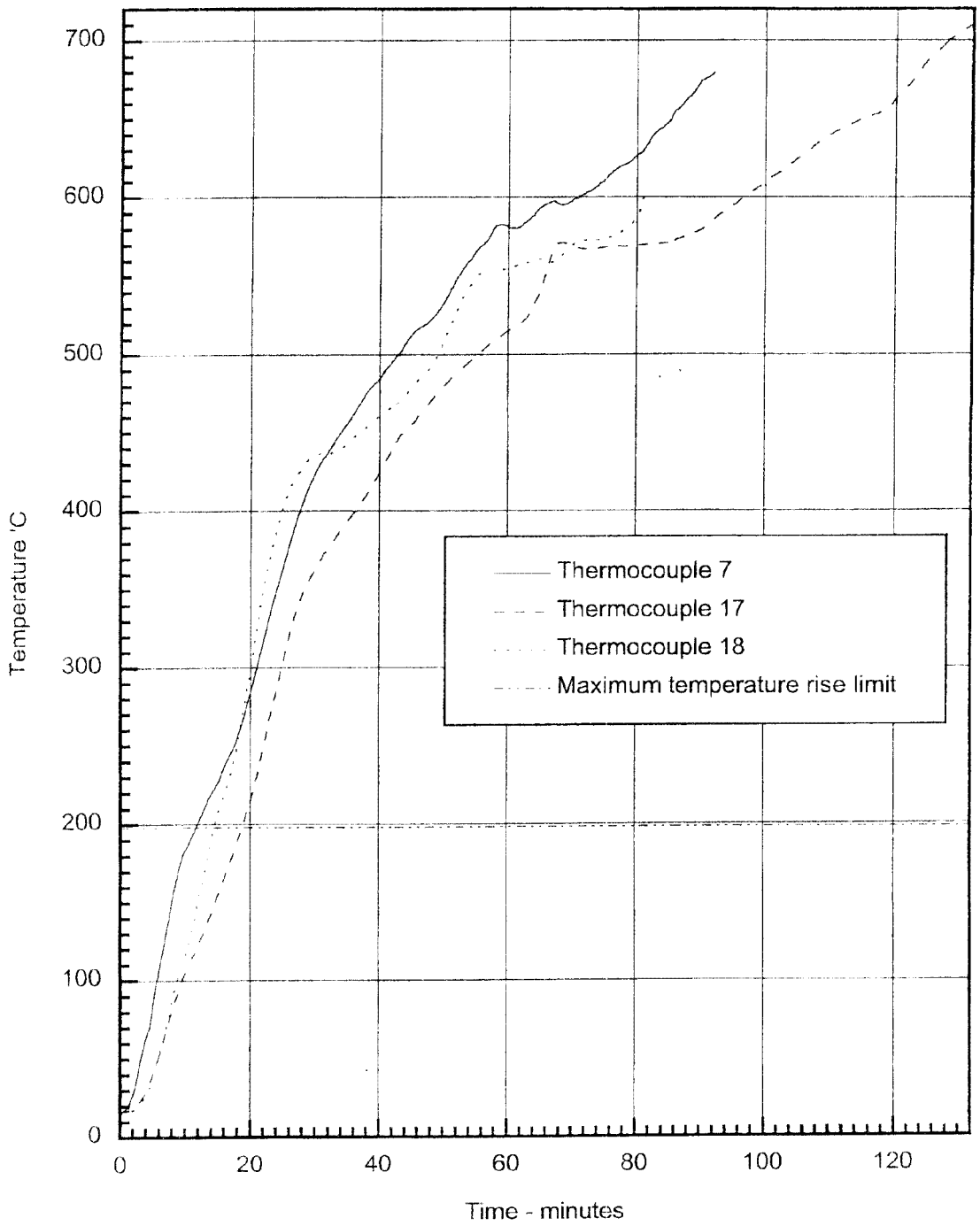

Figure 9 **Temperatures recorded on unexposed face of access panel frame by thermocouples 7,17 and 18**

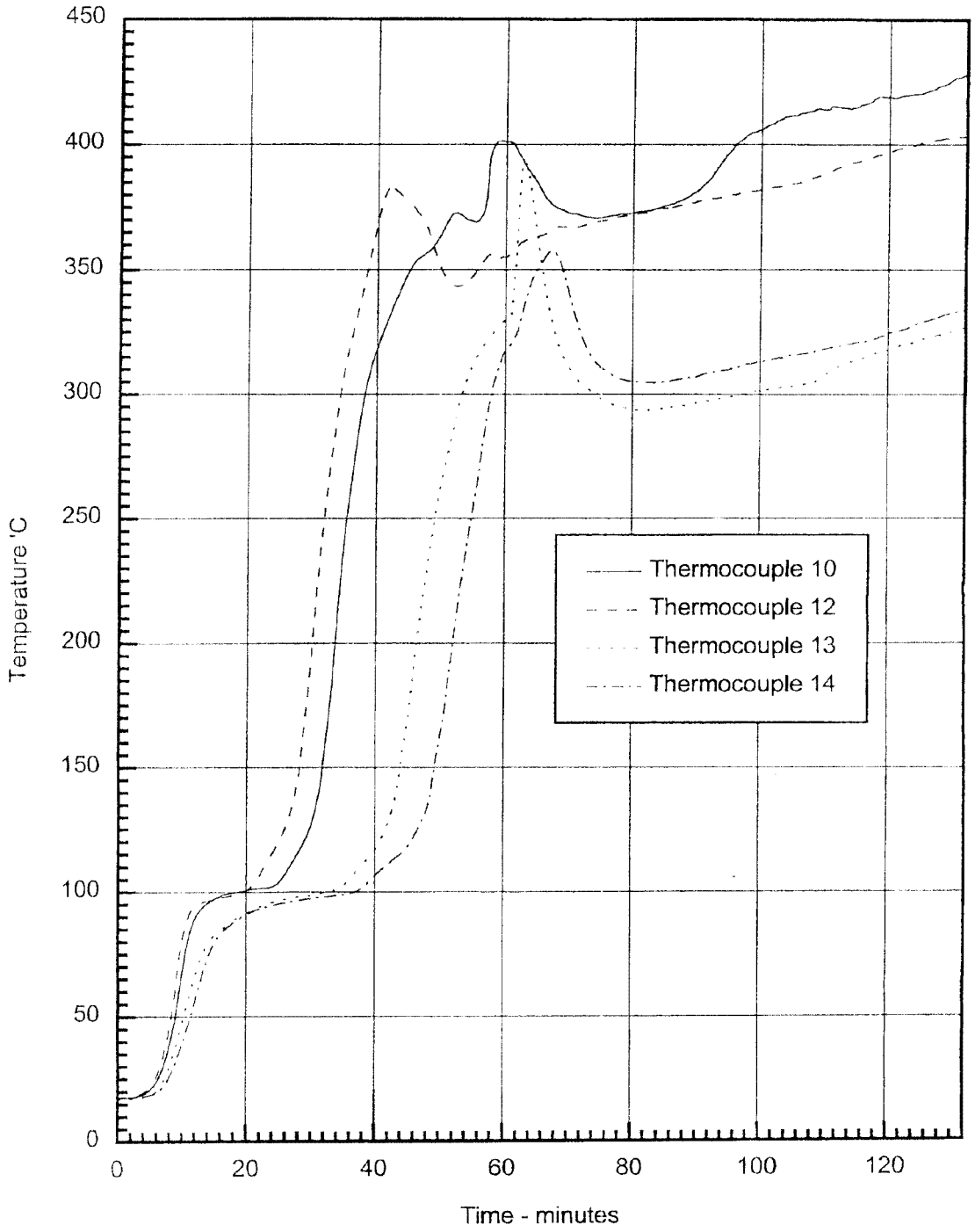

Figure 10 Temperatures recorded on the unexposed face of the access panel leaf by thermocouples 10, 12, 13 and 14

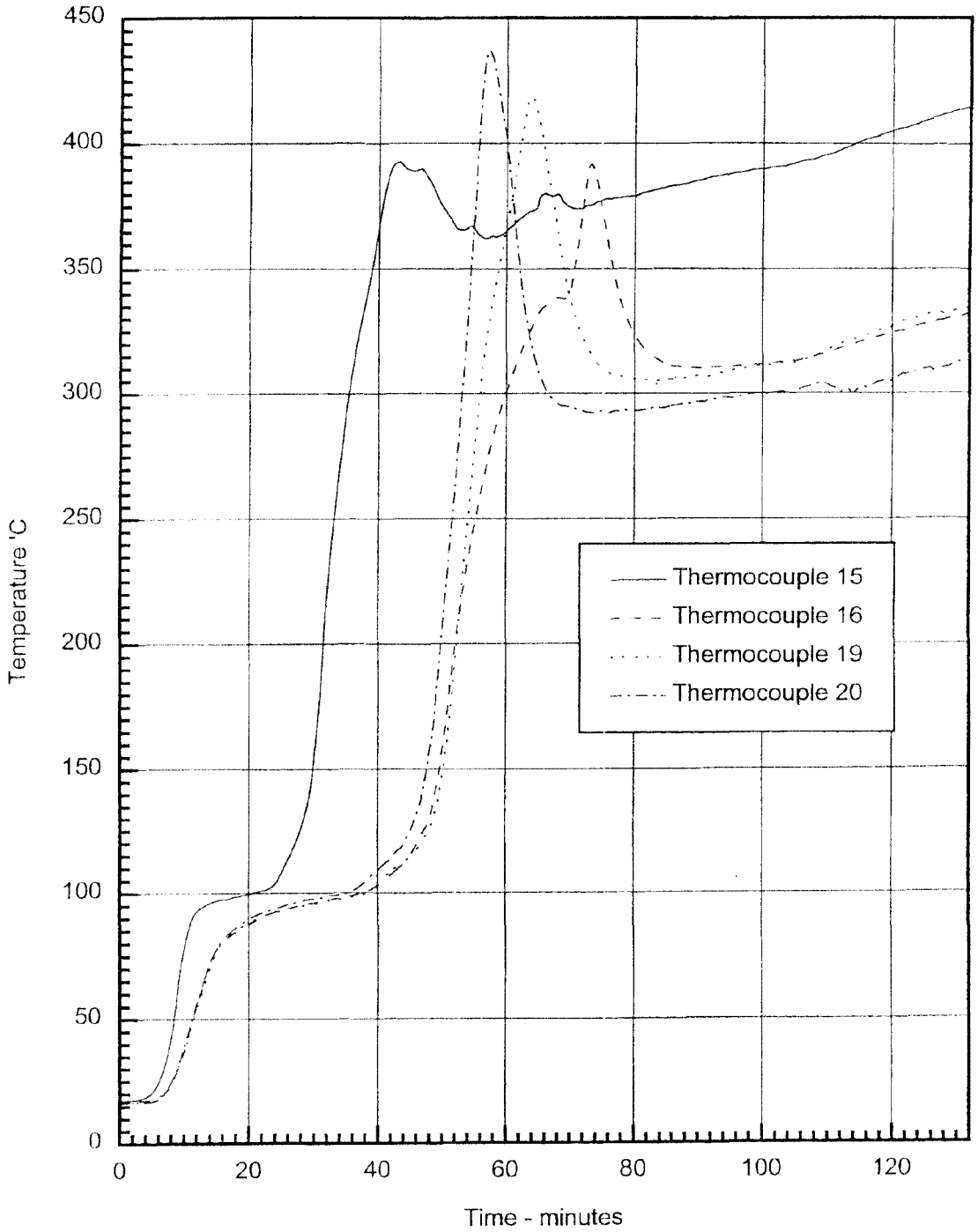

Figure 11 Temperatures recorded on the unexposed face of the access panel leaf by thermocouples 15,16,19 and 20

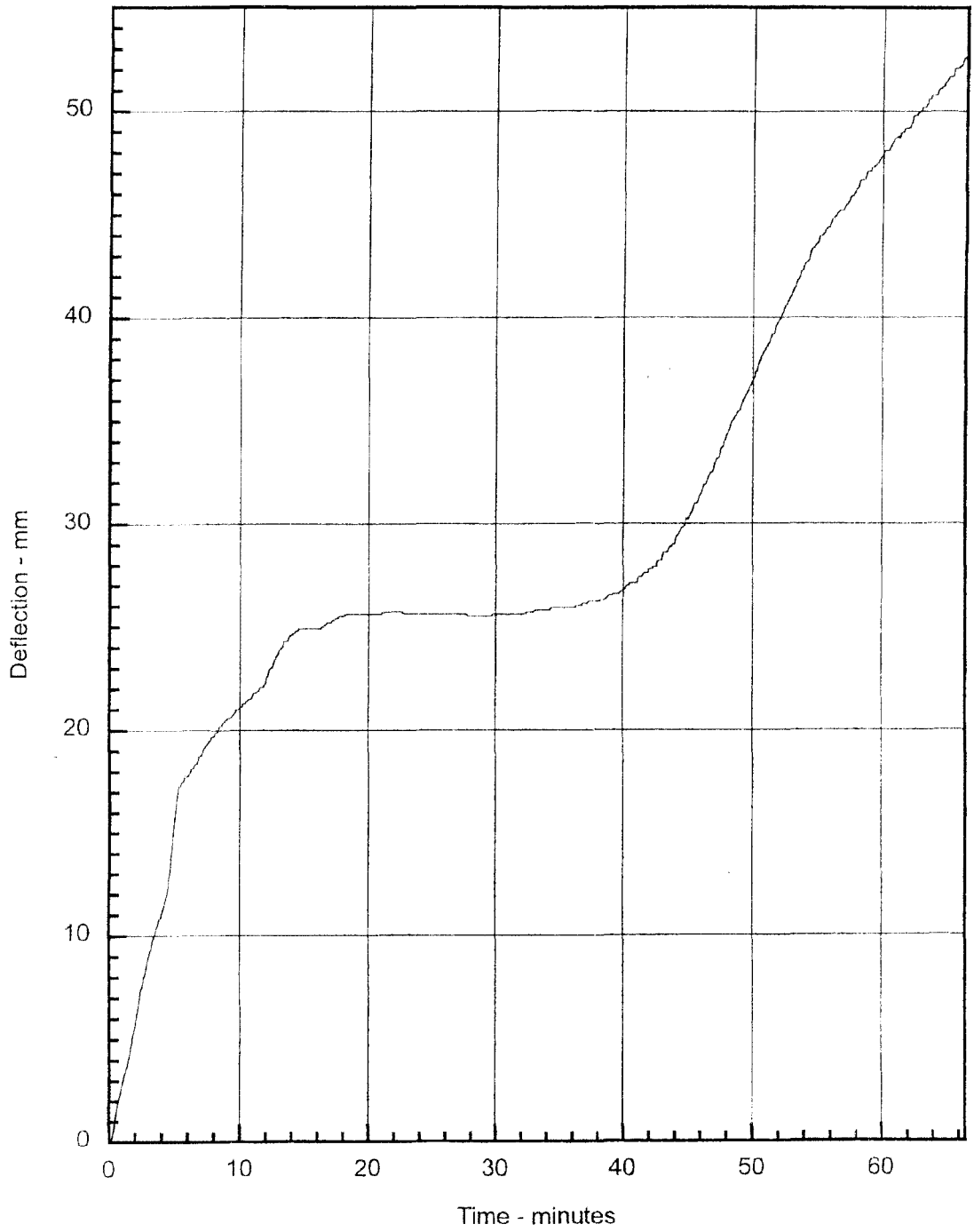

Figure 12 Horizontal deflection recorded at top left corner of access panel leaf

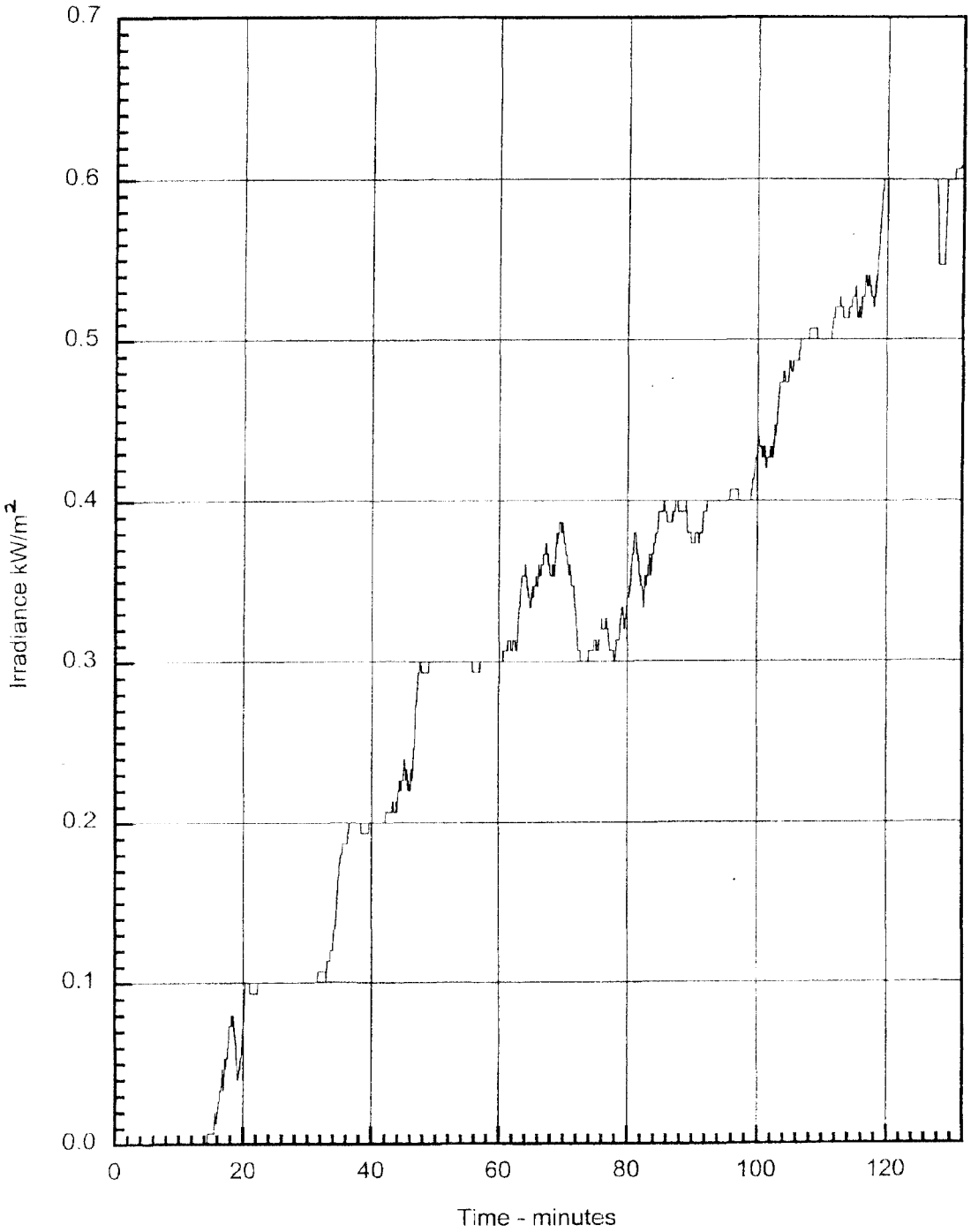

Figure 13 Irradiance recorded 3m from centre of specimen

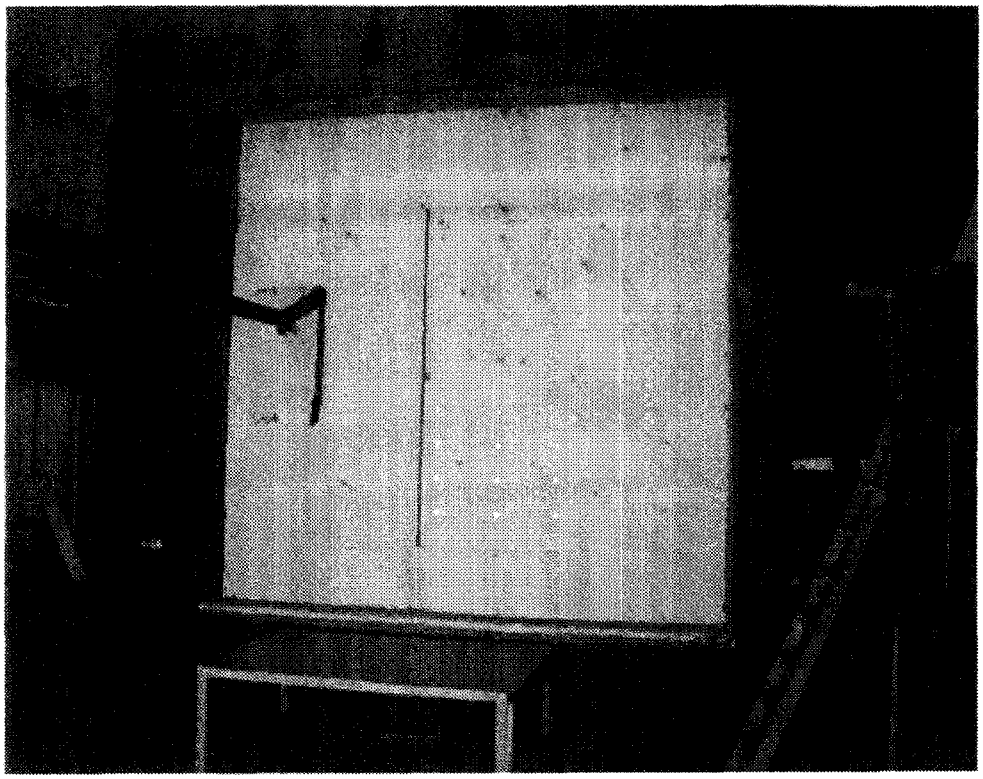

Plate 1 Unexposed face of specimen before test

(Neg.No. 005)

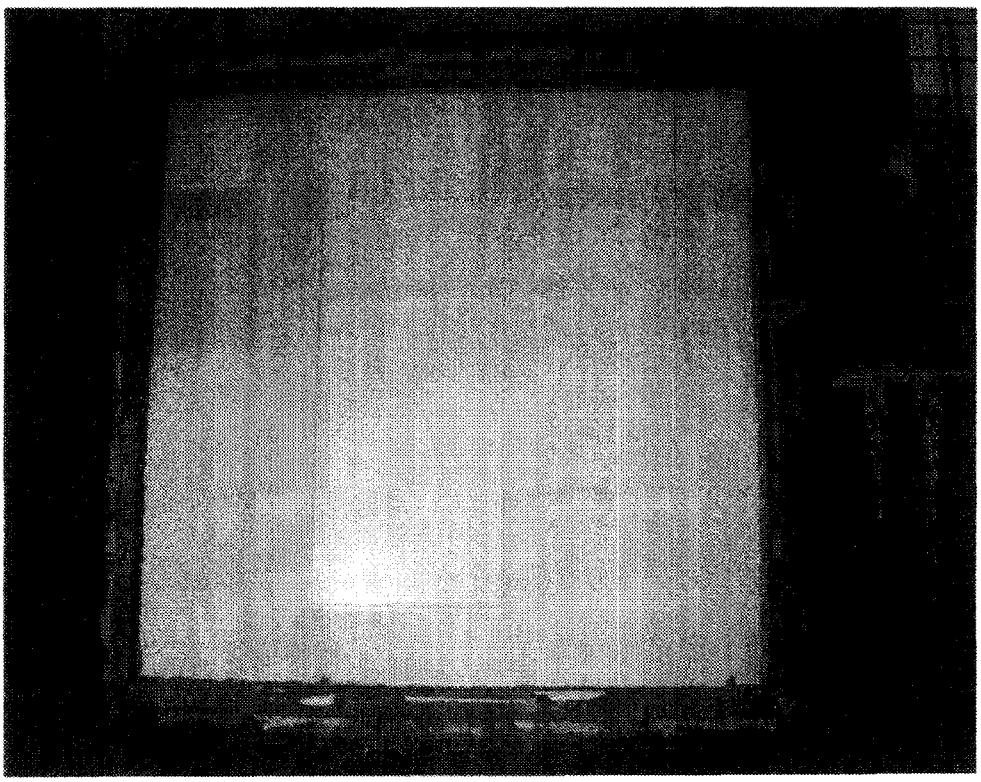

Plate 2 Exposed face of specimen before test

(Neg.No. 002)

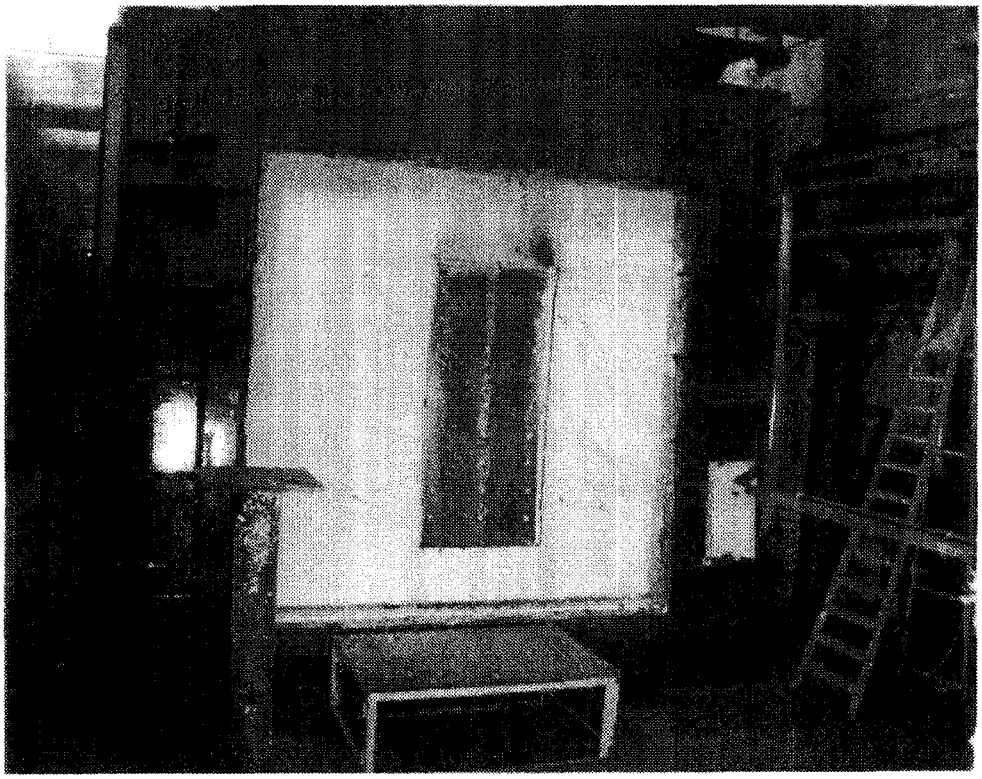

Plate 3 Unexposed face of specimen after 120min

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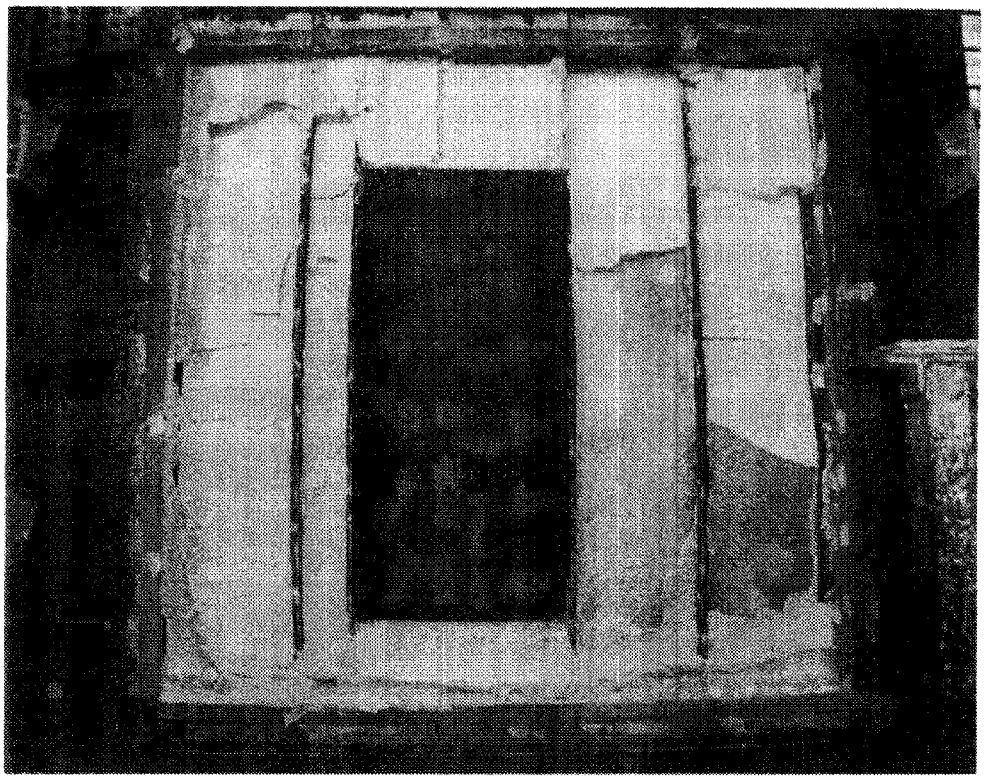

Plate 4 Exposed face of specimen after test

(Neg.No. 009)

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