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TE 94530

TEST REPORT

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

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

Date: 4 July 2000

CONTENTS

SUMMARY

A double-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 12 April 2000.

The access panel comprised two door leaves, nominally 2m high x 2m 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 leaves were hung in a steel frame incorporating a smoke seal, both leaves 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:	16min
Integrity:	135min

1 OBJECTIVE

To determine, at the request of Fire Proofing Services Ltd., the fire resistance of a double-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 being 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 were staggered 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 Double panel door tray

Each door tray consisted of 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 each door tray. The voids within the door trays 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 each door tray using 32mm drywall screws. The panel had a fire retardant smoke seal attached to the frame perimeter and each door was fitted with a continuous steel hinge 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 right hand door panel (as viewed from the exposed face) was fitted with a 1mm-thick back plate and was locked top and bottom from the opposite side by a budget lock. The left-hand door panel was locked using a three-point locking system. (See Figure 5).

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 2000mm wide, with a 25mm-wide picture frame surround mitred at each corner. The three-point lock hole in the left hand door tray was fitted with a plastic dome plug and collar. Plastic spacer plugs were also fitted in the edge of the door trays, two top and bottom of each door with two on the opening side.

Full details of the specimen construction are shown in Figures 1 to 5 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 12 April 2000 and was witnessed by Messrs P. Carpenter, K. Judge, T. Beasley, B. Blenkinsopp, and R. Stokes representing the sponsor. The ambient temperature at the start of the test was 11°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 seventeen 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.

Table 1 Locations of surface thermocouples

Thermocouple	Location
1	On the top perimeter of the supporting construction, next to a screw.
2	Over a stud near the top of the supporting construction, next to a screw.
3	On the supporting construction centrally, adjacent to the top of the access panel opening.
4	On the access panel frame, centrally above the left hand side leaf.
5	On the access panel frame, centrally above the right hand side leaf.
6	In the top right hand corner of the left-hand side access panel leaf.
7	In the top left hand corner of the right hand side access panel leaf.
8	Over an internal top hat section and next to a screw near the top of the left-hand side access panel leaf.
9	Over an internal top hat section and next to a screw near the top of the right hand side access panel leaf.
10•	In the centre of the top left quarter of the access panel.
11•	In the centre of the top right quarter of the access panel.
12	On the right hand perimeter of the supporting construction, at mid height.
13	On the left hand side frame of the access panel, at mid height.
14•	In the centre of the access panel. (On the right hand side leaf).
15	On the right hand side frame of the access panel, at mid height.
16•	In the centre of the bottom left quarter of the access panel.
17•	In the centre of the bottom right quarter of the access panel.

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

3.4 Deflection

A transducer activated by a fine taut wire was attached to the top right corner of the left hand side 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.
5:30	Smoke is issuing from between the access panel leaf and frame.
7:30	Some scorching of the surface of the top left hand side of the left panel leaf is occurring.
12:00	Scorching now observed on top and right hand side of right leaf. The surface of the left hand side leaf is starting to blister over the location of the central internal "top hat" section.
15:00	Both leaves are darkening in colour over the locations of the internal top hat sections. The surface of the left hand side leaf is blistering over the internal top hat locations. Very little blistering has occurred on the right hand side leaf.
20:00	The scorched areas are extending on both leaves.
22:00	The sealant between the access panel frame and supporting construction is crackling, and intumescing.
31:00	The area of scorching and charring on the surface of the leaves is increasing. Some flaming on the inside of the right hand side leaf, in the bottom left corner can be observed through an approximately 1mm wide crack in the board on the surface of the leaf. The flames do not pass to the unexposed face of the leaf, and there is no failure of integrity at this location.
38:00	The flaming referred to at 31min has ceased.
39:00	The board forming the surface of the left hand side leaf has an approximately 2mm wide x 100mm long crack on the right hand side, at mid height.
42:00	The access panel frame has now charred to a black colour over most of its area. A small red glow can be seen between the leaves over approximately the top 250mm of the panel.
46:00	The crack referred to at 39min is now approximately 4mm wide.

Table 2 Observations (continued)

Time min : s	Observation
50:00	The surface of the leaves has now charred a black colour over corresponding locations of the internal top hat sections.
70:00	The crack referred to at 39 min is now approximately 7mm wide x 200mm long.
80:00	Two further cracks have formed over the corresponding locations of the internal top hat sections on the left hand side leaf.
104:00	Both leaves have now turned almost completely black in colour.
135:00	No loss of integrity. Test stopped.

The specimen is shown after 1 hour, at termination, and after the test in Plates 3 to 5.

4.2 Temperature measurements

4.2.1 Furnace temperature

The mean furnace temperature is plotted against time in Figure 6 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 leaves are plotted against time in Figure 7. Individual surface temperatures recorded on the supporting partition are given in Figure 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 16min by thermocouple number 4. The limit for the rise in mean temperature on the door leaf (140°C) was exceeded after 47min.

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 on the supporting construction 100mm from the left edge of the left leaf, B was located on the left leaf, 100mm from the left edge of the leaf, C was located on the right leaf, 100mm from the right edge of the leaf, and D was located on the supporting construction, 100mm from the right edge of the right 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 other than 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 double-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: 16min
Integrity: 135min

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.

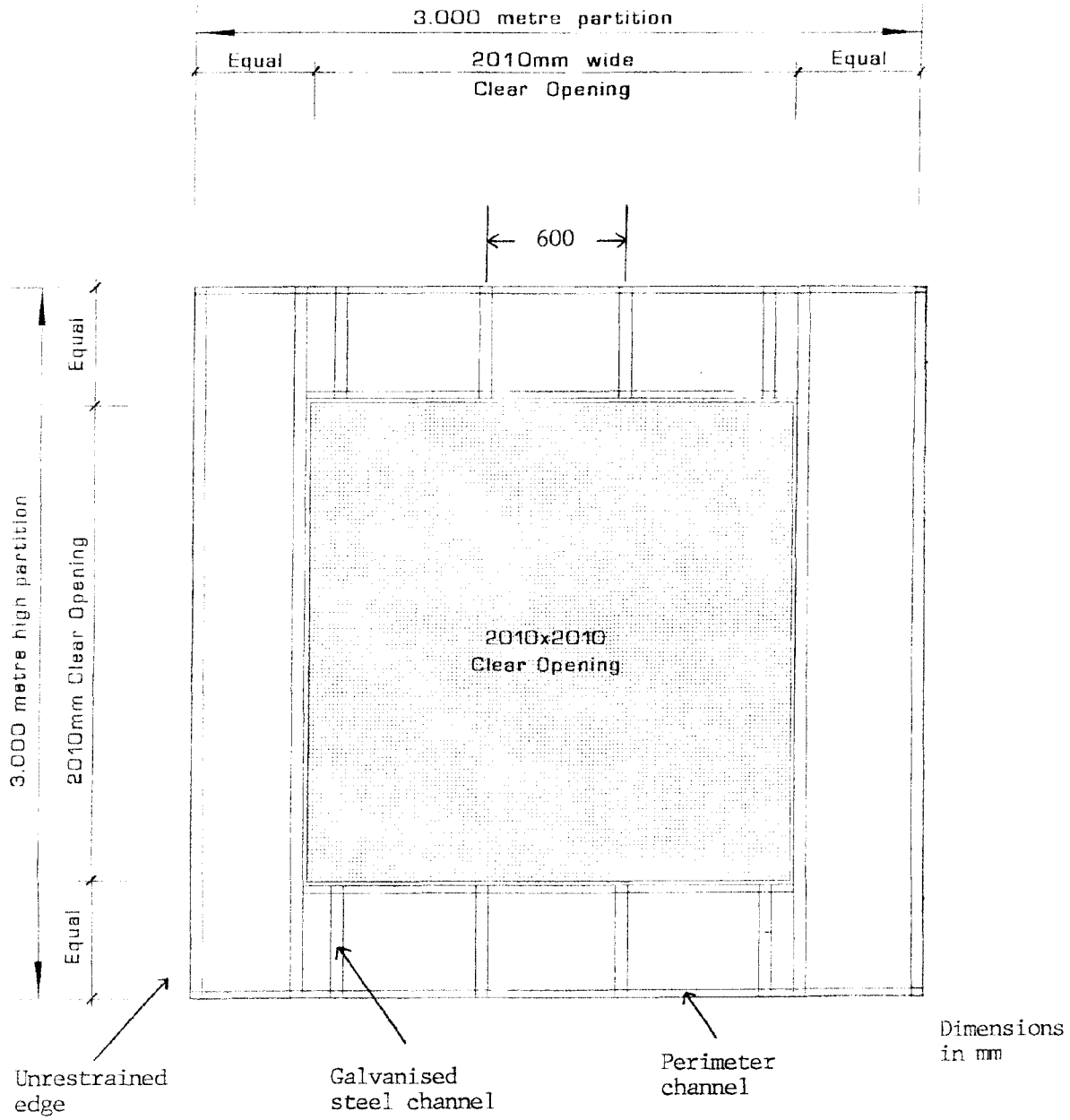

Figure 1 Supporting construction showing location of access panel opening

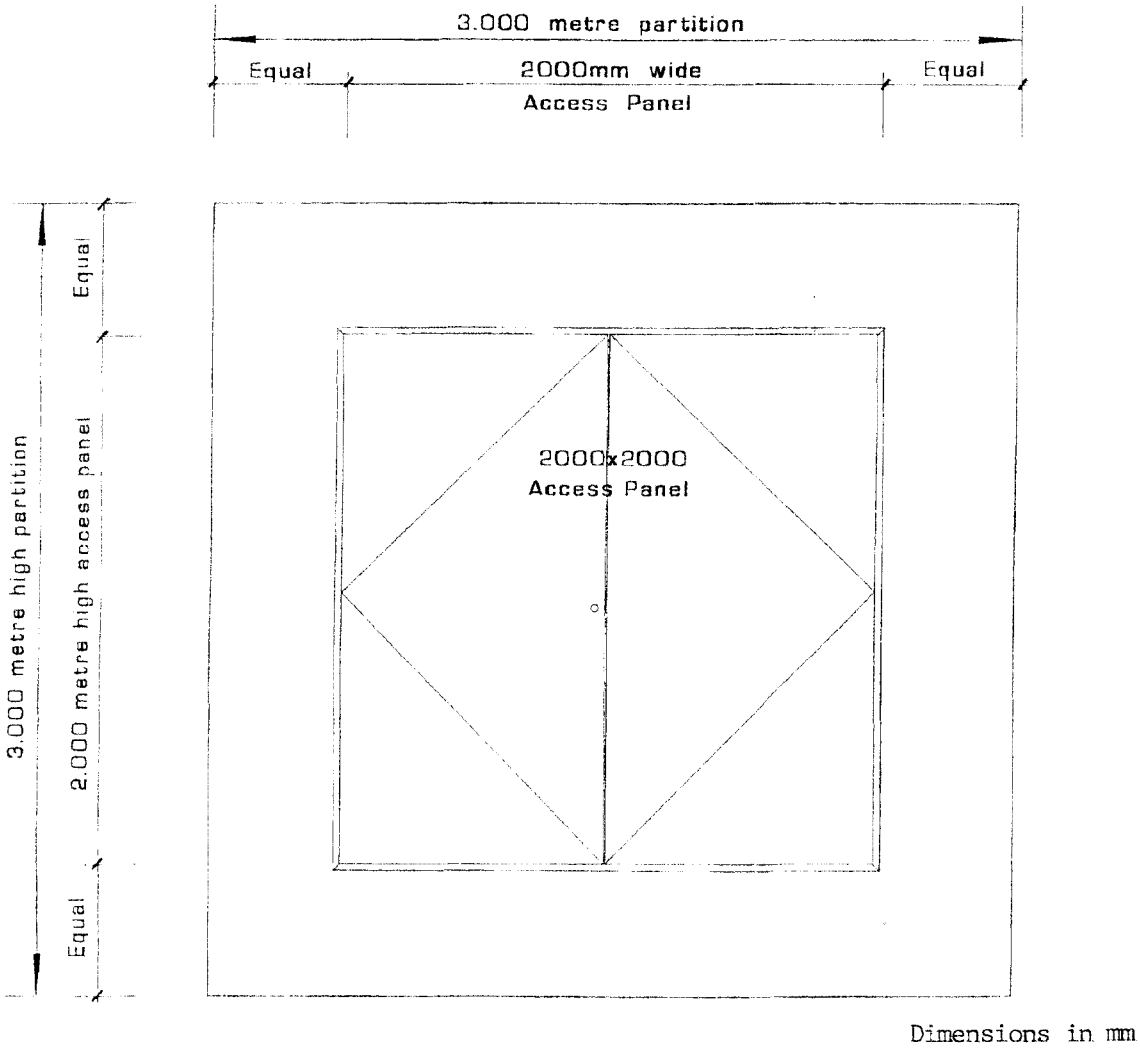

Figure 2 Front elevation showing access panel position

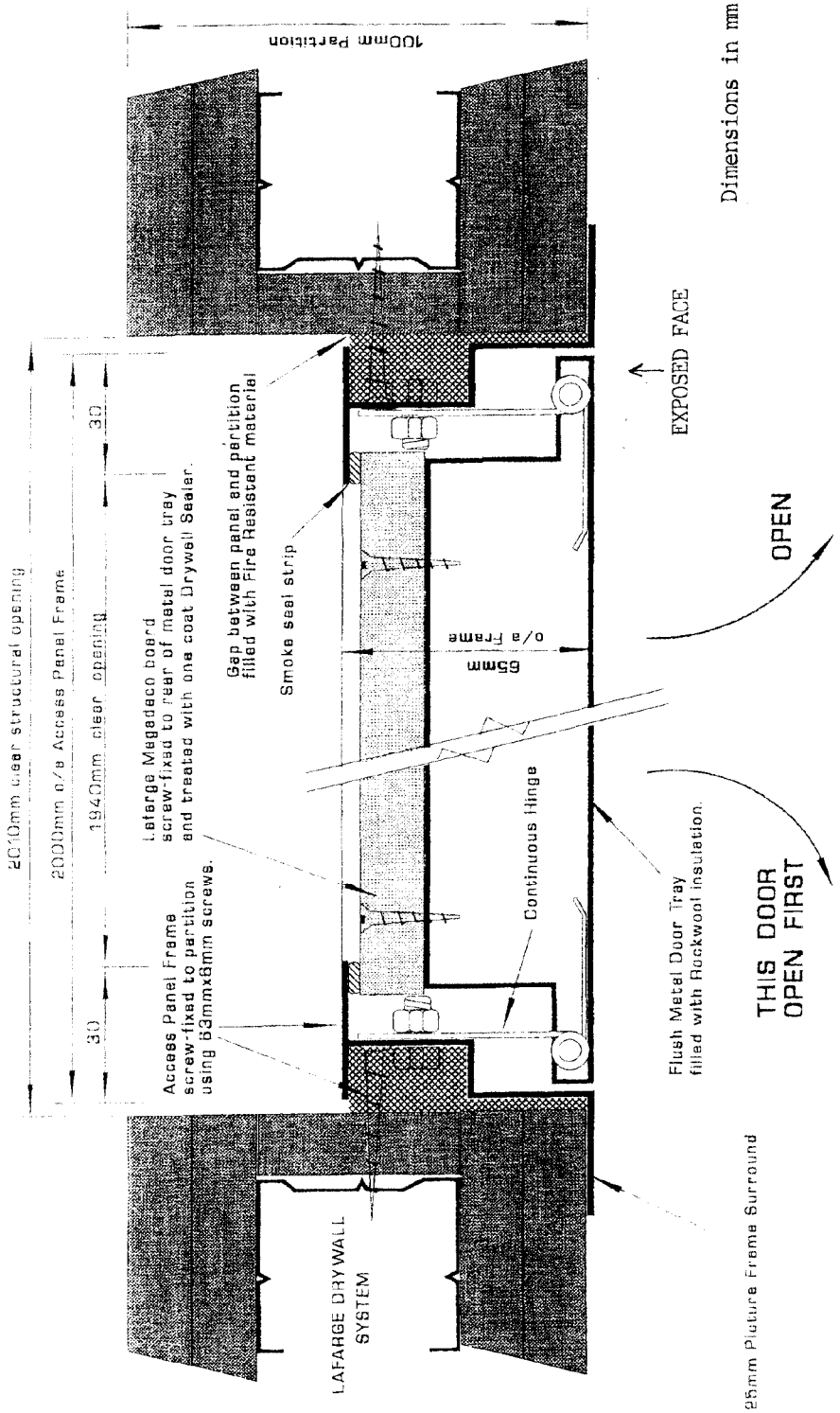

Figure 3 Vertical section through partition and access panel

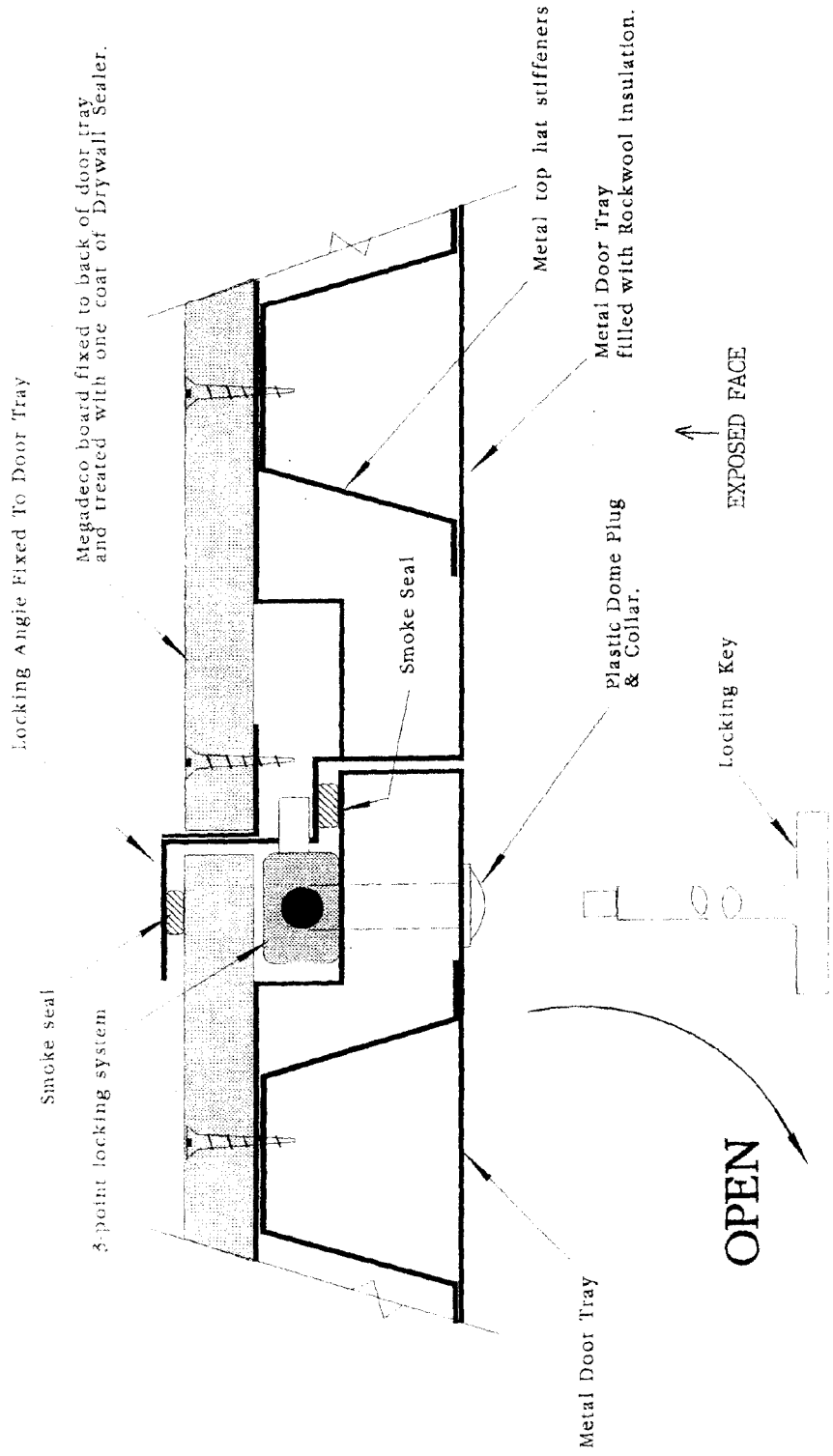

Figure 4 Vertical section through specimen showing detail at leaf joint in centre

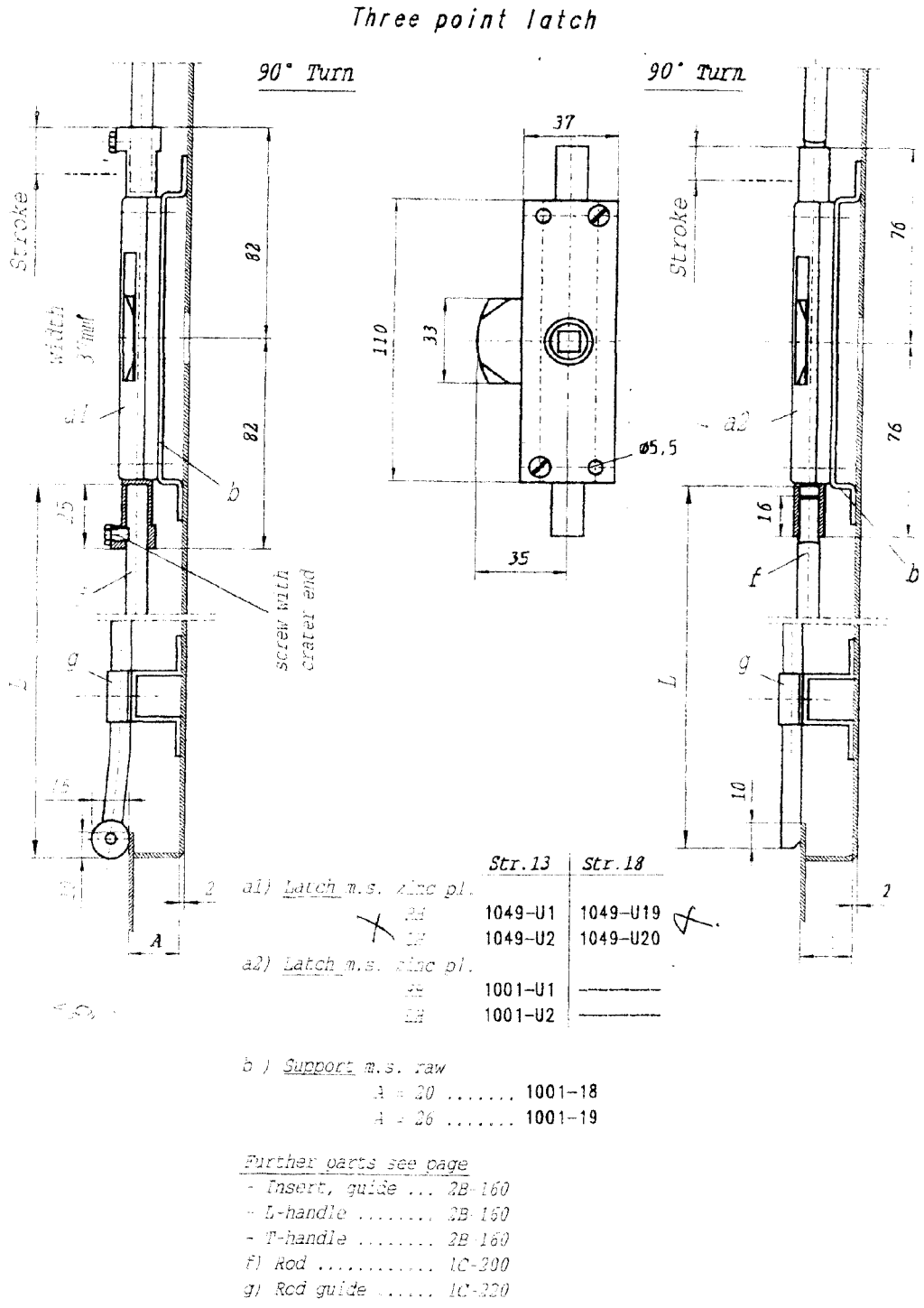

Figure 5 Details of lock mechanism

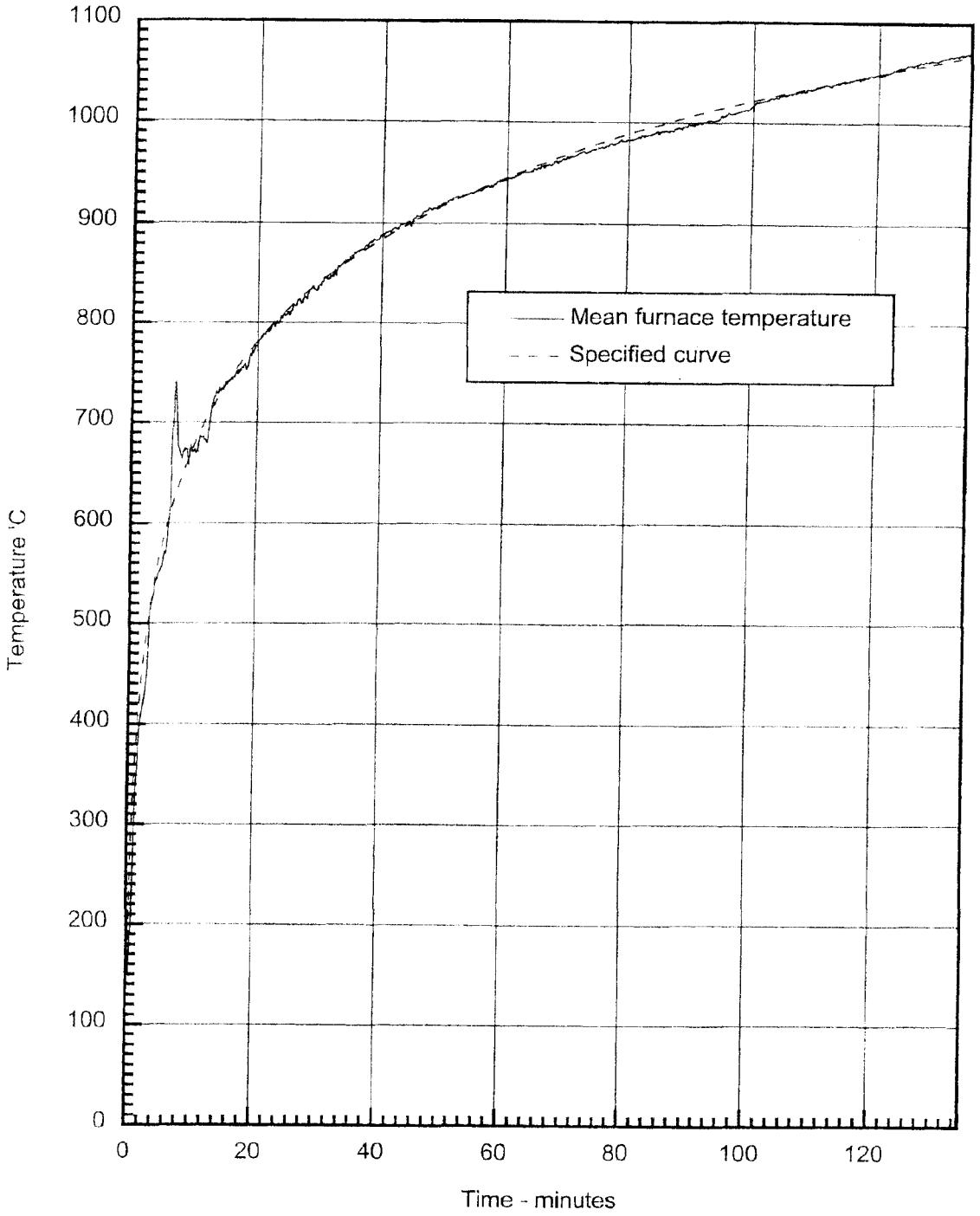

Figure 6 Mean furnace temperature with specified curve for comparison

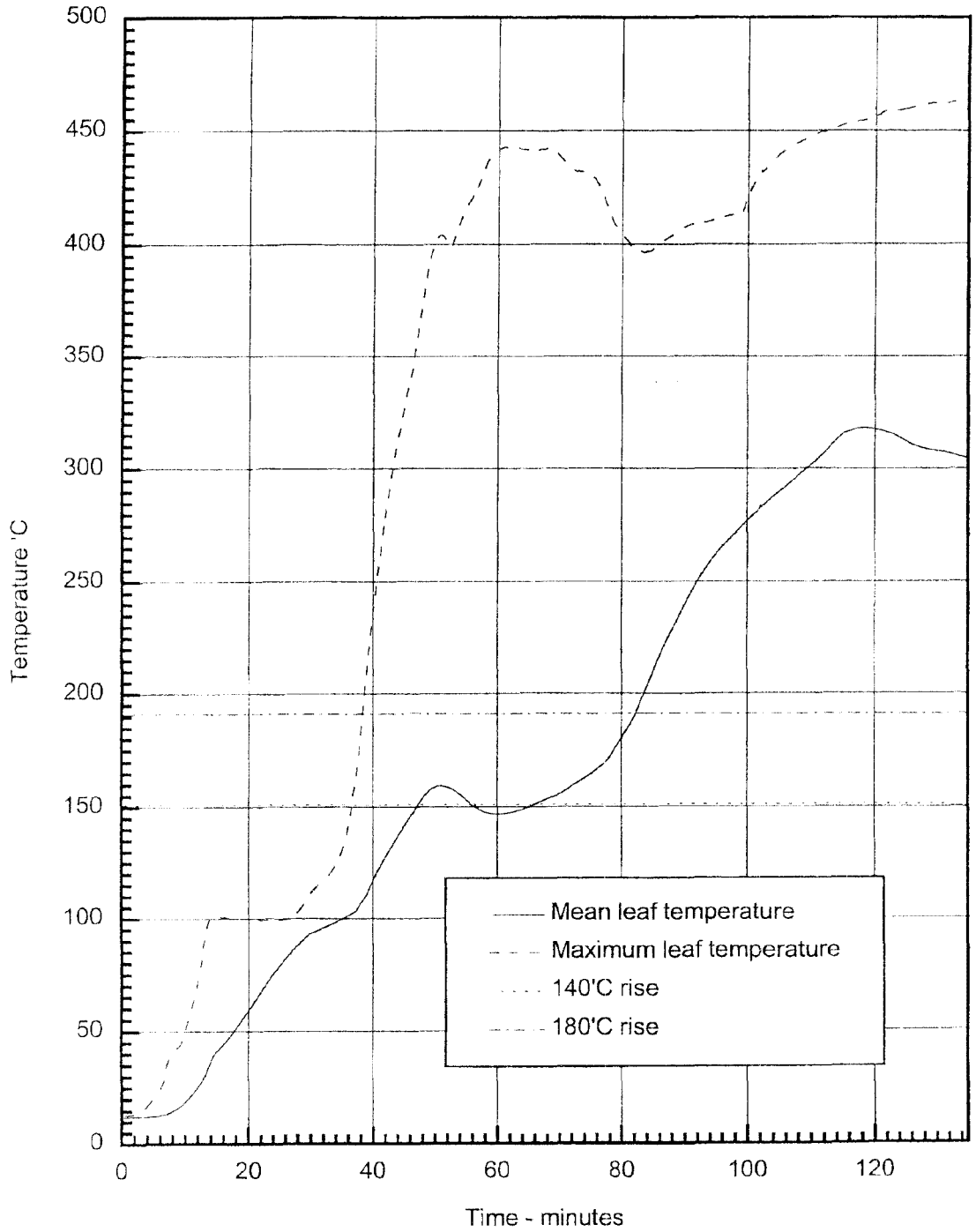

Figure 7 Mean and maximum temperatures recorded on unexposed face of access panel leaves

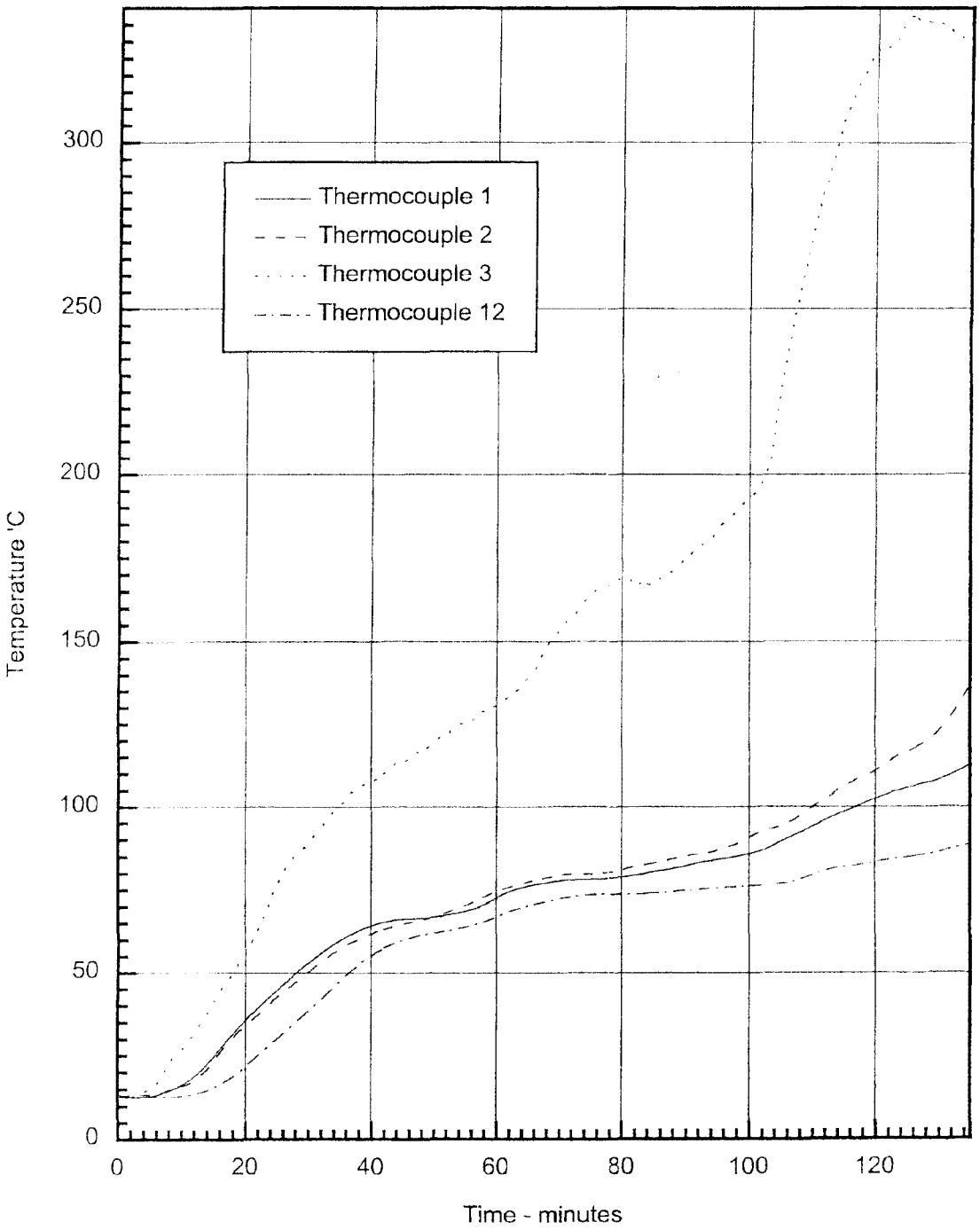

Figure 8 Temperatures recorded on unexposed face of supporting construction

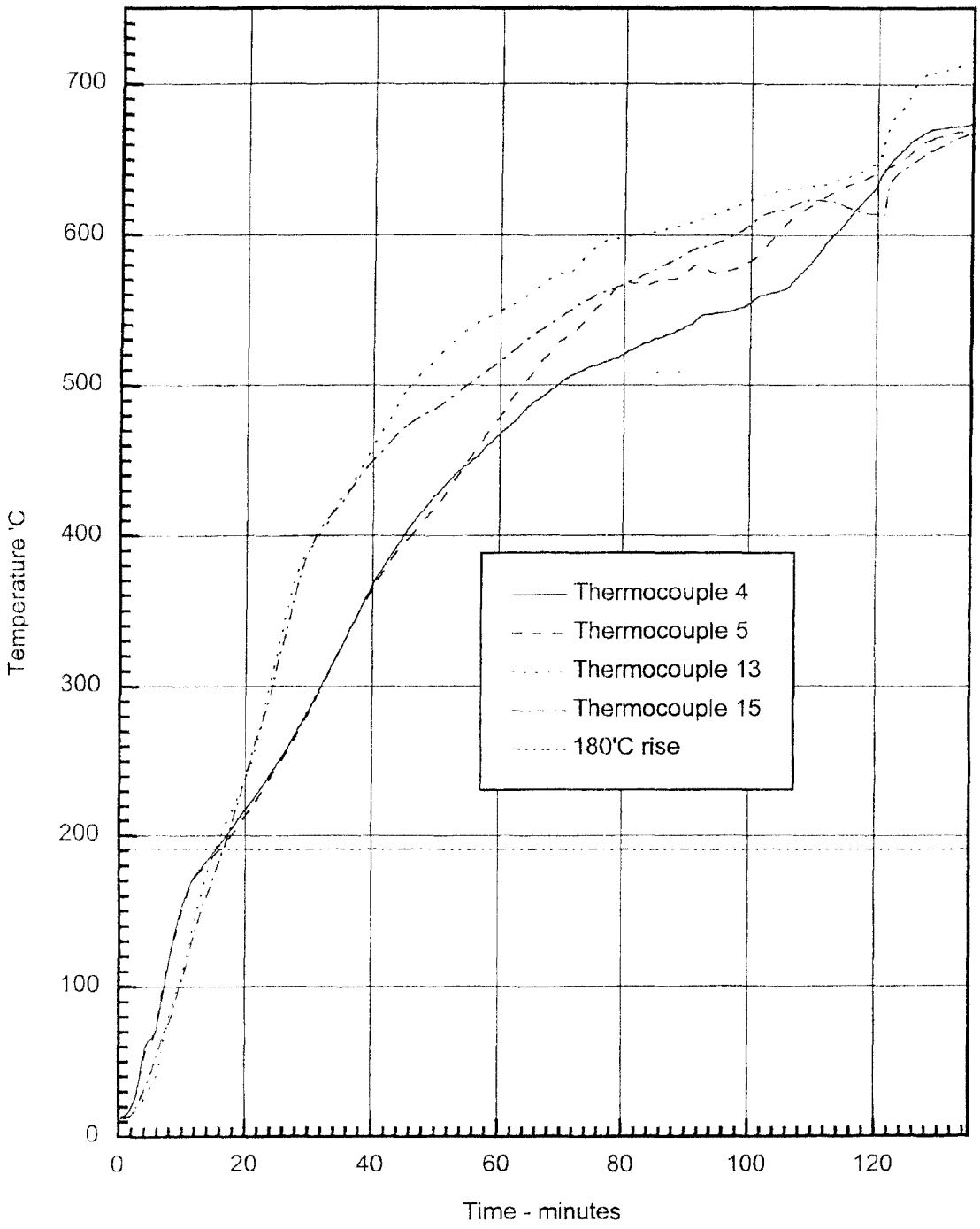

Figure 9 Temperatures recorded on unexposed face of access panel frame

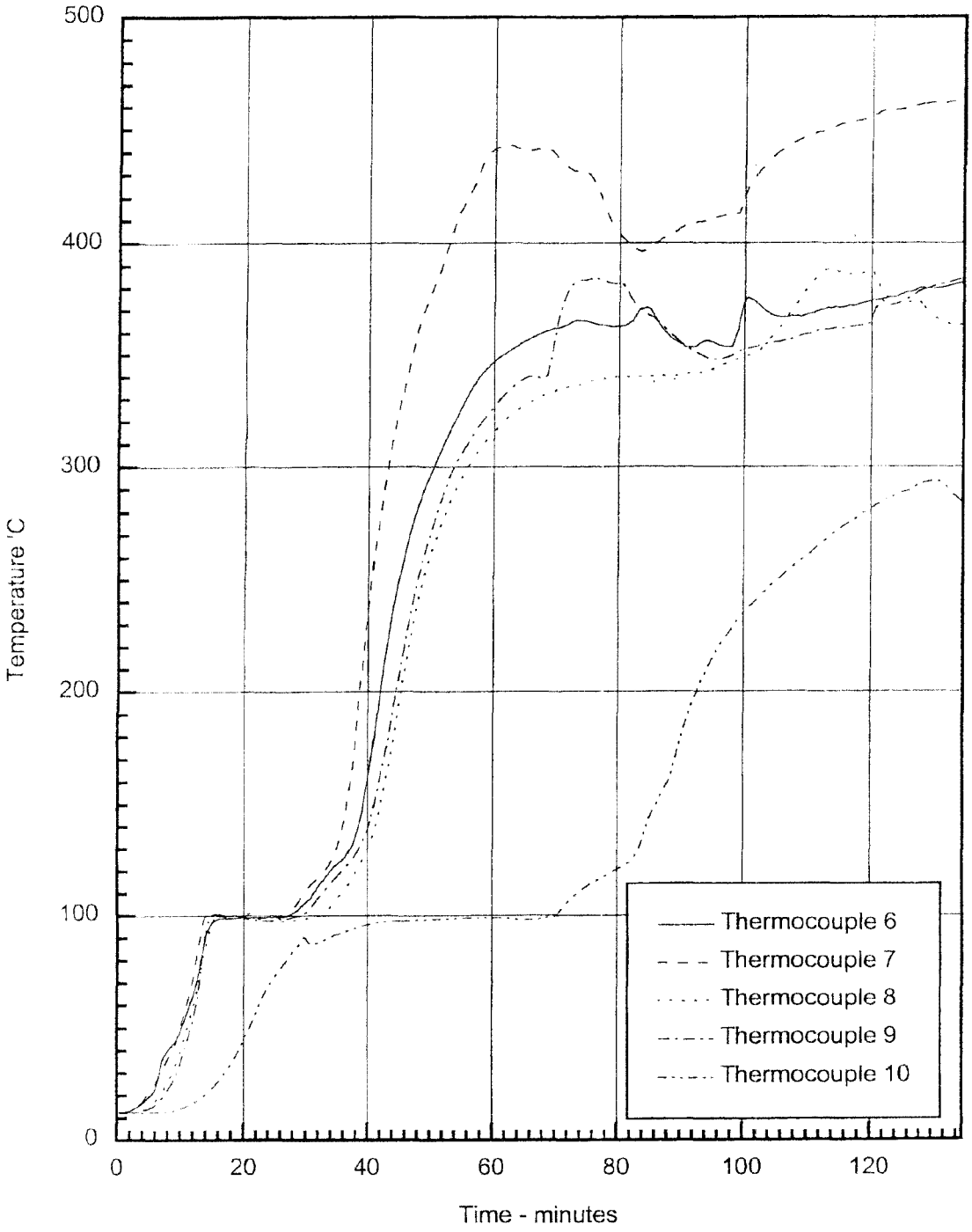

Figure 10 Temperatures recorded on unexposed face of access panel leaves by thermocouples 6 to 10

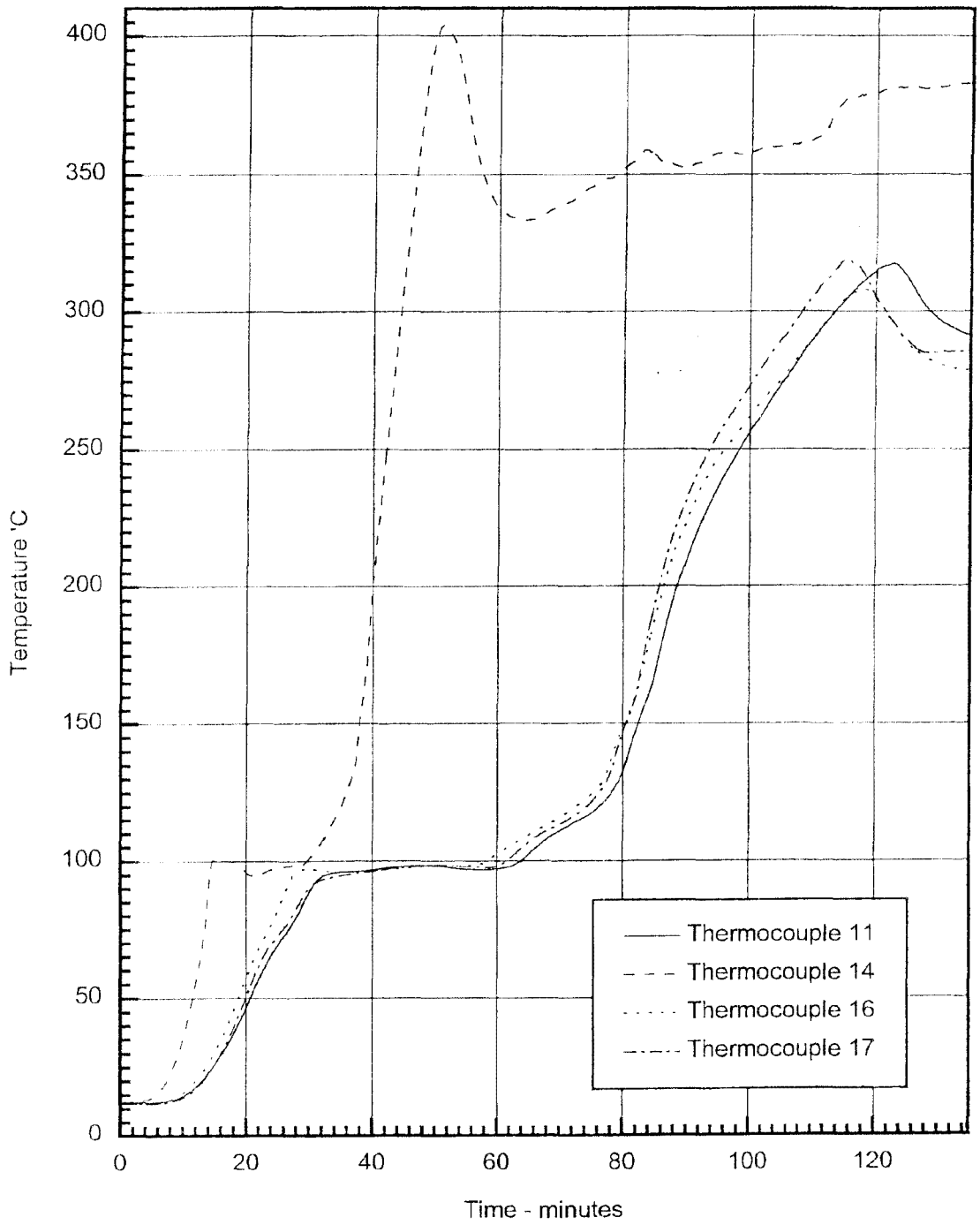

Figure 11 Temperatures recorded on unexposed face of access panel leaves by thermocouples 11, 14, 16 and 17

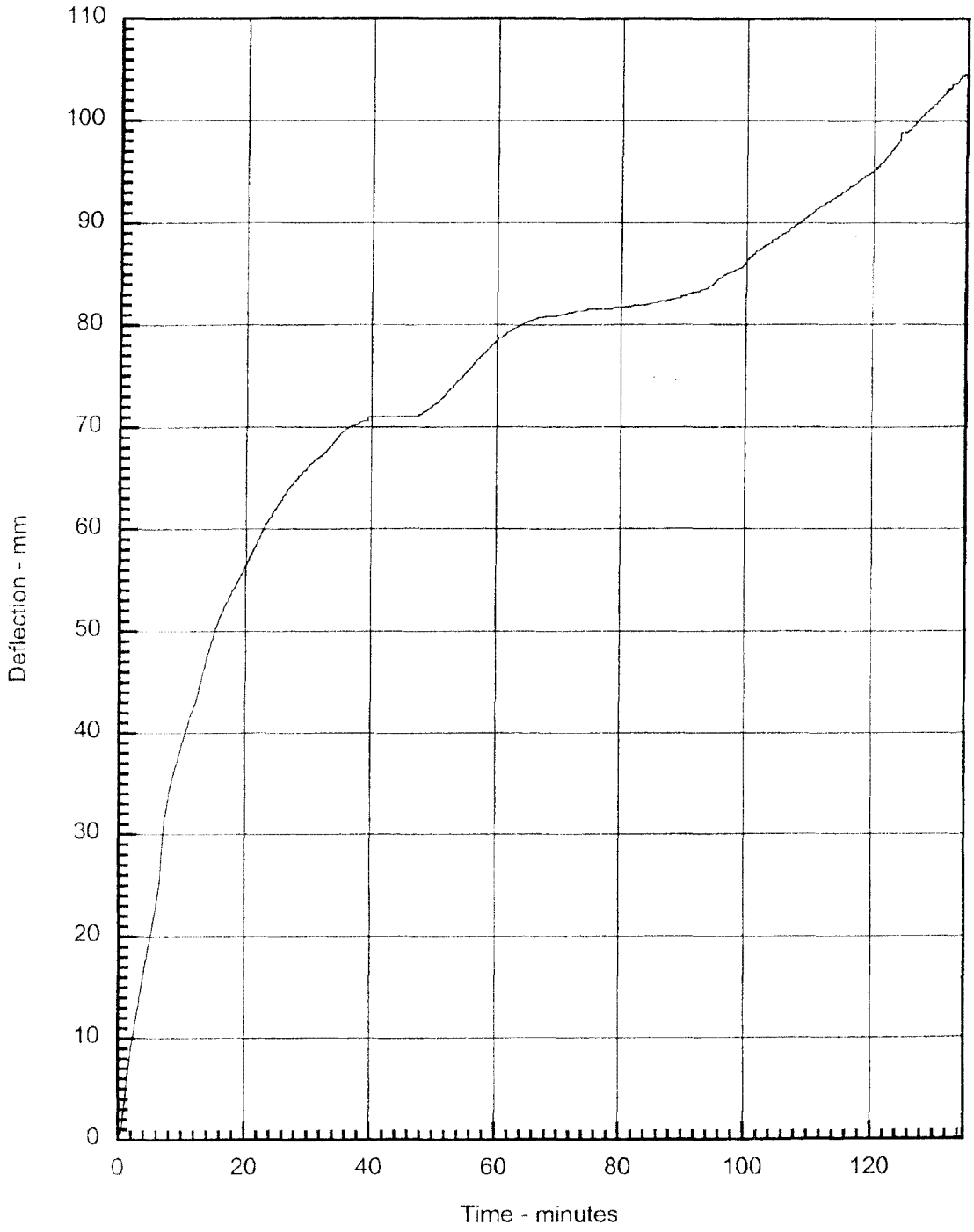

Figure 12 Horizontal deflection recorded in top right corner of left-hand side panel leaf

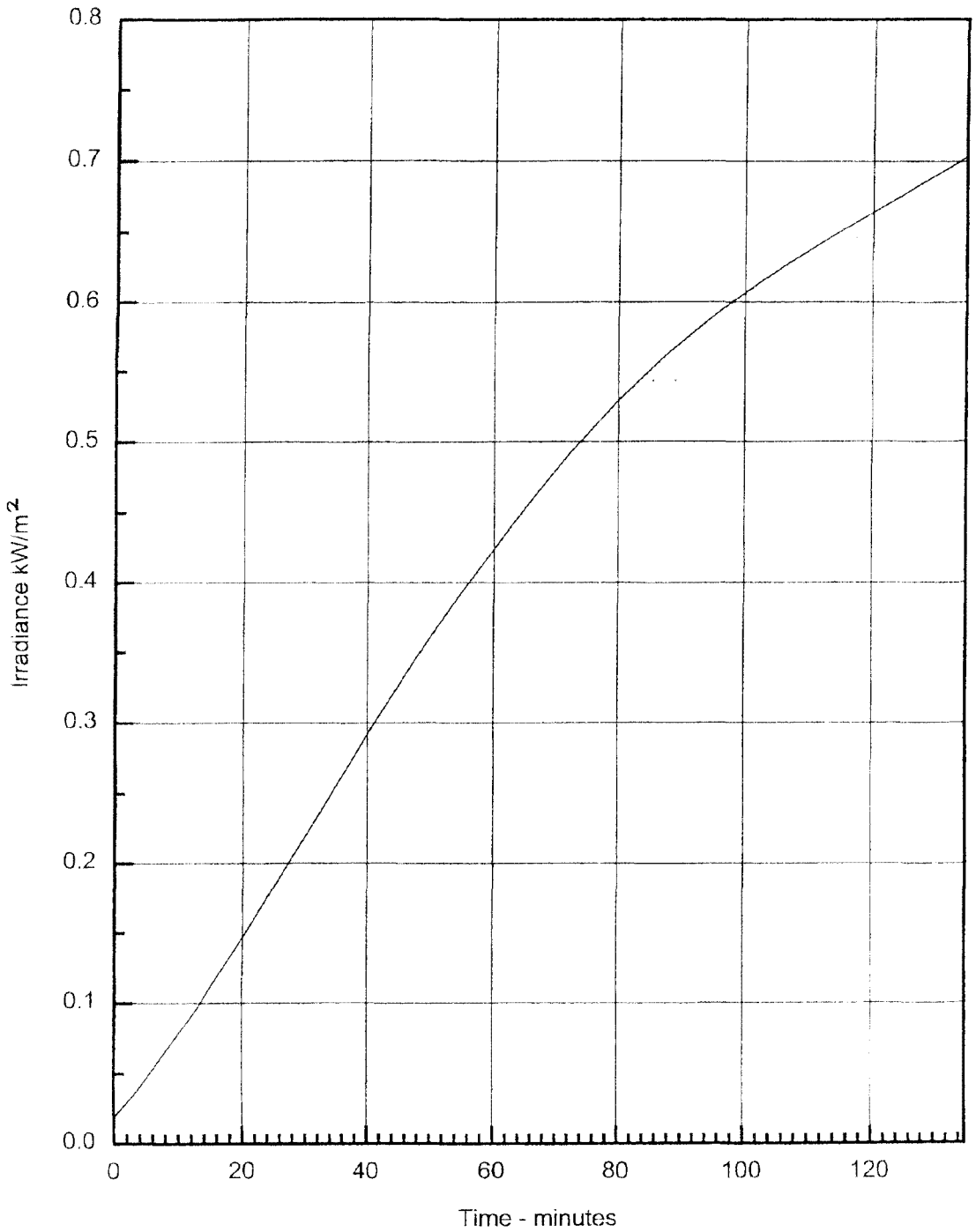

Figure 13 Irradiance recorded 3m from centre of specimen

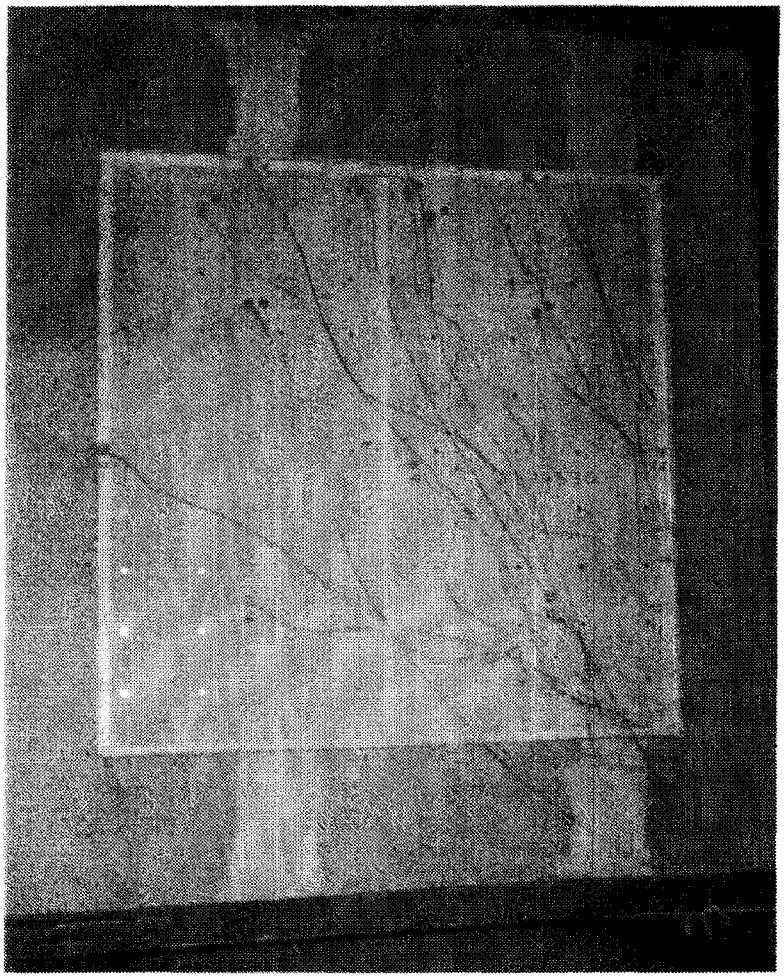

Plate 1 Unexposed face of specimen before test

(Neg.No. 005)

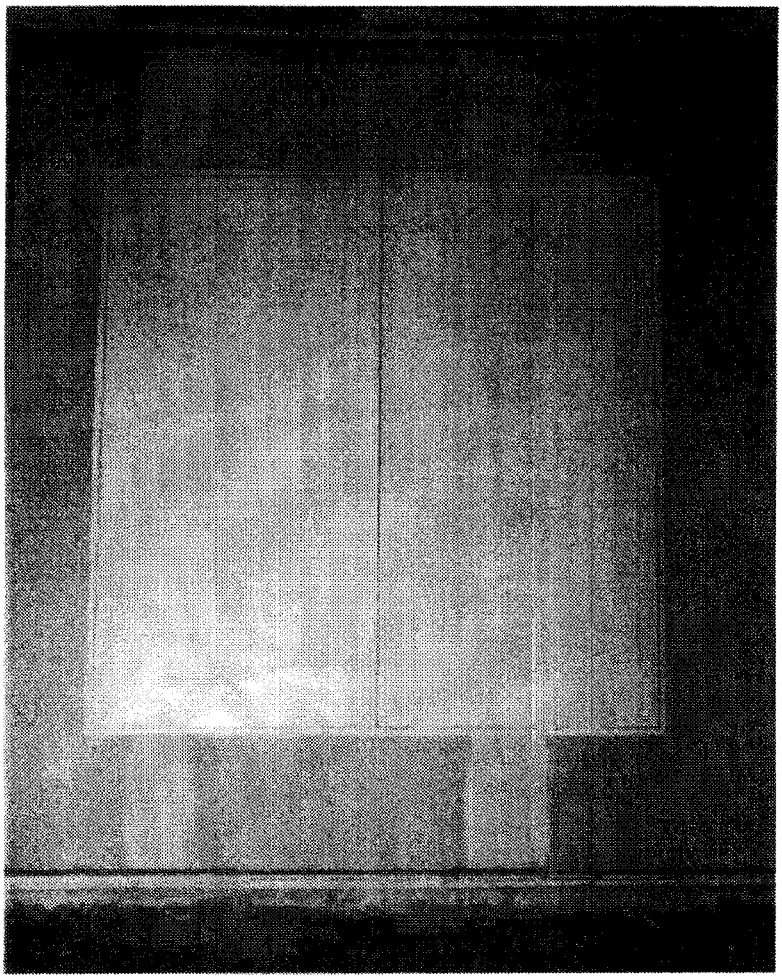

Plate 2 Exposed face of specimen before test

(Neg.No. 002)

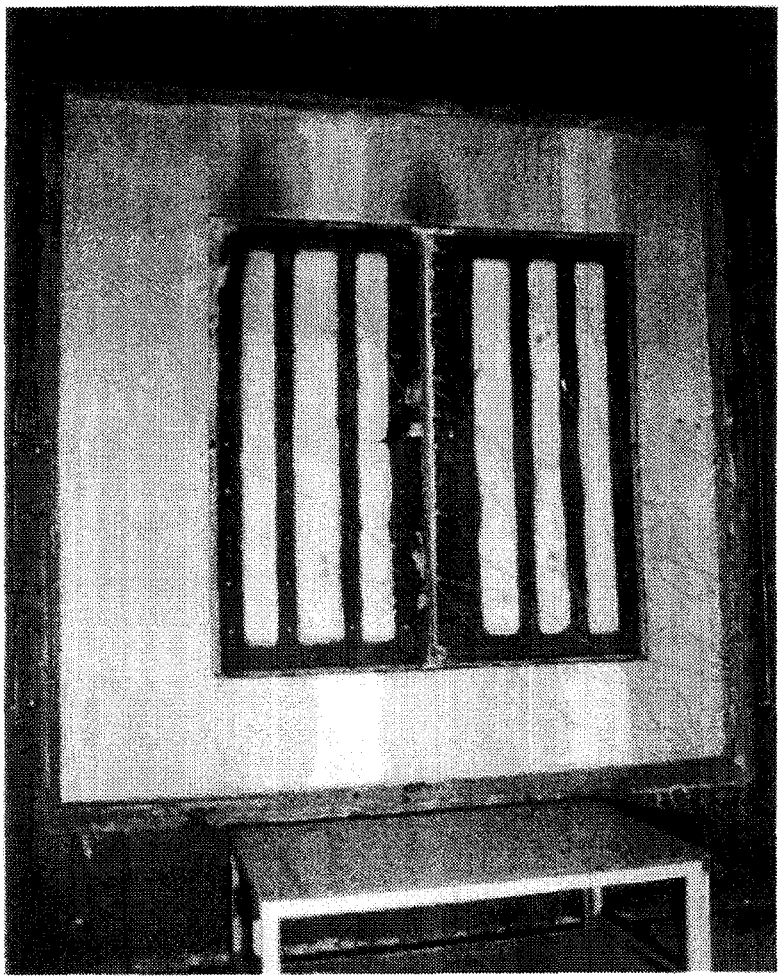

Plate 3 Unexposed face of specimen after 60min

(Neg.No. 008)

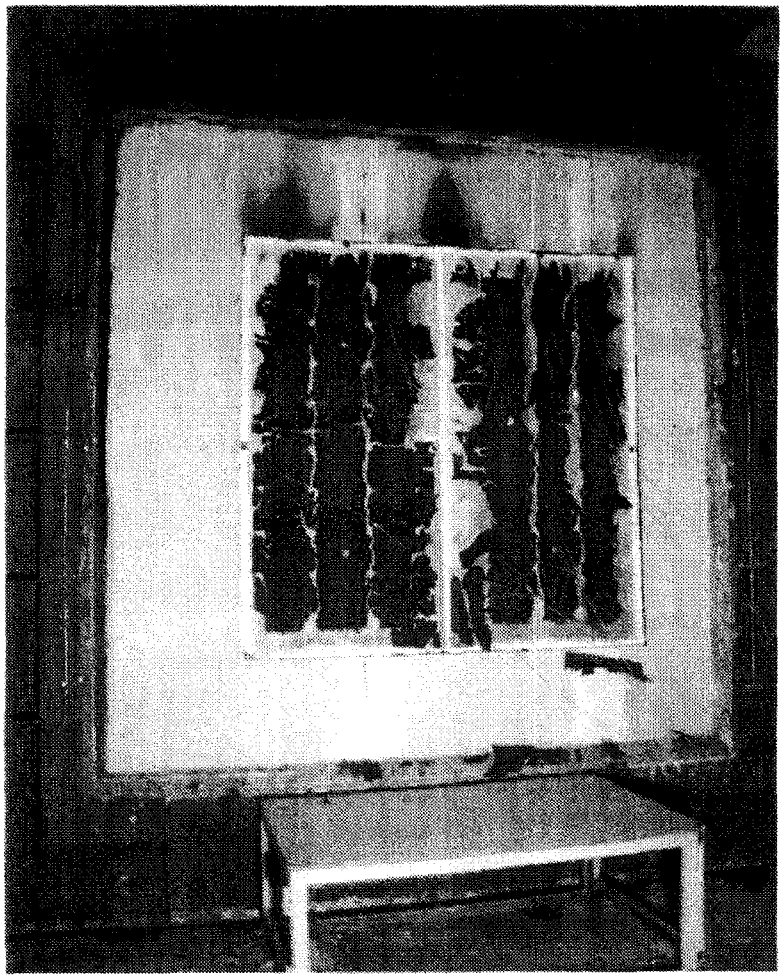

Plate 4 Unexposed face of specimen at termination of test (135min)

(Neg.No. 0011)

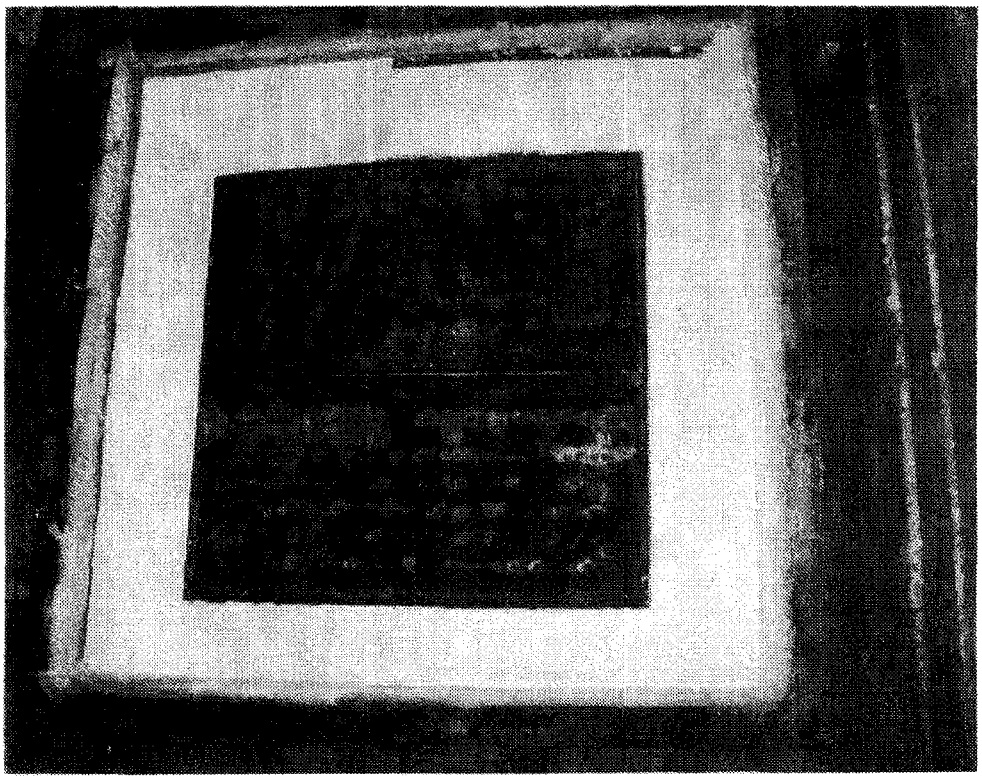

Plate 5 Exposed face of specimen after test

(Neg.No. 0014)

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