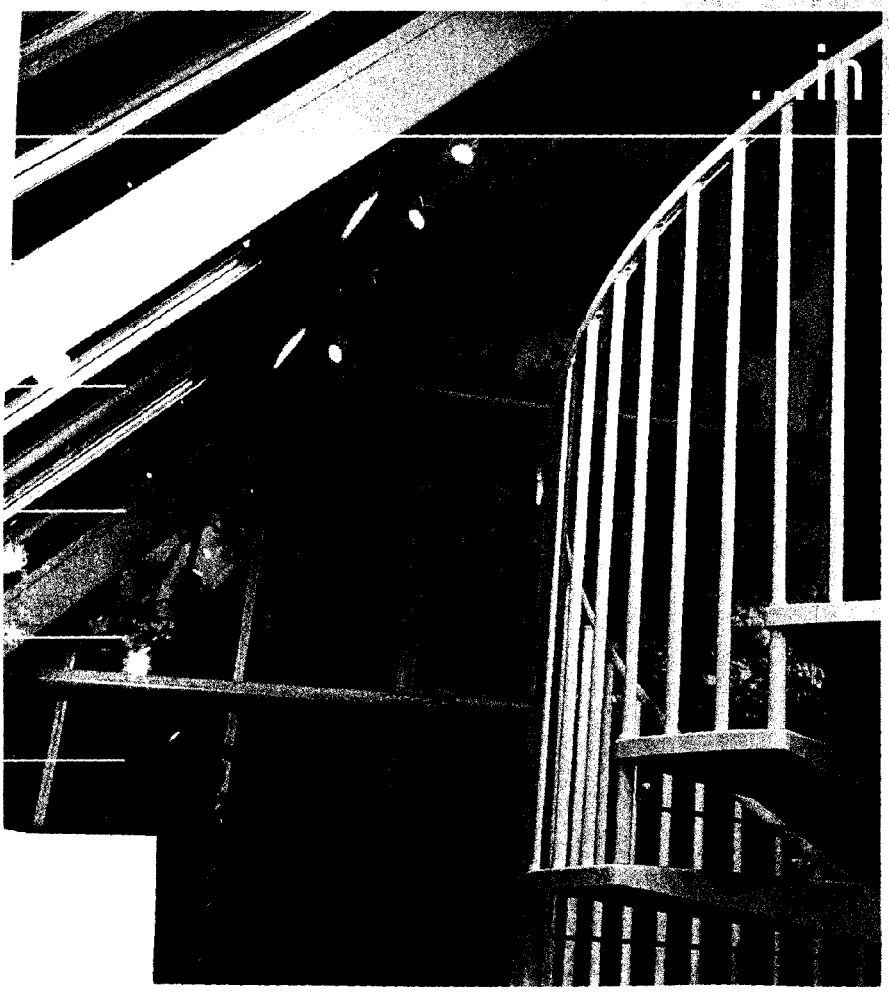
Test Report :
Fire Resistance test in accordance with B.S.476 : Part 22 : 1987 on two access panels installed in a block wall

Test report number FG7586

BRE



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SUMMARY

Two single-leaf steel / plasterboard access panels installed in a 150mm-thick block wall, were subjected to a fire resistance test, in accordance with B.S. 476 : Part 22 : 1987 (clause 6) on 29 October 2001.

Each access panel comprised a single door leaf consisting of a polyester powder coated 1.5mm-thick steel skin on one side and 12.5mm-thick Gyproc moisture board with ceramic tiles attached, on the other. The panel leaves were hung in steel frames bolted directly to the block wall. Prior to the fire test, the gap between each door leaf and frame was filled with intumescent sealant. Both leaves opened towards the furnace, the tiled plasterboard being exposed to the furnace.

The access panels were installed into nominally 610mm x 610mm and 610mm wide x 1810mm high openings in the block wall, being referred to as panels A and B respectively. The specimens when tested in the orientation described were found to have the following fire resistance:

Access panel A:

Insulation:	20minutes
Integrity:	90 minutes

Access panel B

Insulation:	22minutes
Integrity:	90 minutes

1 Objective

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

2 Materials

2.1 Joint Sealant.

The joint sealant used was manufactured by Evo-Stik and named "Fire Protection Intucaulk joint sealant". It was described as an oil-based intumescent fire resistant sealant for gap filling, glazing and butt joints.

2.2 Tile adhesive

The adhesive used to affix the tiles to the exposed face of the access panels and block wall was manufactured by Sealocrete PLA Ltd. and was named "Sealocrete ceramic wall tile fix & grout". It was described as "a waterproof, ready mixed, thin-bed, water based adhesive and grout for use with ceramic wall tiles on most types of interior surface."

3 Construction

3.1 Supporting Construction.

A 150mm-thick aerated concrete block wall was constructed within the aperture (nominally 3m x 3m) of a heavily reinforced concrete test frame, leaving two openings, 610mm wide by 610mm high and 610mm wide x 1810mm high.

The supporting construction arrangement is shown in Figure 1.

3.2 Specimen construction.

The sponsor provided the following descriptions of the specimens. Surface details and dimensions were verified by BRE before the test.

For ease of reference in this report, the 610mm x 610mm-access panel is referred to as panel A and the 610mm x 1810mm access panel as panel B.

3.2.1 Access Panel A

Access panel A consisted of a 1.5mm-thick Zintec steel recessed door tray, which was polyester powder-coated to Ral 9010 20% gloss. Pre-formed 1.5mm-thick top-hat section stiffeners were welded vertically at the sides of the access panel leaf and horizontally at the top, bottom and across the centre of the access panel leaf between the vertical stiffeners. The vertical top-hat section on the hinge side of the door was 90mm wide; all other sections were 40mm wide. All top-hat sections were 40mm deep. A 12.5mm-thick sheet of Gyproc moisture board was screwed into the recessed door tray using self-tapping screws. The door was hinged at the top and bottom, each hinge consisting of a 6mm-diameter steel pin inserted into a steel pin block with a locating fixing screw to the rear of the door to allow for the door leaf to be removed when necessary. The pin blocks (at the top and bottom of the panel leaf) were located within the vertical top hat stiffener at the left-hand side top of the door leaf.

A steel roller ball castor was positioned at the base of the hinged side of the leaf in order to allow a smooth opening action of the door.

The panel leaf locking mechanism consisted of two Dzus Touch Latches, one located 150mm from the top and one located 150mm from the bottom of the leaf.

3.2.2 Access Panel B

Access panel B consisted of a 1.5mm-thick Zintec steel recessed door tray, which was polyester powder-coated to Ral 9010 20% gloss. Pre-formed 1.5mm-thick top-hat section stiffeners were welded vertically at the sides and horizontally at the top and bottom of the door tray. Two additional horizontal stiffeners were located 580mm apart, centrally between the top and bottom of the door. The vertical top-hat section on the hinge side of the door was 90mm wide; all other sections were 40mm wide. All top-hat sections were 40mm deep. A 12.5mm-thick sheet of Gyproc moisture board was screwed into the recessed door tray using self-tapping screws. The door was hinged at the top and bottom, each hinge consisting of a 6mm-diameter steel pin inserted into a steel pin block with a locating fixing screw to the rear of the door to allow for the door leaf to be removed when necessary. The pin blocks were located at the top and bottom of the leaf within the vertical top hat stiffener at the left-hand side of the door leaf.

A steel roller ball castor was positioned at the base of the hinged side of the leaf in order to allow a smooth opening action of the door.

The panel leaf locking mechanism consisted of three standard budget locks located near the top, centre and bottom of the access panel tray. These locks locate over the 20mm flange of the frame to hold the panel closed.

3.2.3 Panel frames

Both access panel frames were formed from 1.5mm-thick Zintec steel, polyester powder-coated to Ral 9010 20% gloss. The frames were a 95mm deep Z-section, consisting of a 25mm-wide front flange and a 20mm-wide rear flange, which locates against the exposed face of the wall.

Access panel frame A was held to the block wall using three 38mm-long, 6mm-wide RAWL plug toggle bolts each side and three across the bottom of the frame. The frame was secured to the lintel at the top of the aperture using two 55mm-long, 6mm-diameter medium weight RAWL bolts.

Access panel frame B was held to the block wall using five 38mm-long, 6mm-wide RAWL plug toggle bolts (at 400mm centres) each side and one at the bottom of the frame. Two 55mm long, 6mm-diameter medium weight RAWL bolts were additionally used at the bottom of the frame, and two at the top.

3.2.4 General

After fitting, the exposed (plasterboard side) of each door was tiled with 147mm-square white ceramic tiles. The joints between the tiles on the access panels were also grouted with the adhesive described above.

Following installation of both access panels, the joint between the access panel leaves and frame was filled with intumescent sealant described above.

Full details of the specimen construction are shown in Figures 1 to 7 and the completed construction is shown before the test in Plates 1 and 2.

The three budget lock holes in access panel leaf B were fitted with plastic dome plug inserts.

4 Test Procedure

4.1 General

The test was carried out on 29 October 2001 and was witnessed by Messrs T. Beasley, D. Blenkinsopp, N. Mead and N. Whitehead representing the sponsor. The ambient temperature at the start of the test was 14°C.

4.2 Furnace control

The furnace temperature was measured by means of thirteen bare-wire chromel/alumel thermocouples arranged symmetrically in the furnace 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 so that a pressure of 18Pa existed at the top of the access panels.

4.3 Specimen temperature

The temperature on the unexposed face of the specimen was measured using twenty six 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	Access Panel	Location
A1	A	On the top of the access panel frame, centrally above the leaf.
A2	A	In the top left-hand corner of the access panel leaf.
A3	A	In the top right-hand corner of the access panel leaf, on a top hat stiffener.
A4 •	A	In the centre of the top left quarter of the access panel leaf.
A5 •	A	In the centre of the top right quarter of the access panel leaf.
A6	A	On the left-hand side frame of the access panel, at mid height.
A7	A	On the top hat stiffener across the centre of the access panel leaf, at the left-hand side of the leaf.

Thermocouple	Access Panel	Location
A8	A	On the right-hand side frame of the access panel, at mid height.
A9	A	On the left-hand side of the access panel leaf, below the central stiffener.
A10 •	A	In the centre of the access panel. (Below the central stiffener).
A11 •	A	In the centre of the bottom left quarter of the access panel leaf.
A12 •	A	In the centre of the bottom right quarter of the access panel leaf.
A13	A	On the unexposed face of the supporting block wall, at the right-hand side of the aperture at mid height.
B1	B	On the top of the access panel frame, centrally above the leaf.
B2	B	In the top left-hand corner of the access panel leaf.
B3	B	In the top right-hand corner of the access panel leaf, on a top hat stiffener.
B4	B	On the side of a stiffener, adjacent to the top budget latch.
B5 •	B	In the centre of the top left quarter of the access panel leaf.
B6 •	B	In the centre of the top right quarter of the access panel leaf.
B7	B	On the left-hand side frame of the access panel, at mid height.
B8	B	On the left-hand side of the access panel leaf, adjacent to the budget latch at mid height of the leaf.
B9 •	B	In the centre of the access panel.
B10	B	On the right-hand side frame of the access panel, at mid height.
B11	B	On the unexposed face of the supporting block wall, at

Thermocouple	Access Panel	Location
		the right-hand side of the aperture at mid height.
B12 •	B	In the centre of the bottom left quarter of the access panel leaf.
B13 •	B	In the centre of the bottom right quarter of the access panel leaf.

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

4.4 Deflection.

A transducer activated by a fine taut wire was attached near the centre of each access panel leaf to continuously monitor deflection of each leaf throughout the test.

5 Results

5.1 Observations

The observations made during the test are given in Table 2. Unless stated, all observations are of the unexposed face. Access panel A refers to the 610mm x 610mm access panel, and access panel B refers to the 610mm x 1810mm access panel.

Table 2 Observations

Time min	Observation.
0:00	Test started.
2	Steam is issuing from between the frame and block wall of both access panels.
5	Increasing steam is issuing from between the frame and block wall of both access panels.

Time min	Observation.
11	A pool of water has collected on the frame at the bottom of access panel B.
14 ½	Some tiles are starting to fall from the exposed face of the access panel and block wall around panel B. The unexposed faces of both access panels are starting to darken very slightly as they heat up.
16	All tiles on and around the exposed face of access panel A are still in position. A moderate amount of smoke is now issuing from both access panels.
19	Most of the tiles on and around access panel B (inside the furnace) have fallen away and the exposed adhesive is flaming.
20	Six tiles from the bottom left hand corner of the exposed face of access panel A have fallen away.
23	The vertical frame members of both access panels are starting to char in a few places.
29	Considerable charring of all of the left hand member of frame A and the right hand member of frame B at mid height.
30	A red glow is visible between the frame and block wall on both sides of frame A, and at the bottom of panel leaf A adjacent to the frame. A similar glow is visible between the frame and block wall of panel B. The vertical right hand member of frame B is starting to distort away from the block wall slightly at its unexposed edge.
35	A small amount of blue smoke is now issuing from the access panels. The unexposed faces of both access panel leaves are now turning black in colour adjacent to the side top hat stiffeners. Access panel leaf A is also starting to turn black at the bottom of the leaf.
45	The bottom half of access panel leaf A is now dark in colour, and the left hand side vertical stiffener is black in colour.
48	The right hand side frame member of access panel B is distorting away from the block wall by approximately 6mm at one location. However, no through gap into the furnace is present due to the 20mm flange of the frame against the block wall inside the furnace.
54	All the tiles on both access panels inside the furnace have fallen away. All plasterboard on the panels inside the furnace is still in position, but has cracked near the bottom of access panel leaf B.

Time min	Observation.
55	All unexposed face surfaces of access panel A are now grey or black in colour with the exception of the central horizontal stiffener and the bottom of the right hand side vertical stiffener, which are still white. The only remaining white areas on access panel B are the bottom half of the top third of the panel, the higher of the two horizontal stiffeners across the panel leaf and the bottom half of the right-hand side vertical stiffener.
60	No loss of integrity on either access panel. Some yellow deposits have formed on the left-hand side frame of panel A and at two places on the right hand side frame of panel B
71	The left-hand side vertical stiffener of access panel A is now mostly coated with yellow deposit.
81	The left-hand side frame member of access panel B has distorted by a maximum of approximately 10mm in one location, although no through gap into the furnace is present.
90	No loss of integrity on either access panel. Test stopped at sponsor's request.

The specimen is shown after 1 hour, at termination, and after the test in Plates 3 to 7.

5.2 Temperature measurements

5.2.1 Furnace temperature

The mean furnace temperature is plotted against time in Figure 8 with the specified curve for comparison.

5.2.2 Temperature measurements on the unexposed face

The individual, mean and maximum temperatures recorded on the access panel leaves and frames are plotted against time in Figures 9 to 16.

The limit for maximum temperature rise (180^{O}C) was first exceeded on access panel A after 20 minutes and on access panel B after 22 minutes. The limit for the rise in mean temperature on access panel leaf A was exceeded after 28 minutes and on access panel leaf B after 27 minutes.

5.2.3 Deflection measurements

The deflection recorded near the centre of each access panel leaf is shown plotted against time in Figure 17.

6 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^{o}C above its initial value;

b) when the temperature recorded at any positions on the unexposed face is in excess of 180^{O}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.

7 CONCLUSION

Two single leaf access panels incorporated in a 150mm thick block wall, as described in this report, when tested in accordance with B.S. 476 : Part 22 : 1987 was found to have the following fire resistance:

Access panel A

Insulation: 20 minutes

Integrity: 90 minutes

Access panel B

Insulation: 22 minutes

Integrity: 90 minutes

8 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 : Parr 22 : 1987. British Standards Institution, London, 1987.

9 FIGURES

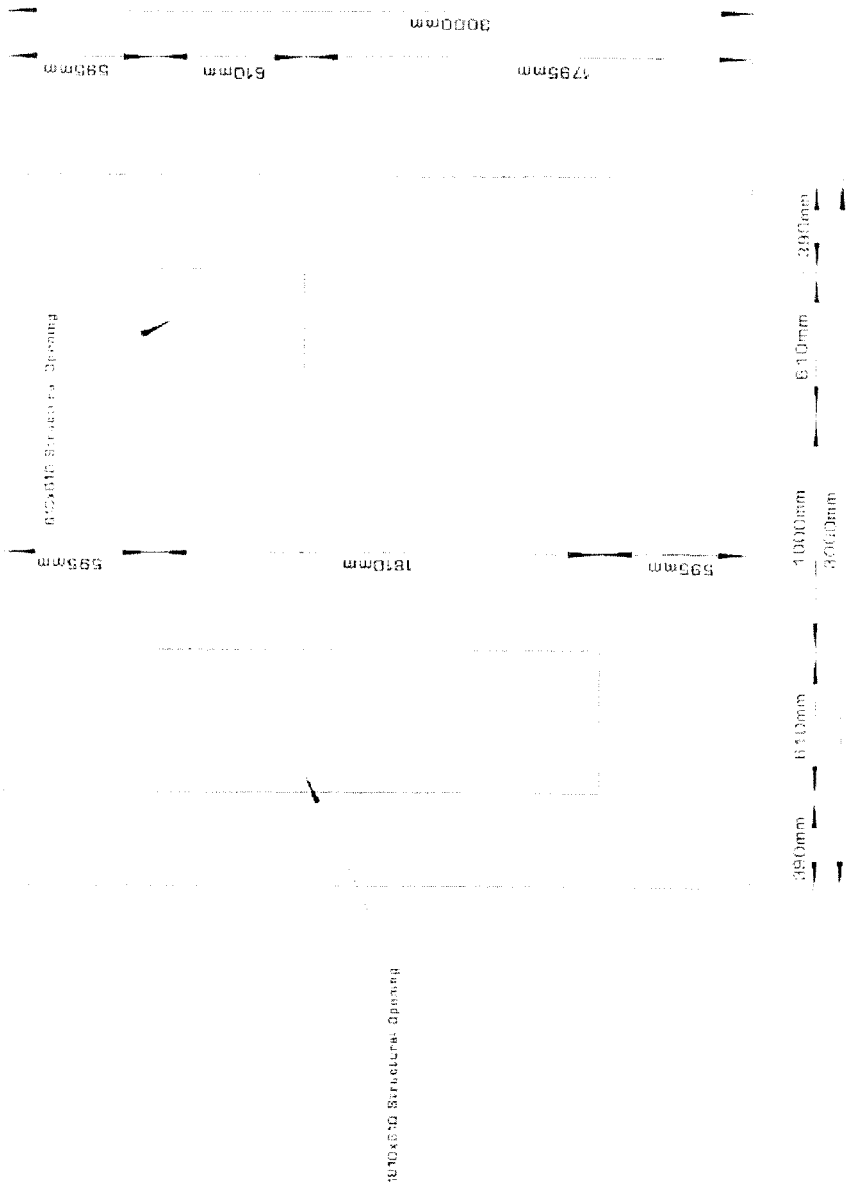

Figure 1 Arrangement of access panel apertures in block wall (viewed from exposed face)

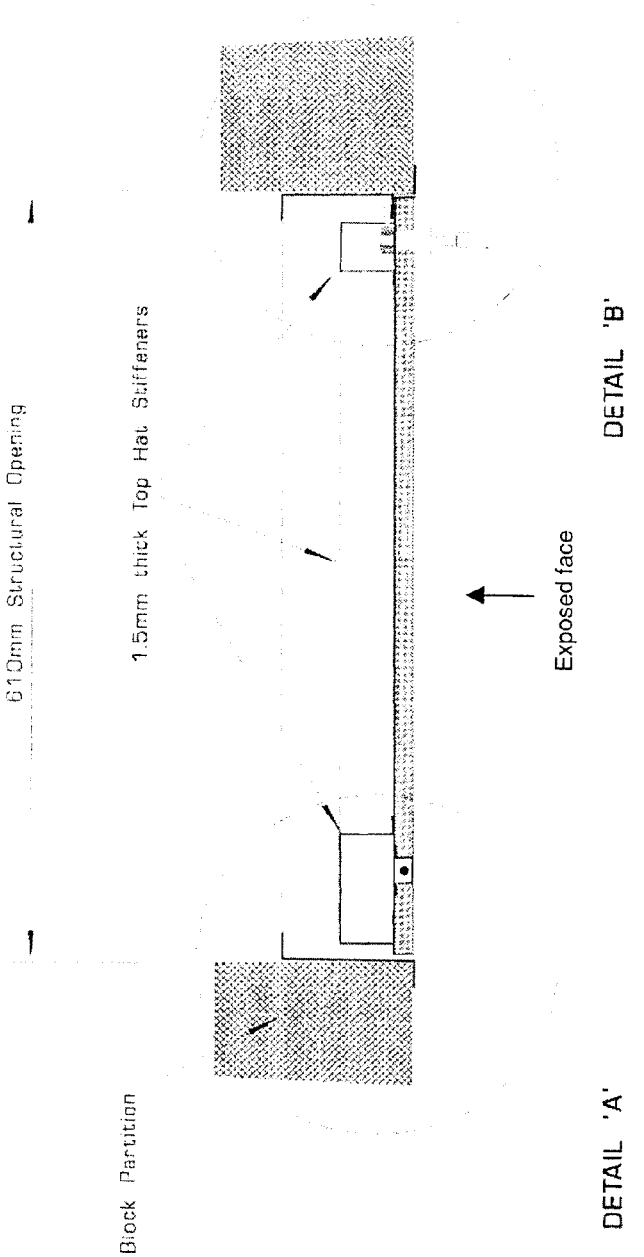

Figure 2 Horizontal section showing large access panel detail (tiles not shown for clarity)

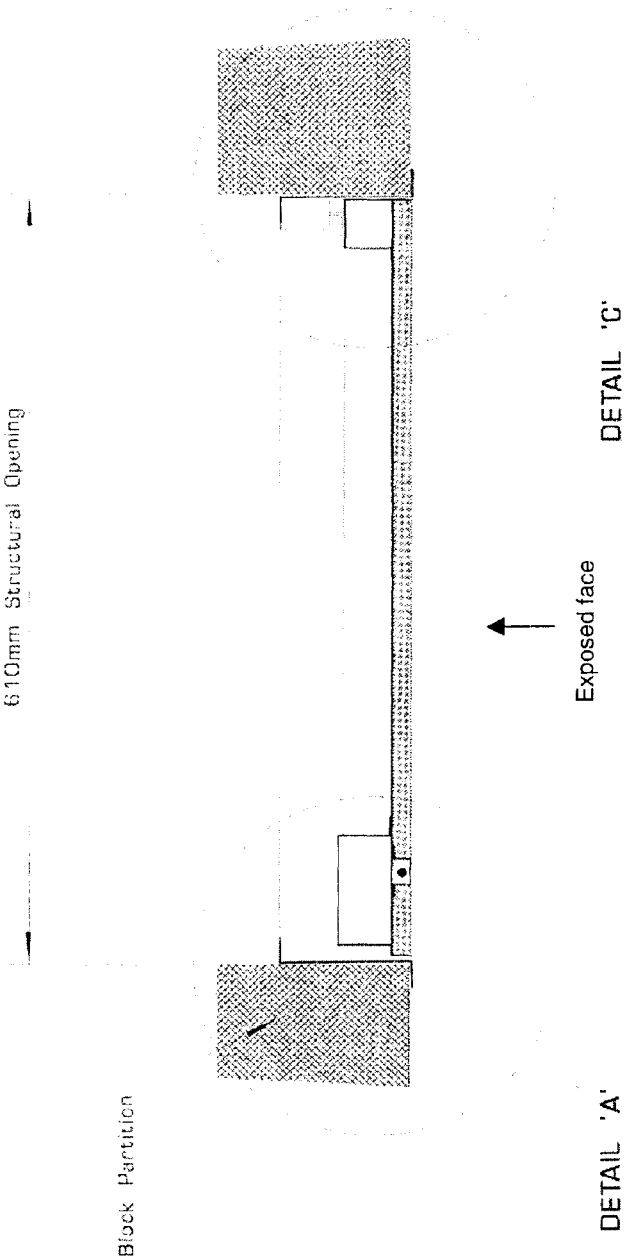

Figure 3 Horizontal section showing small access panel detail (tiles not shown for clarity)

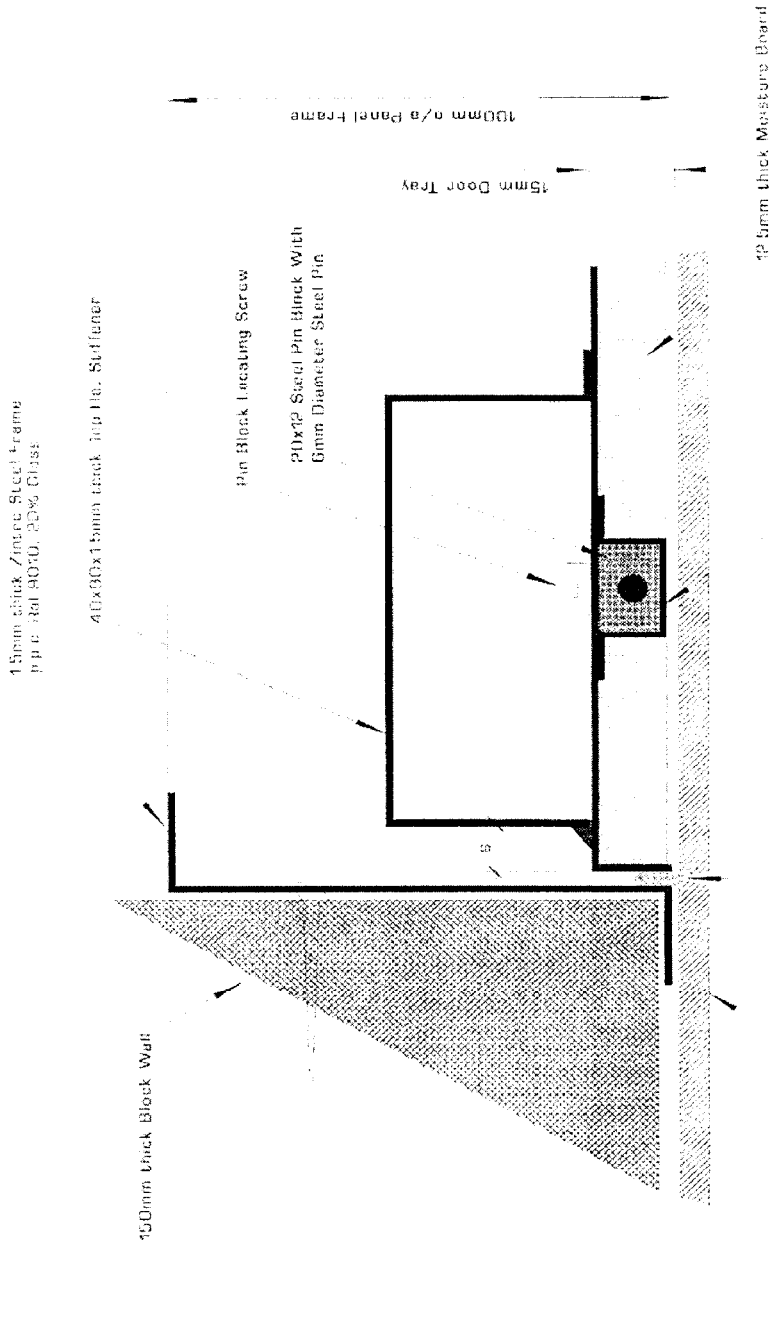

Figure 4 Enlarged section detail 'A', from Figures 2 and 3

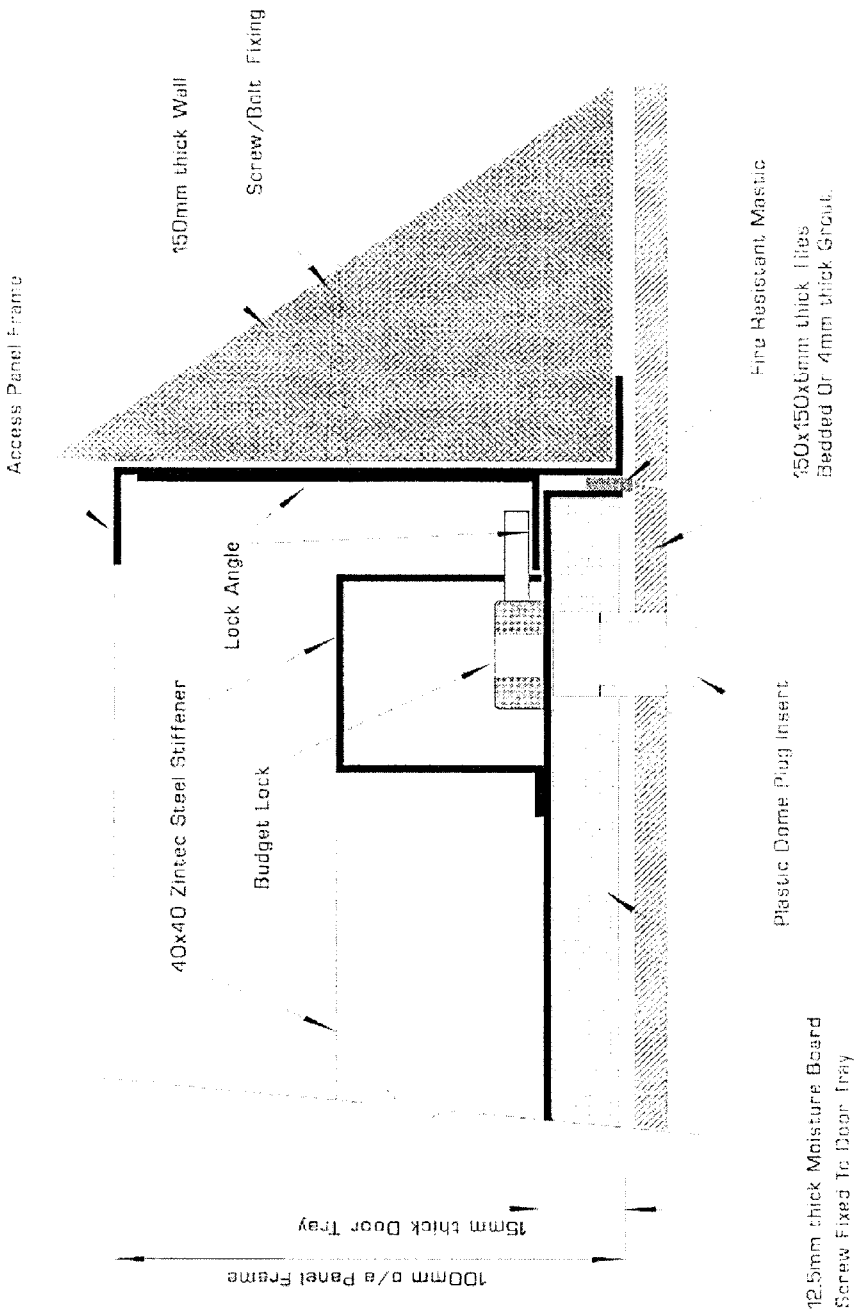

Figure 5 Enlarged section detail 'B', from Figure 2

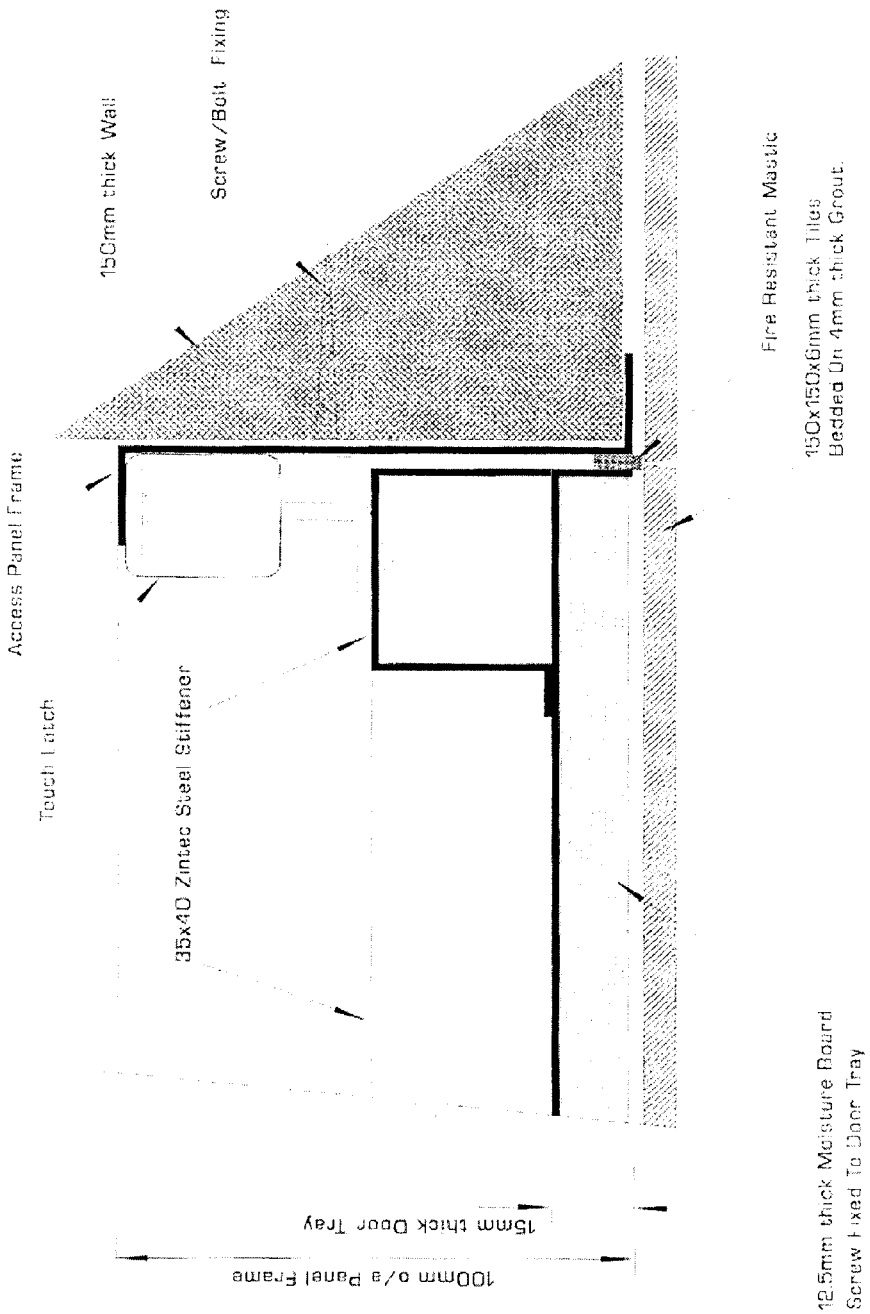

Figure 6 Enlarged section detail 'C', from Figure 3

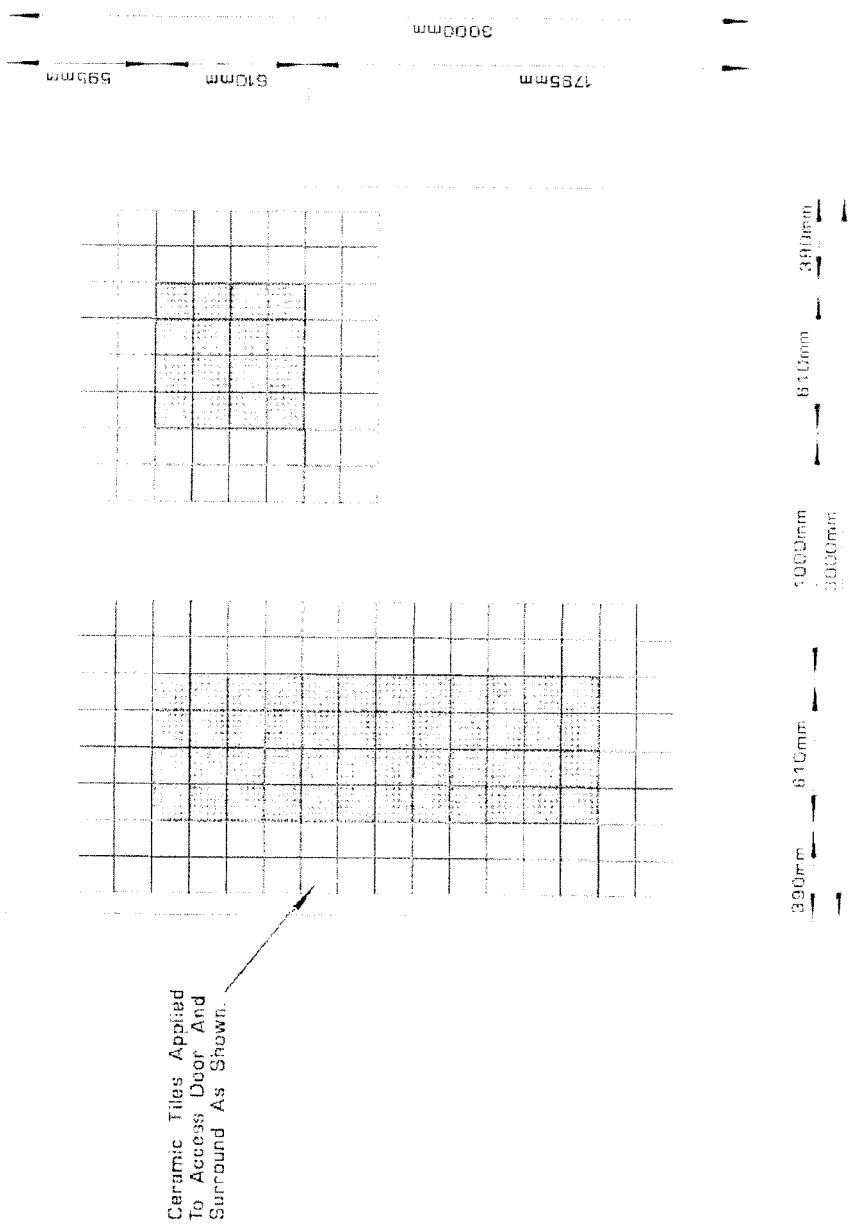

Figure 7 General view of exposed face of test specimen

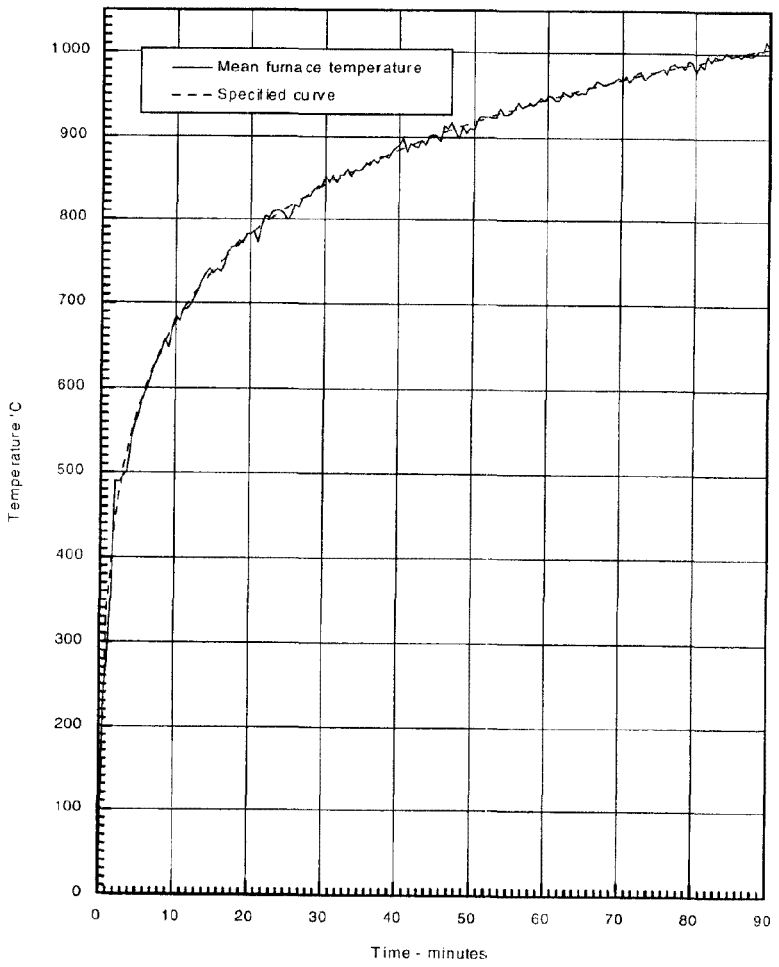

Figure 8 Mean furnace temperature with specified curve for comparison

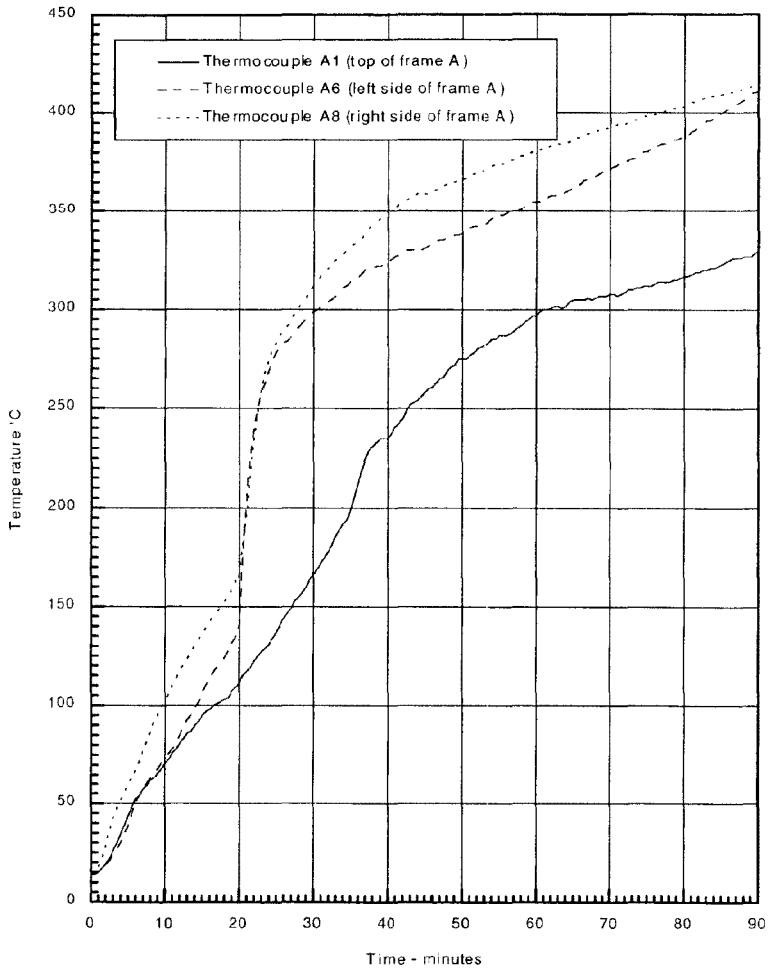

Figure 9 Temperatures recorded on unexposed face of access panel frame A.

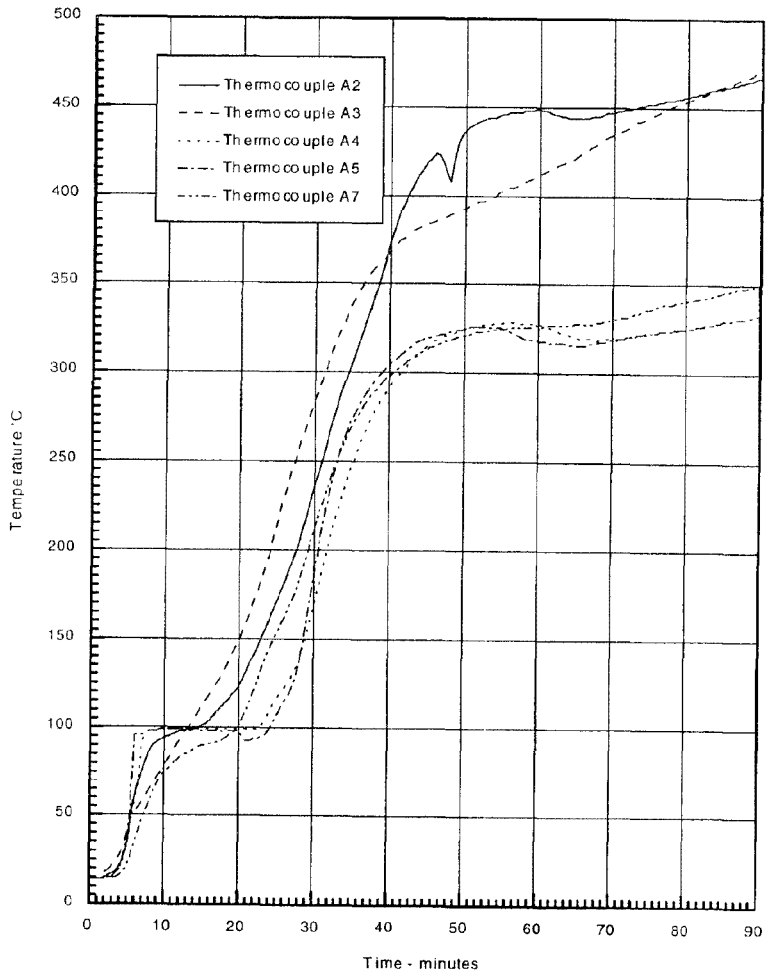

Figure 10 Temperatures recorded on the unexposed face of access panel leaf A by thermocouples A2 to A5 and A7

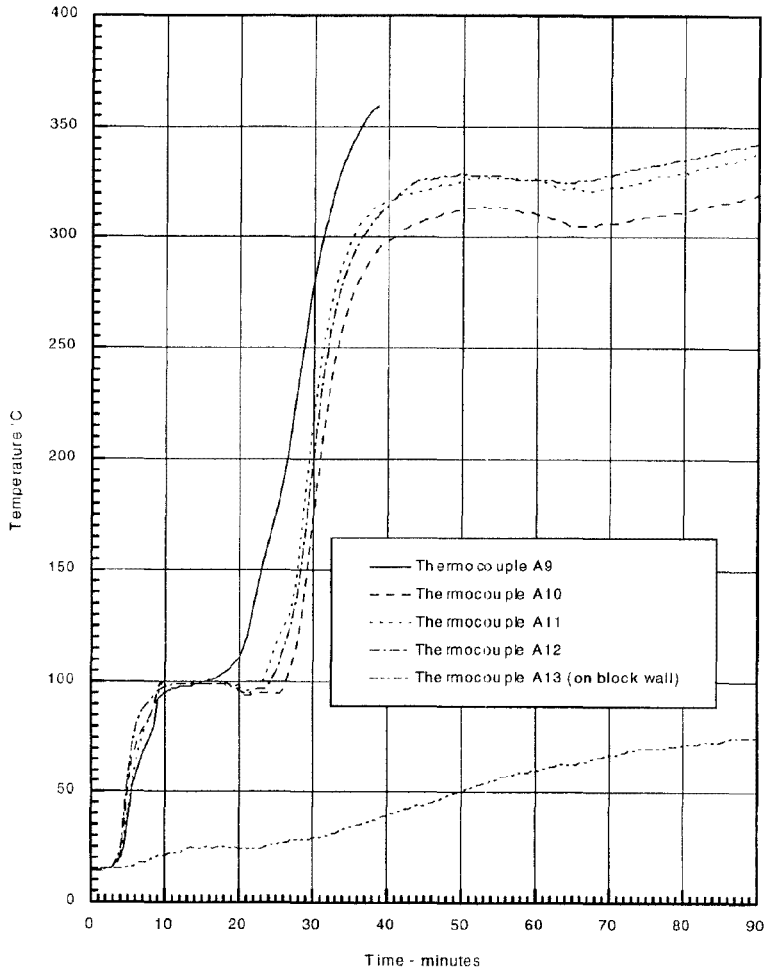

Figure 11 Temperatures recorded on the unexposed face of access panel leaf A by thermocouples A9 to A13

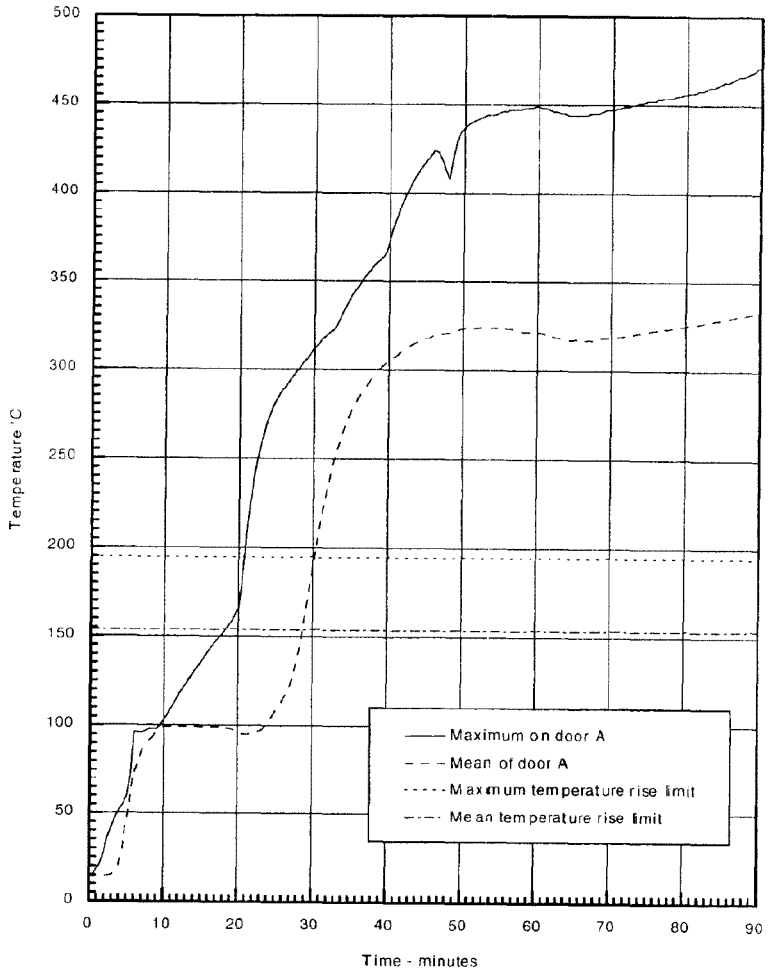

Figure 12 Mean and maximum temperatures recorded on unexposed face of access panel A.

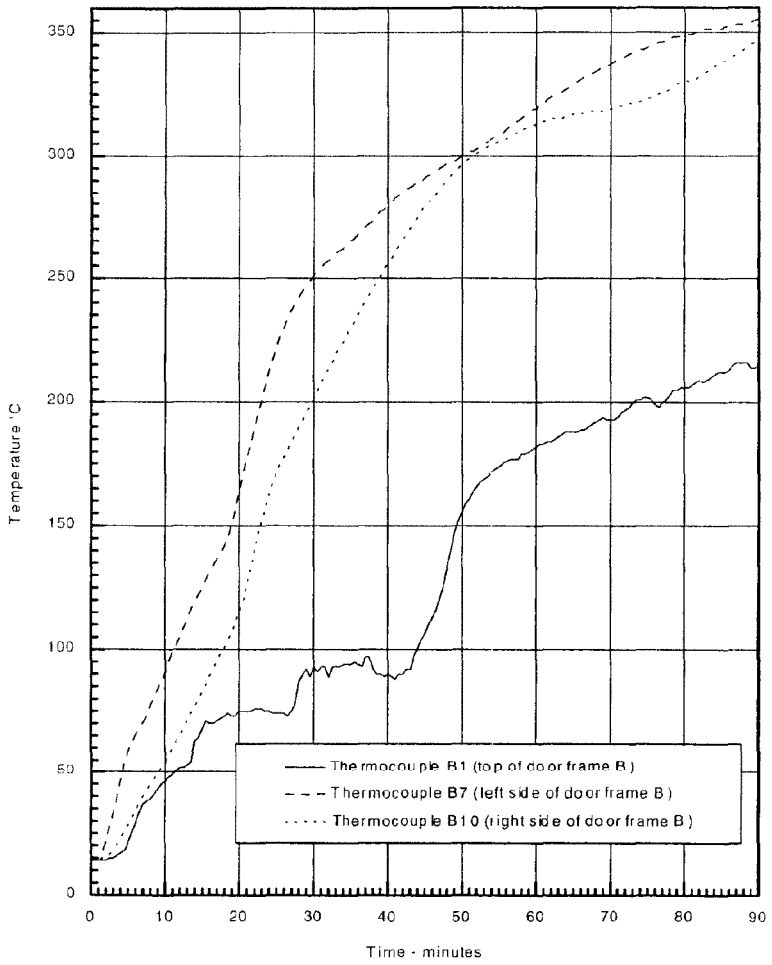

Figure 13 Temperatures recorded on unexposed face of access panel frame B.

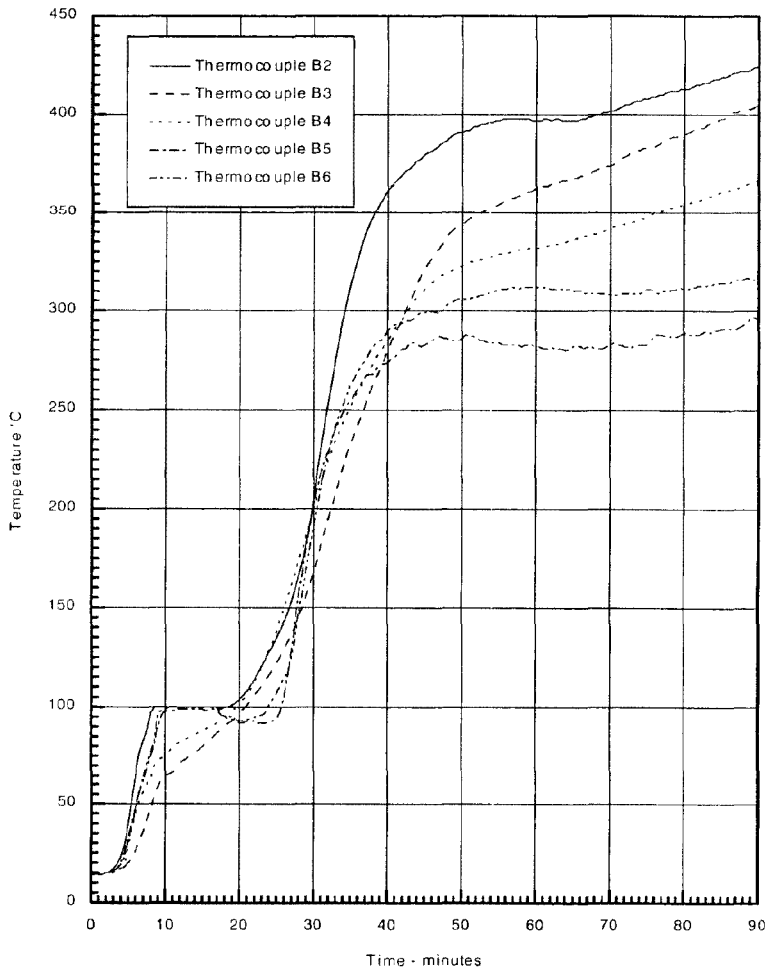

Figure 14 Temperatures recorded on the unexposed face of access panel leaf B by thermocouples B2 to B6

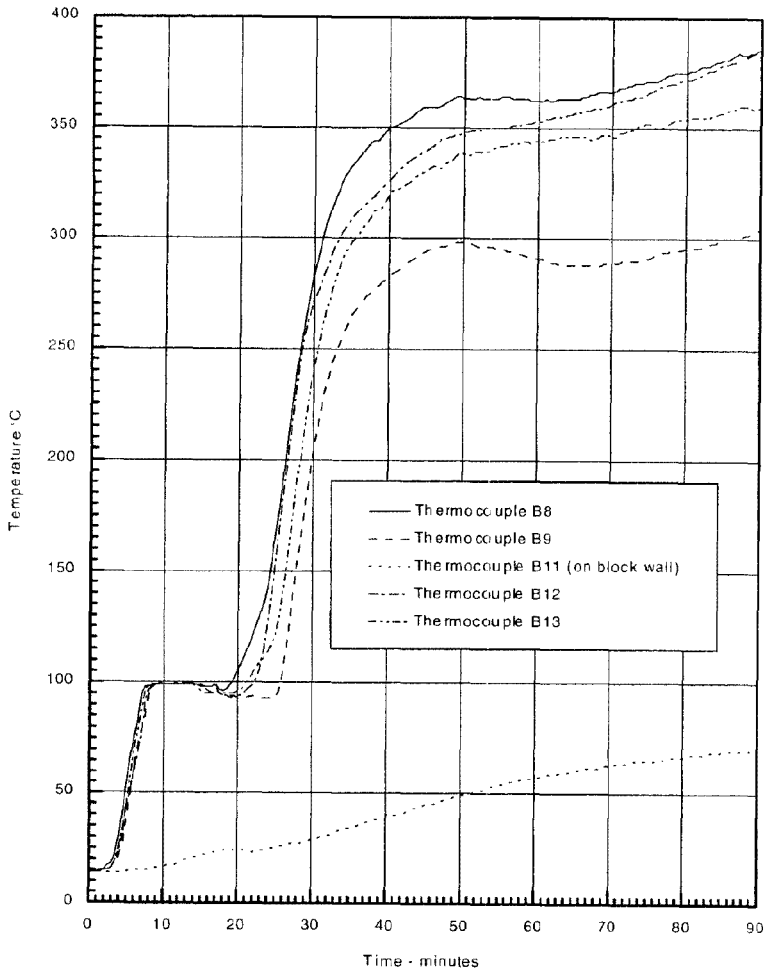

Figure 15 Temperatures recorded on the unexposed face of access panel leaf B by thermocouples B8, B9 and B11 to B13.

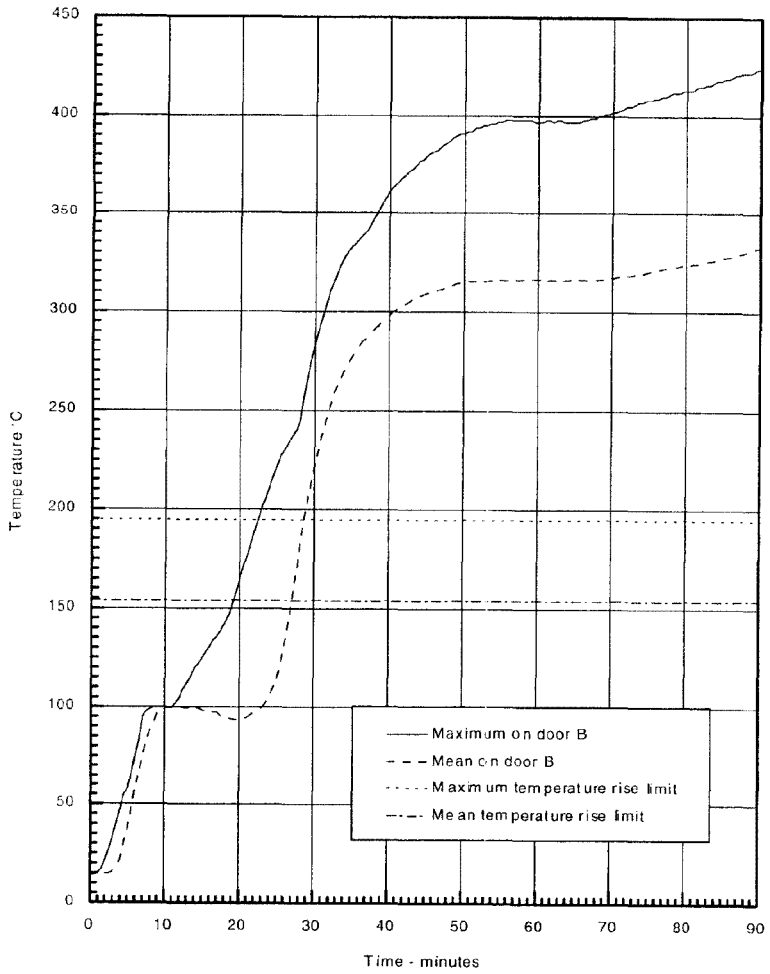

Figure 16 Mean and maximum temperatures recorded on the unexposed face of access panel B.

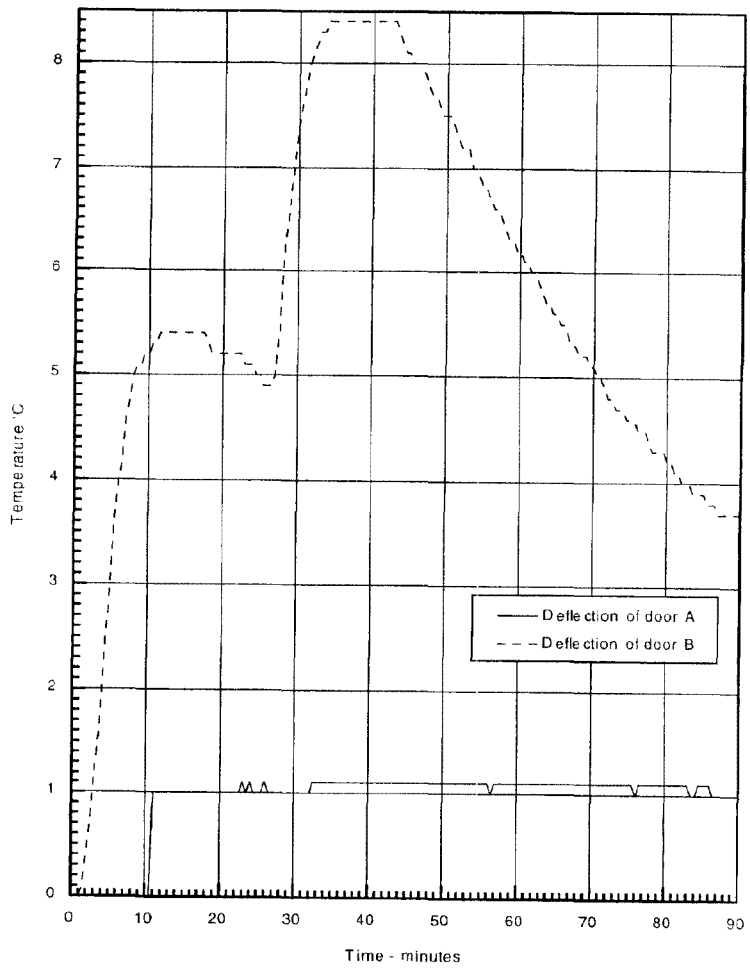

Figure 17 Horizontal deflection (towards furnace) recorded near the centre of each access panel leaf.

10 PHOTOGRAPHS

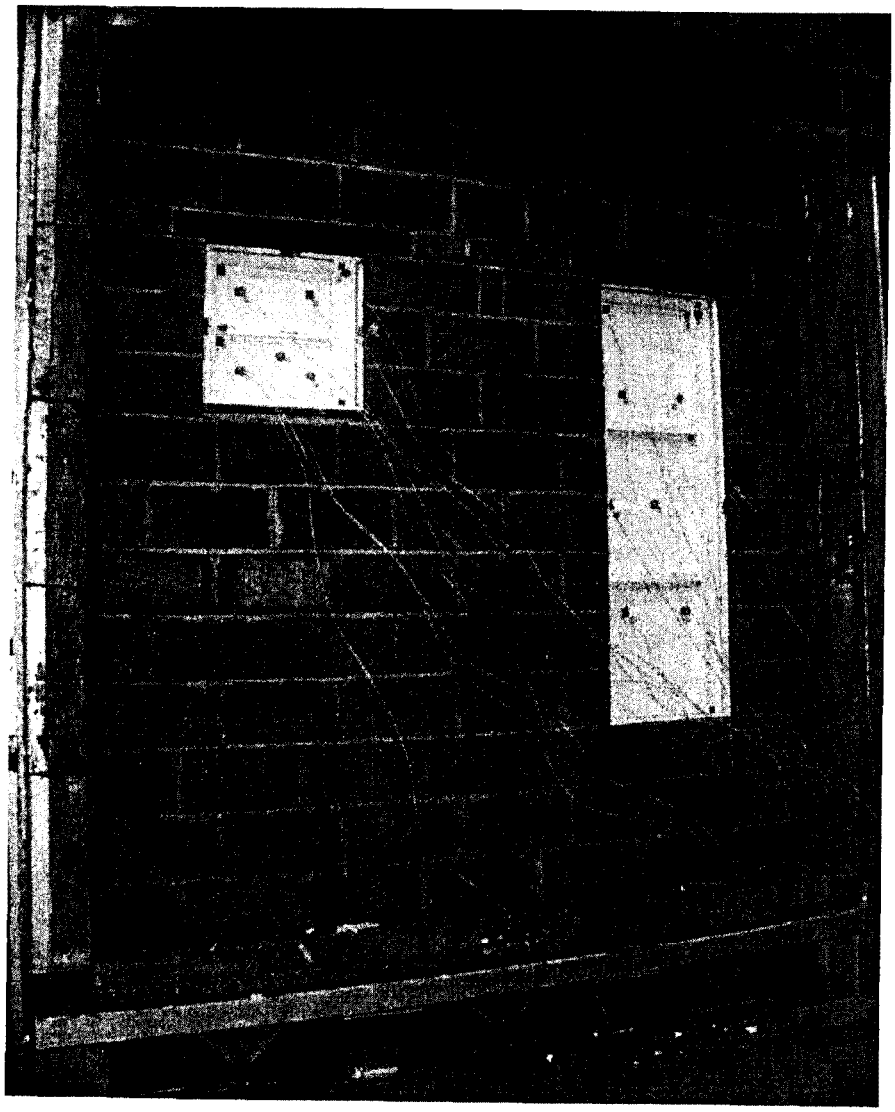

Plate 1 Unexposed face of acces spanels before test.

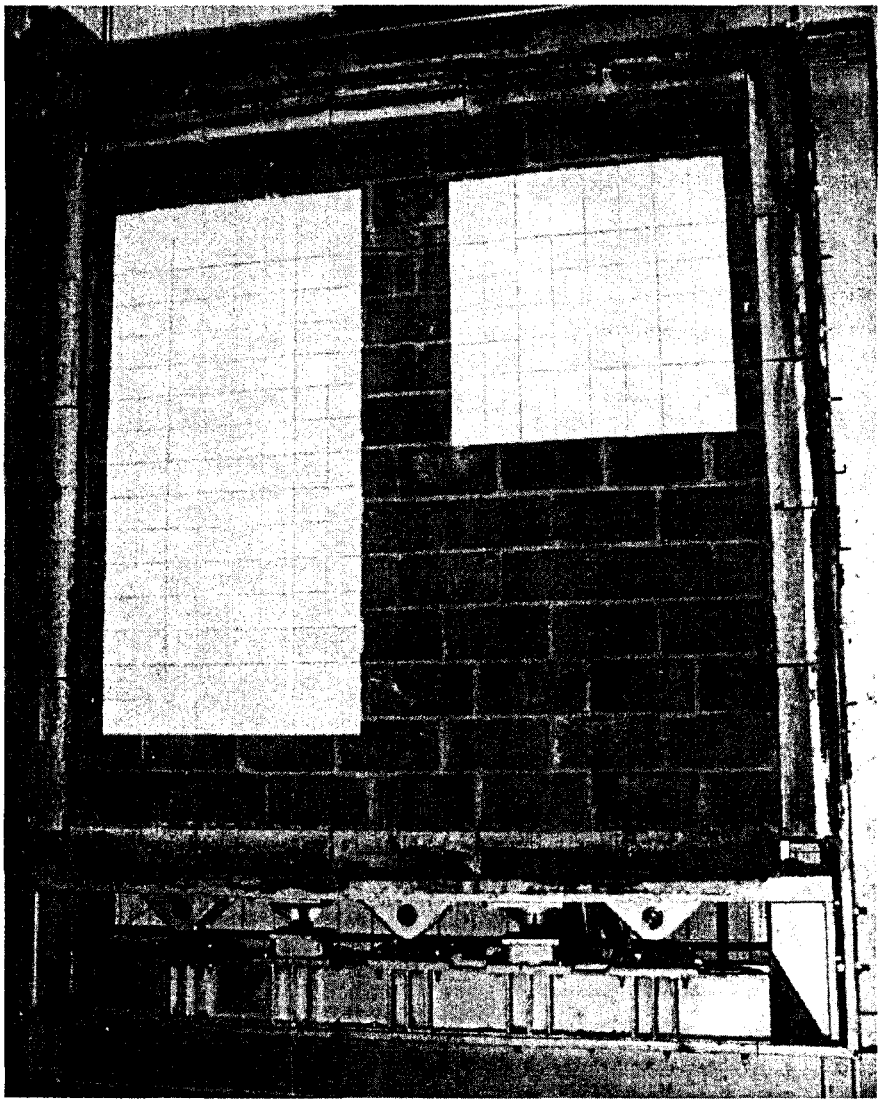

Plate 1 Exposed face of access panels before test.

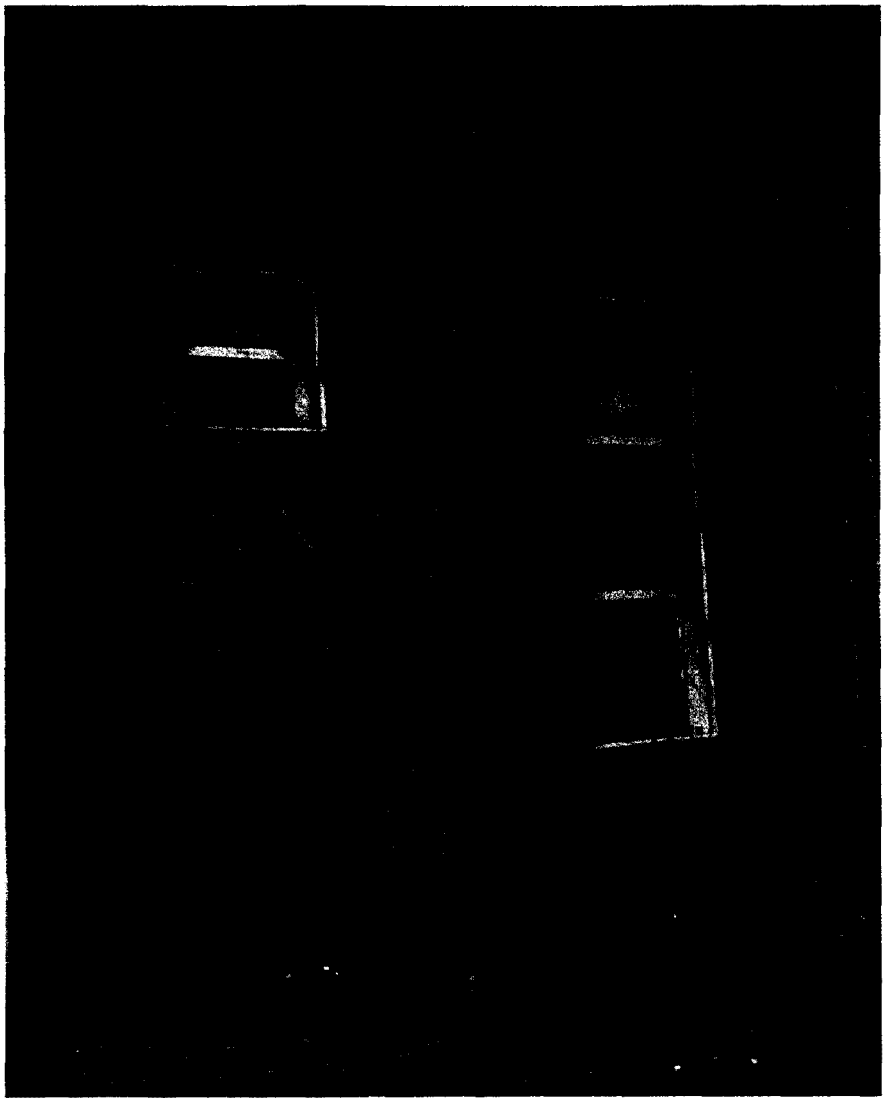

Plate 2 Unexposed face of access panels after 60 minutes.

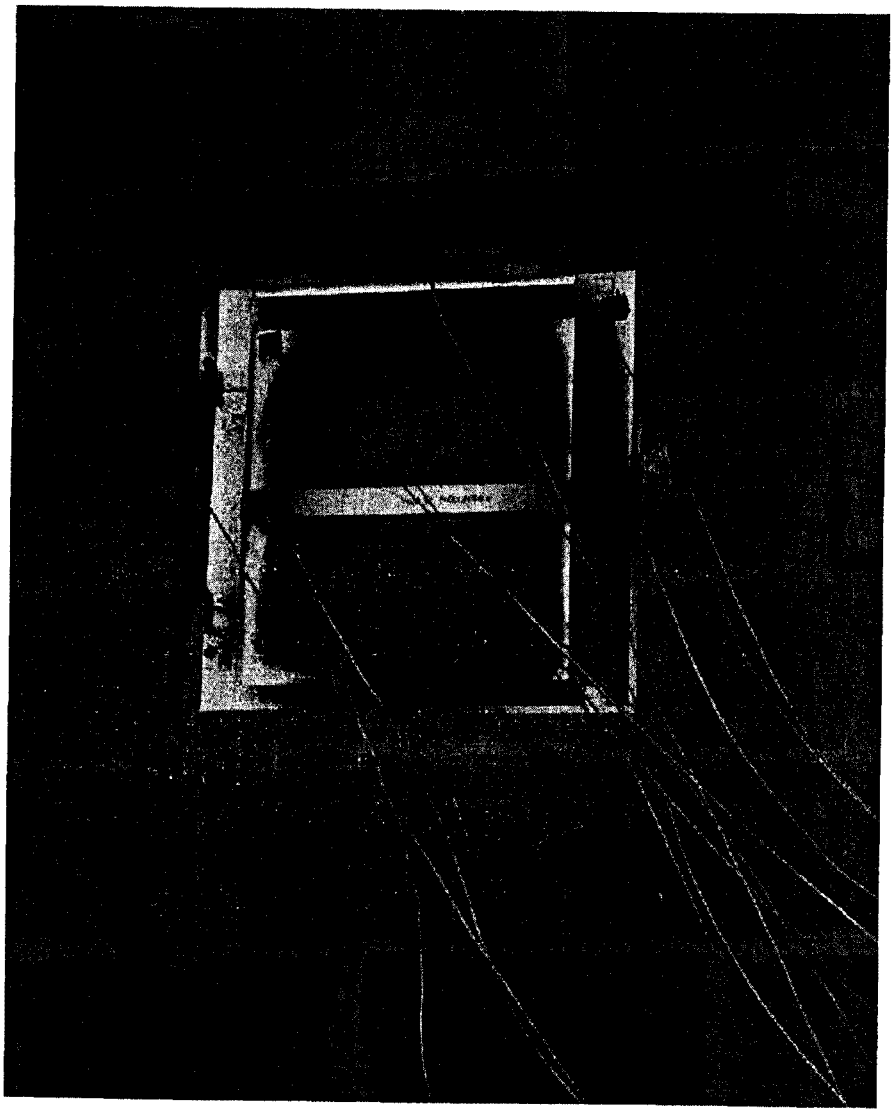

Plate 3 Unexposed face of access panels A at termination of test (90 minutes).

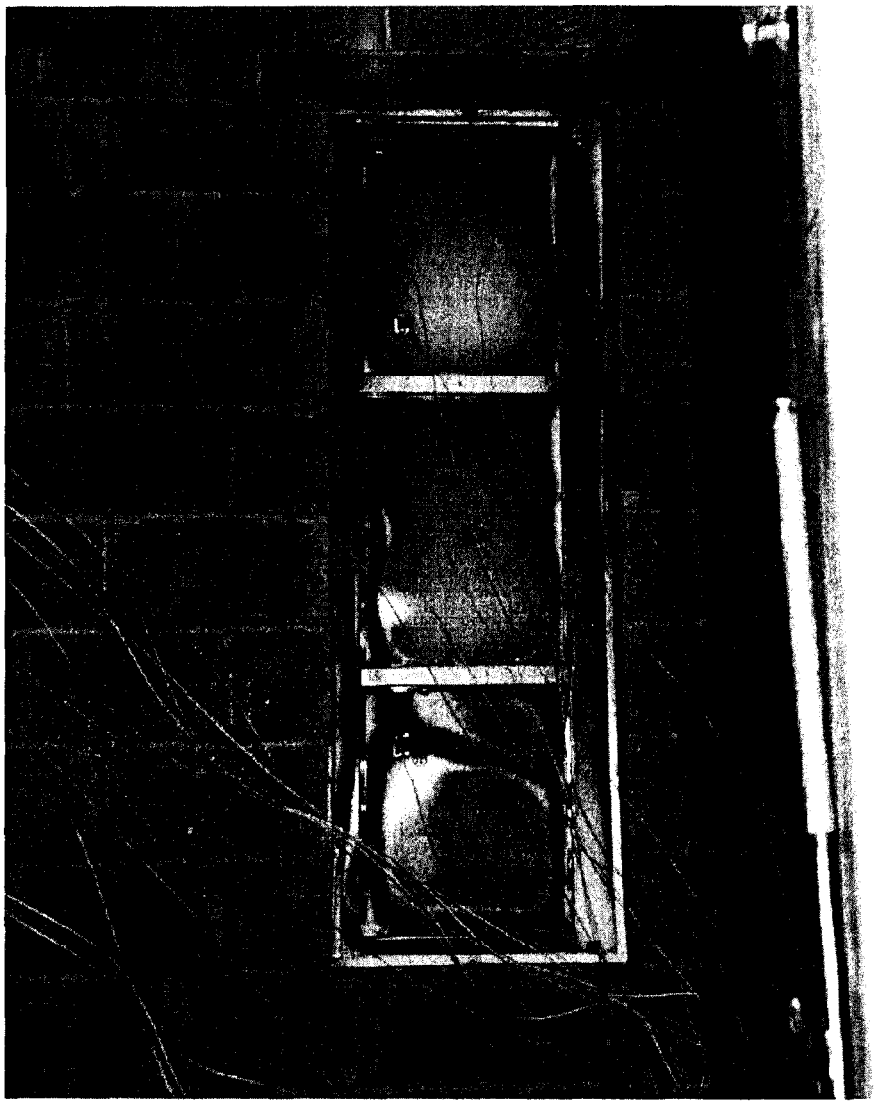

Plate 4 Unexposed face of access panel B at termination of test (90 minutes).

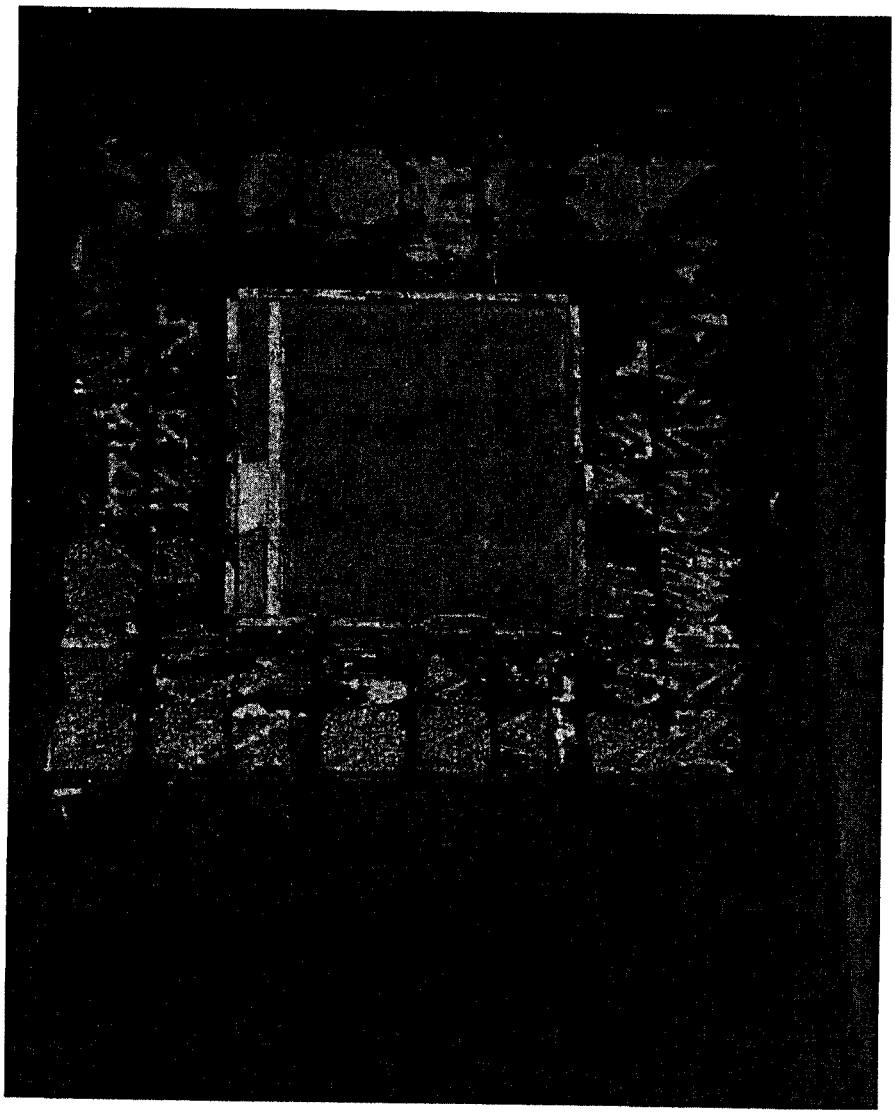

Plate 5 Exposed face of access panel A after test.

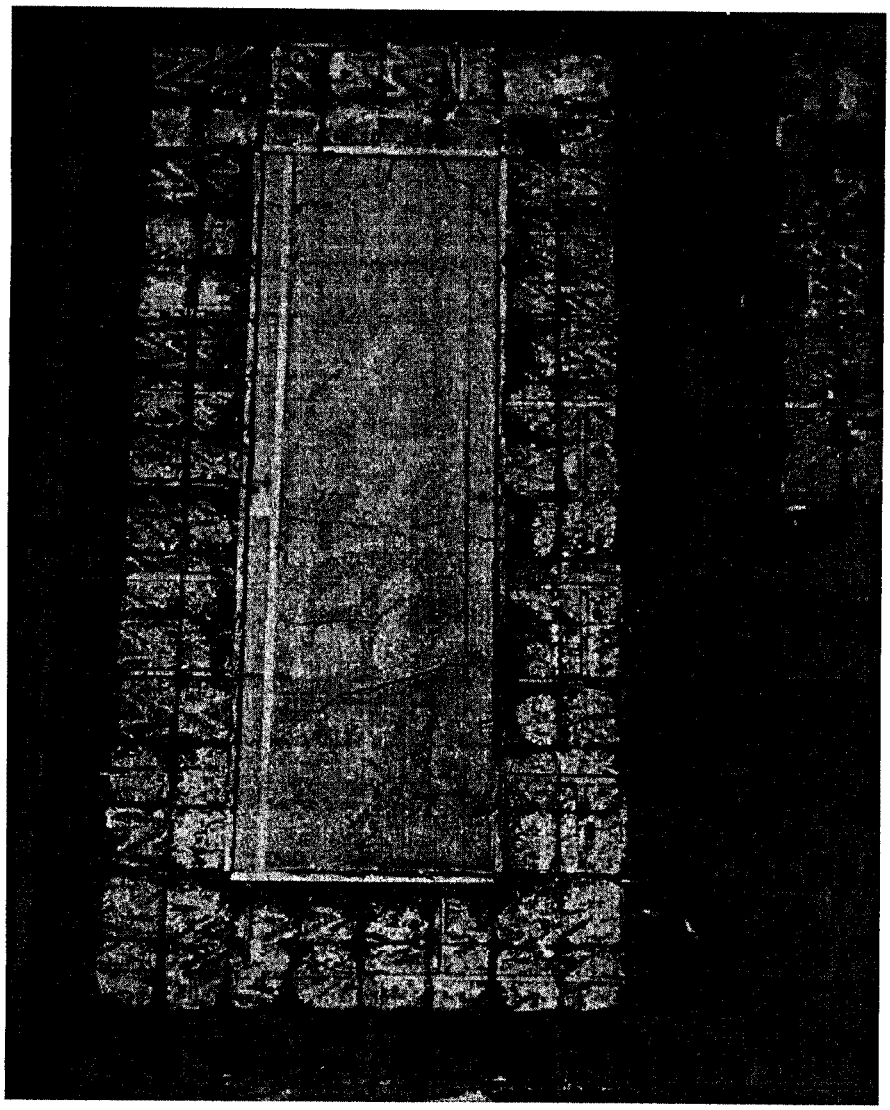

Plate 6 Exposed face of access panel B after test.