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Fire resistance test in accordance with BS 476 : Part 22 : 1987 on a single-leaf hinged access panel in a small plasterboard partition

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UKAS TESTING

0578

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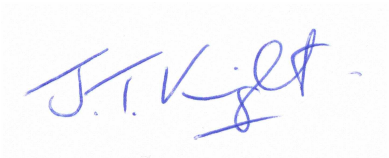
Signature 

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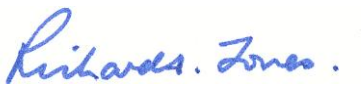
Signature 

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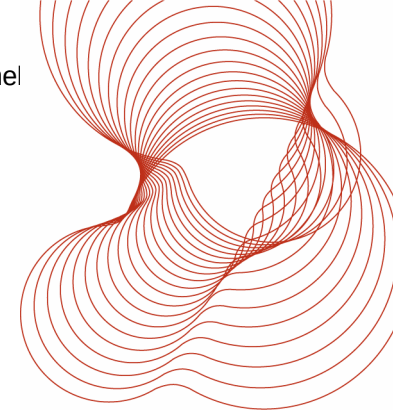


Summary

A single-leaf steel/plasterboard access panel incorporated in a steel-framed plasterboard partition, 1.5m x 1.5m, was submitted to a fire resistance test carried out in accordance with BS 476 : Part 22 : 1987 (Method 6) on 26 September 2006 for a duration of 120min.

The access panel comprised a preformed steel door leaf, 893mm high x 596mm wide x 62mm thick, manufactured from a polyester-powder-coated 1mm-thick steel sheet incorporating a sheet of 12.5mm-thick Megadeco plasterboard encapsulated the unexposed face The panel leaf was hung in a steel frame incorporating seals.

The access panel was incorporated in a steel-frame partition comprising two layers of 15mm-thick Lafarge Firecheck plasterboard on each face of the partition. The access panel opened towards the furnace and in this orientation achieved the following fire resistance:

Insulation: 22min

Integrity: 120min

1 Objective

A test was carried out in accordance with BS 476 : Part 22 : 1987[1], at the request of Fire Proofing Services Ltd., to determine the fire resistance of a single-leaf hinged access panel in a 1.5m x 1.5m plasterboard partition.

2 Test construction

2.1 Supporting construction

A Lafarge drywall partition, 130mm thick, was constructed within the opening, 1.5m x 1.5m, of a steel test frame lined with aerated concrete blockwork as follows:

Galvanised steel channel was secured to the test frame along the opening base and soffit using drywall screws and plugs at nominally 600mm centres. Lafarge galvanised steel studs, ref. CS70/R were friction-fit located vertically between the channels.

Each side of the partition was clad with two layers of Lafarge 15mm-thick Firecheck plasterboard. All boards were screwed to the studs at nominally 300mm centres using drywall screws. The boards were arranged so that the vertical joints coincided with studs and were staggered in adjacent layers

Lafarge Plasterboard FineForm Ready-mixed Joint Compound and tape finished the joints in the outer layer of plasterboard.

An aperture formed in the partition was framed by the steel channel and studs and lined with 15mm-thick Firecheck.

2.2 Specimen construction

The following descriptions of the specimen are an amplification of those supplied by the sponsor. Surface detail and dimensions were verified by the BRE before the test.

2.2.1 Panel door leaf

The door leaf comprised two layers. The unexposed face layer measured 893mm high and 557mm wide x 13mm thick, the exposed face layer measured 596mm wide x 49mm thick. The total door leaf thickness was 62mm. The main body of the door leaf consisted of a 1.0mm-thick Zintec steel (BS EN 101522003) skin strengthened with two pre-formed 1.0mm-thick vertical stiffeners welded to the sides of the door leaf.

The voids between the stiffeners were filled with 50mm-thick E-Coustiquilt membrane an acoustic quilt comprising an uneven sandwich of 20mm and 30mm thick yellow-coloured glass fibre either side of a 1mm-thick black-coloured fexible sheet. Lafarge Megadeco wallboard, 12.5mm thick, covered with a 1.0mm-thick Zintec folded steel rear protection plate was fitted to the rear of the door leaf with fourteen 32mm-long drywall screws/washers. The steel plate was folded over at the perimeter covering the edges of the Megadeco wallboard.

The door hinge consisted of a 1.5mm-thick mild-steel continuous hinge welded to the side edge of the door leaf and to the panel frame using M6 bolts and nuts with washers.

The locking device was a EMKA standard 3-point locking system using 8mm-diameter rods locking into the frame top and bottom, with a central lock on the locking side having a latch of 5mm-thick steel, 35mm wide. The lock/latch was operated by a square key. A steel plug sealed the key hole.

All door seams and edges were fully sealed and welded.

Two adjacent grey intumescent seals, each 10mm wide x 2mm thick, were fitted to the unexposed face of the leaf directly opposite a similar pair of seals fitted to the door frame (see section 2.2.2).

2.2.2 Panel frame

The frame consisted of a 1.2mm-thick Zintec steel (BS EN 101522003) Z section with M6 bolts welded to the hinge side 150mm in from each edge and then at 300mm centres. The Z section sat within and against the exposed face of the aperture in the partition. The frame provided a clear opening, 802mm high x 476mm wide, over which the door leaf closed. The 25mm-wide front flange was mitred at each corner. The frame was fixed into the aperture in the partition with approximately 12 screws being 50mm-long x 5mm-diameter self-drill/tap countersunk-head Phillips bright-steel.

Two adjacent grey intumescent seals, 10mm wide x 2mm thick, were fitted to the frame stop adjacent to the aperture (opposite the pair on the door leaf). Two adjacent cream-coloured flexible seals, each 8mm wide x 4mm thick were fitted to the frame stop parallel to the intumescent seals.

All frame edges were welded and fully sealed to the partition with fire-resistant mastic coloured grey on the unexposed face and white at the frame/partition interface. Each locking hole position in the frame was capped and sealed.

2.2.3 Miscellaneous

The door opened towards the furnace.

The specimen was installed on 22 September 2006.

The gap between the access panel door leaf and the frame was measured to range between 2mm and 3mm along the top edge, 1mm and 2mm along the bottom edge, 1.5mm and 2.5mm along the hinge side, and 2mm along the latch side.

The test construction is shown in Figures 1 - 3, and also before test in Photos 1-8.

3 Conditioning

A representative sample of Megadeco and the glass fibre part of E-Coustiquilt membrane were taken during construction, weighed and then oven-dried in order to determine the free moisture content by weight loss technique. The free moisture content for the Megadeco dried at 50ºC was found to be 0.5%, and of the glass fibre dried at 105ºC to be 1.4%. Both percentages are of the dry weights.

4 Test procedure

4.1 General

The test was carried out on 25 September 2006 and was witnessed by Mr T Beasley representing the sponsor. The ambient temperature at the start of the test was 15ºC.

4.2 Furnace control

The furnace temperature was measured by means of four 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 BS 476 : Part 20 : 1987[2]. The mean furnace temperature recorded is plotted against time in Graph 1.

After the first 5min of the test the pressure in the furnace was maintained in accordance with the standard[2] so that a pressure of 19Pa ±2Pa existed at the level of the top of the access panel to represent the access panel located at the top of a wall.

4.3 Temperature measurements on unexposed face

Eleven K-type thermocouples were fitted, in accordance with the standard[2], to the unexposed face of the access panel to monitor the temperature of the unexposed face at locations given in Table 1.

Table 1 Unexposed face thermocouple locations

Thermocouple	Location
1	At centre of top frame member
2	Near top non-hinge side corner of leaf
3	Near non-hinge edge of leaf level with thermocouple 4
4	At centre of upper left-hand quarter section of leaf
5	At centre of upper right-hand quarter section of leaf
6	At mid-height of left-hand frame member
7	At centre of leaf
8	At mid-height of leaf towards right-hand side over an internal stiffener
9	At mid-height of right-hand frame member
10	At centre of lower left-hand quarter section of leaf
11	At centre of lower right-hand quarter section of leaf

The mean unexposed face temperature was calculated from the average of thermocouples 4, 5, 7, 10 and 11.

4.4 Deflection measurements

A fine steel wire was stretched across the unexposed face at mid-height of the door. Horizontal deflection of the centre of the leaf was monitored manually by reference to the wire.

5 Results

5.1 Observations

Observations made during the test are given in Table 2. Unless otherwise stated they are of the unexposed face.

Table 2 Observations

Time min	Observations
0	Test started
5	Smoke beginning to issue from inside face of plasterboard aperture perimeter
34	Smoke issuing from leaf/frame interface at bottom edge of panel
35	Leaf bowed at sides increasing leaf/frame interface separation at sides up to approx. 8mm
37	Bow in right-hand side of leaf become an uneven ripple
89	Leaf/frame separation at sides increased up to approx. 25mm at mid height. Intumesced seal had sealed the gap, but now deteriorating resulting in a 5mm-wide gap developed through one side of the seal.
120	Maximum leaf/frame separation measured to be 27mm at mid-height of left-hand side (see photo)
120	Test stopped

There was no failure of integrity throughout the test.

The construction after test is shown is Photos 9 and 10.

5.2 Temperatures recorded on unexposed face

The unexposed-face temperature limit was first exceeded (180ºC maximum rise) by thermocouple 9 after 22min. The mean and maximum temperatures recorded are plotted against time in Graph 2.

5.3 Deflection recorded

The horizontal deflection measurement recorded at the centre of the leaf are given in Table 3.

Table 3 Deflection recorded on door leaf

Time mins	**Deflection** mm
0	0
17	1
32	2
37	1
86	6

6 Performance criteria

The standards[1,2] state that a partition is regarded as having a fire resistance (expressed in minutes under integrity and insulation) that is equal to the elapsed time (in completed minutes) between the commencement of heating and either the termination of heating, or failure to meet the integrity or insulation criteria, 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, before the unexposed face in the vicinity indicates a temperature of 300°C, cracks, gaps or fissures allow flames or hot gases to cause flaming or glowing of a cotton fibre pad;

c) when (after the cotton pad test is unsuitable) a 6mm-diameter gap gauge can penetrate through a gap into the furnace and be moved in the gap for a distance of at least 150mm;

d) when (after the cotton pad test is unsuitable) a 25mm 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 position 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.

7 Conclusion

A single-leaf access panel in a plasterboard partition, 1.5m x 1.5m, as described in this report, was tested in accordance with BS 476 : Part 22 : 1987. In the orientation tested, panel opening towards the furnace, the access panel was found to achieve the following fire resistance:

Insulation:	22min
Integrity:	120min

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.

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 : Part 22 : 1987. British Standards Institution, London, 1987.

9 Figures

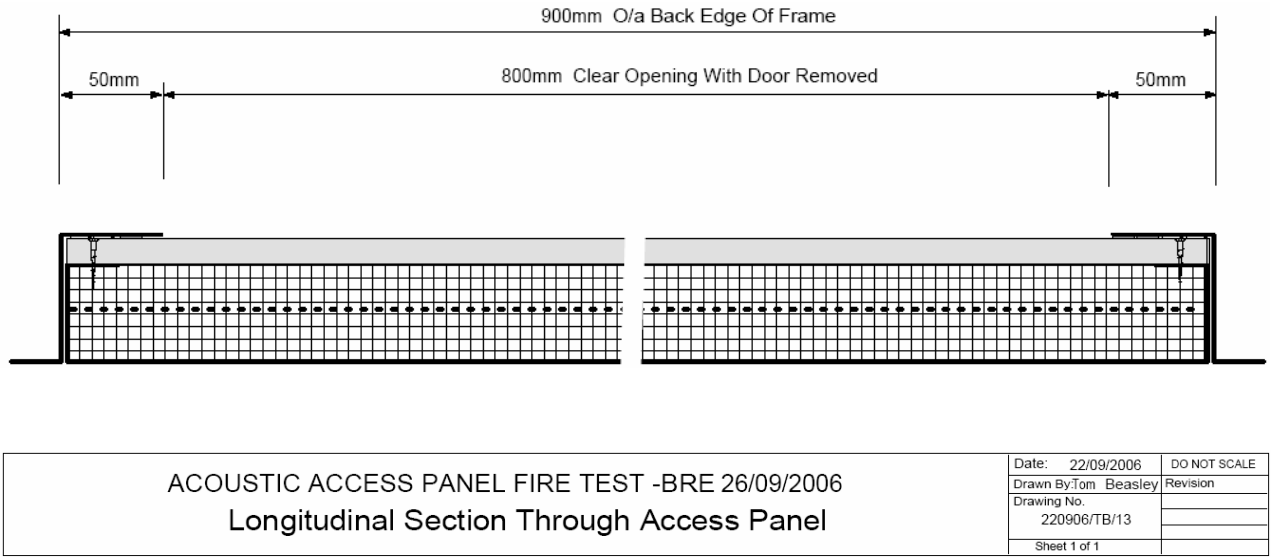
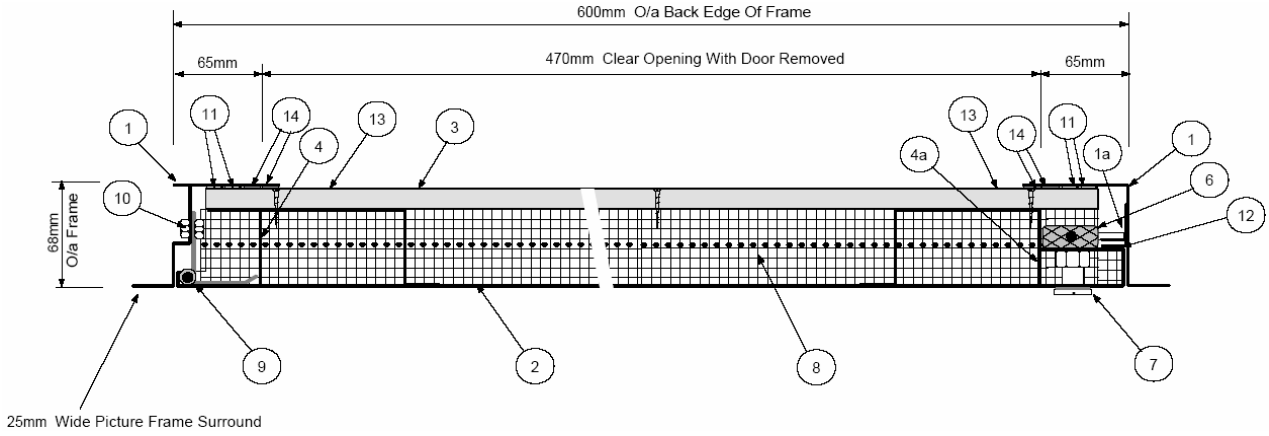


Figure 1 Details of door leaf



ACOUSTIC ACCESS PANEL FIRE TEST -BRE 26/09/2006 Horizontal Section Showing Hinge & Locking Systems	Date: 22/09/2006	DO NOT SCALE
	Drawn By:Tom Beasley	Revision
	Drawing No. 220906/TB/12	
	Sheet 1 of 1	

Key To Drawings :

1. Access panel frame manufactured from 1.2mm thick Zintec steel sheet (BS EN 101522003). The 25mm wide picture frame surround was mitred at each corner. All seams were fully welded and sealed.

1a. 15mm x 15mm x 15mm x 1.2mm thick Zintec steel (BS EN 101522003) locking channel welded to inside of frame.

2. Access panel door tray manufactured from 1.0mm thick Zintec steel sheet (BS EN 101522003), cut and folded to dimensions shown.

3. 12.5mm thick Lafarge Megadeco wallboard (BS EN 1363) factory screw fixed to the rear of the door tray using 32mm drywall screws

4. 1.0mm thick Zintec steel (BS EN 101522003)stiffener welded to rear face of door tray. Size 20mm x 48mm x 120mm x 48mm.

4a. 1.0mm thick Zintec steel (BS EN 101522003)stiffener welded to rear face of door tray. Size 20mm x 48mm x 90mm x 48mm.

6. 3-point locking system (see enclosed detail) with central lock operating 8mm diameter rods which lock into frame top and bottom. The rods are secured to the door tray with 4No. lock guides.

7. 12mm diameter metal screw bung with neoprene washer, covering budget lock hole in door tray.

8. 50mm thick E-Coustiquiltmatting inserted into cavities between door tray and Megadeco (BS EN 1363) wall board.

9. Galvanized steel continuous hinge welded to door tray and bolted to frame using M6bolts and nuts with washer.

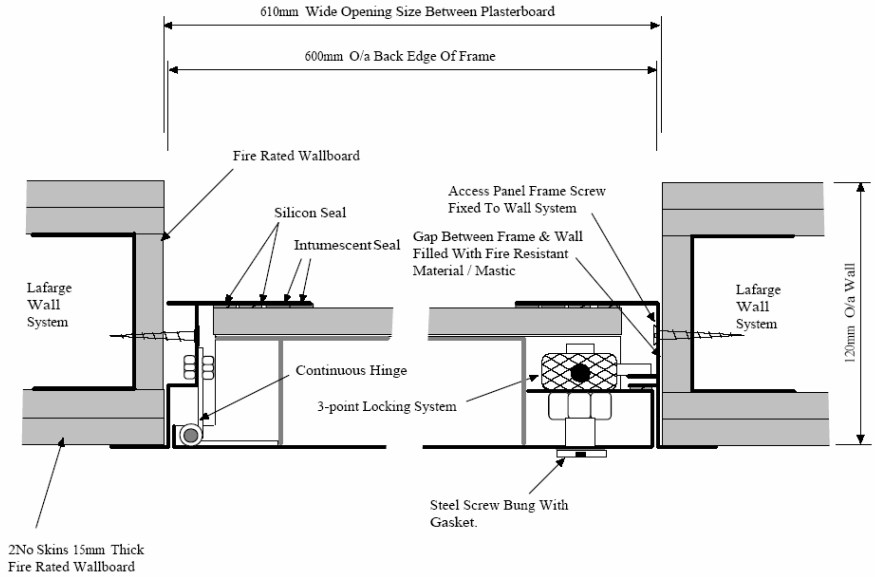
10. M6bolts welded to panel frame at 150mm in from edges and 300mm centres thereafter. Door tray secured to frame using M6nuts and washers.

11. 2 No. strips of self-adhesive 8mm x 4mm Closed Cell Sponge Silicone Seal around inside edge of frame.

13. 1.0mm thick Zintec Steel (BS EN 101522003)rear protection plate (p.p.c. RAL 9010, 20% gloss) screw fixed to Megadeco board.

14. 4No. 10mm wide x 2mm thick self adhesive intumescent(BS 476, Part 1) glazing strip (Envirograph Ref: G10/10) fitted around inside edge of frame and rear edge of door tray (see drawing).

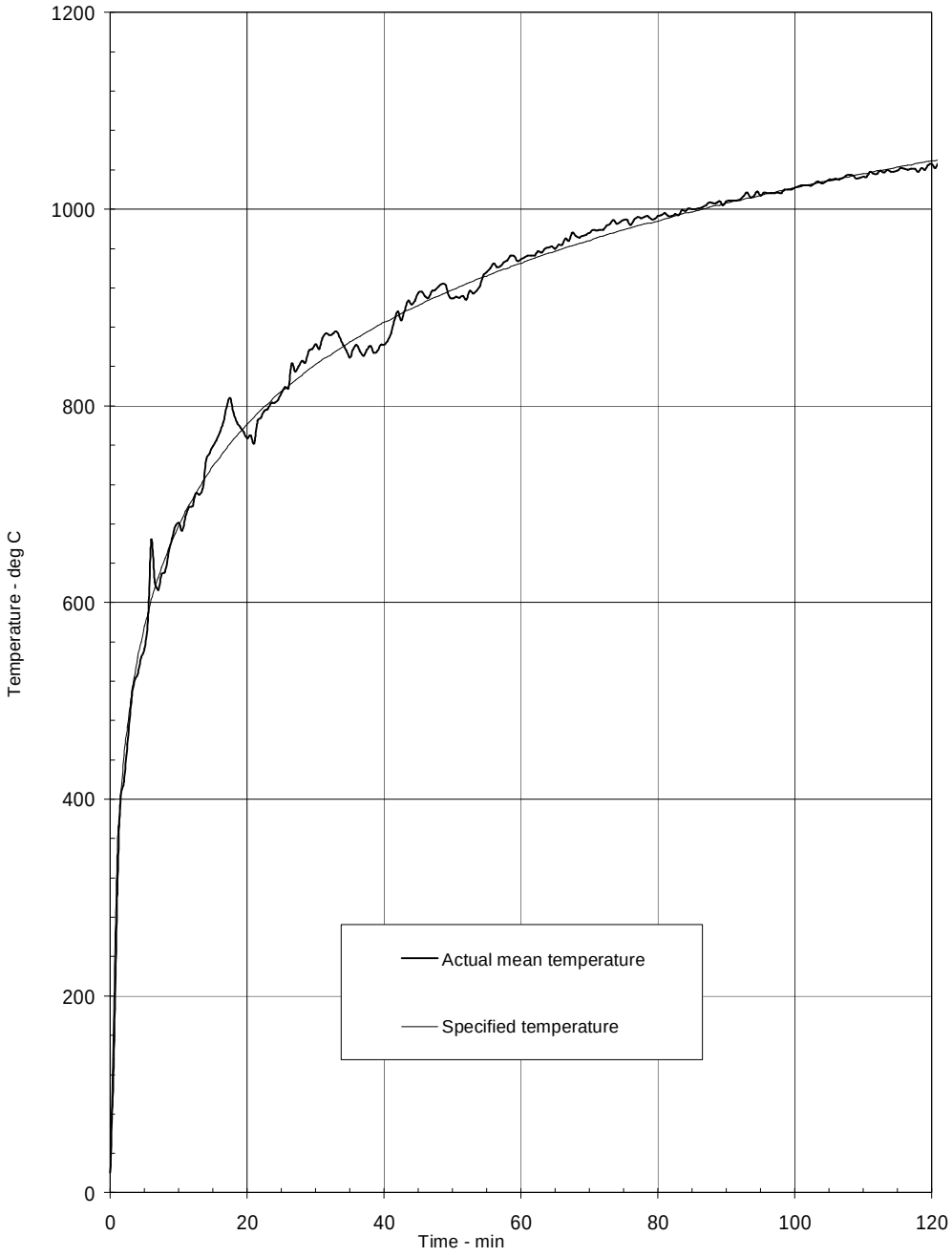
Figure 2 Details of door leaf



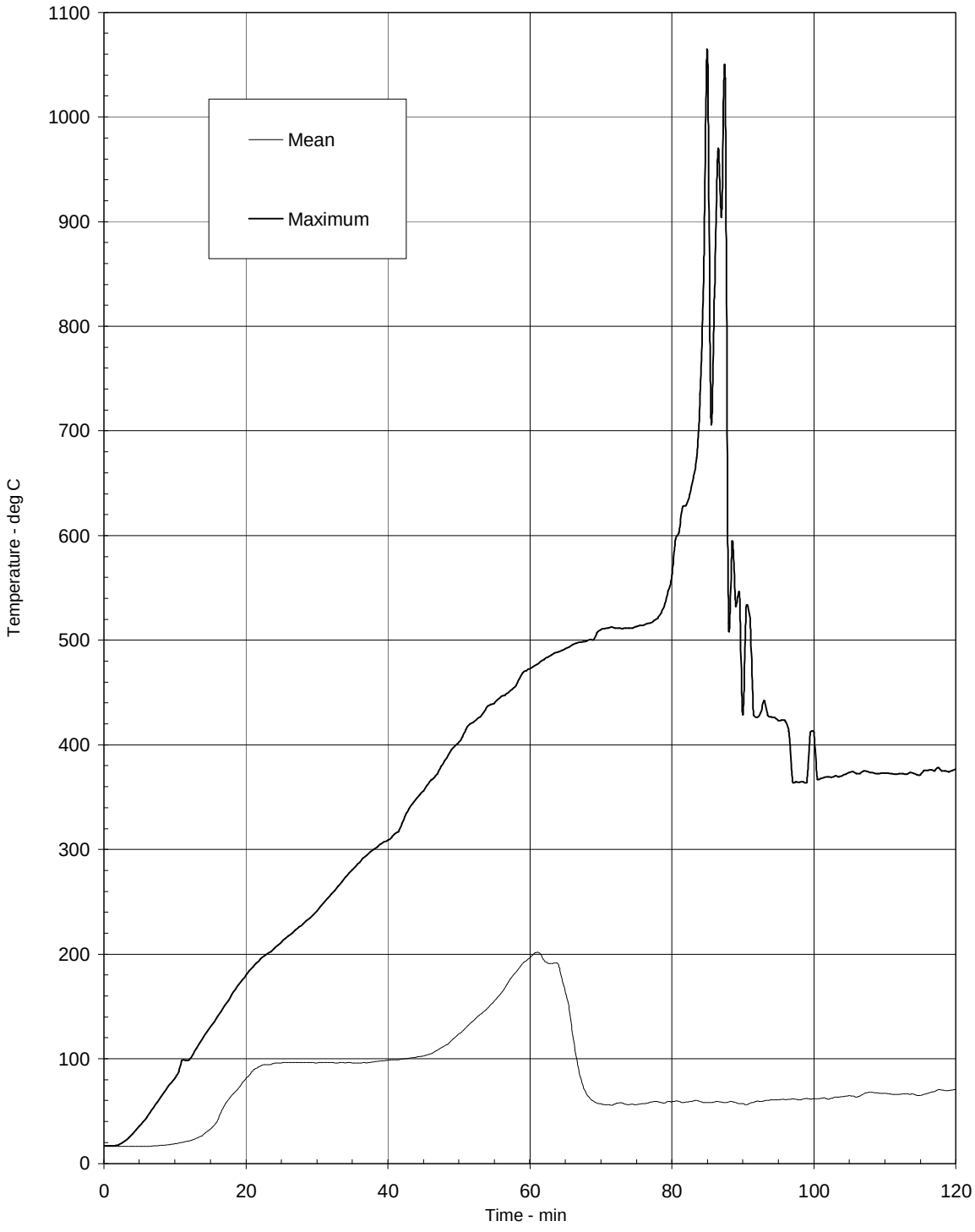
BRE FIRE TEST - 26/09/2006. Typical Horizontal Section Through Access Panel & Partition	Date: 22/09/2006	DO NOT SCALE
	Drawn By:T. Beasley	Revision
	Drawing No. 220906/TB/10	
	Sheet 1 of 1	

Figure 3 Horizontal section through door in partition

10 Graphs



Graph 1 Furnace temperature



Graph 2 Temperatures recorded on unexposed face

11 Photographs

Photo 1 Open access panel before test

Photo 2 Access panel frame before test

Photo 3 Access panel frame before test

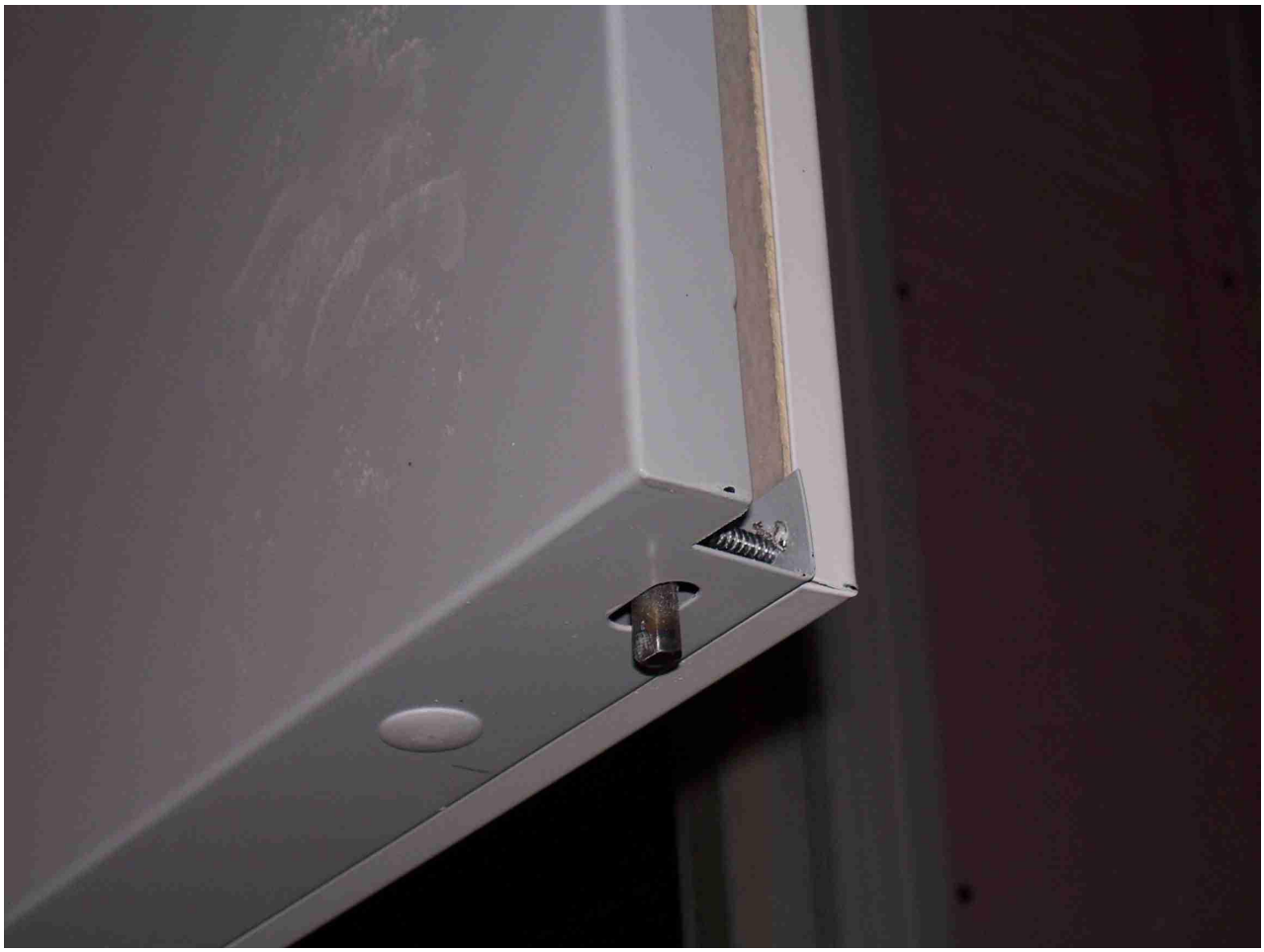


Photo 4 Open access panel leaf before test

Photo 5 Open access panel leaf before test

Photo 6 Exposed face of test construction before test

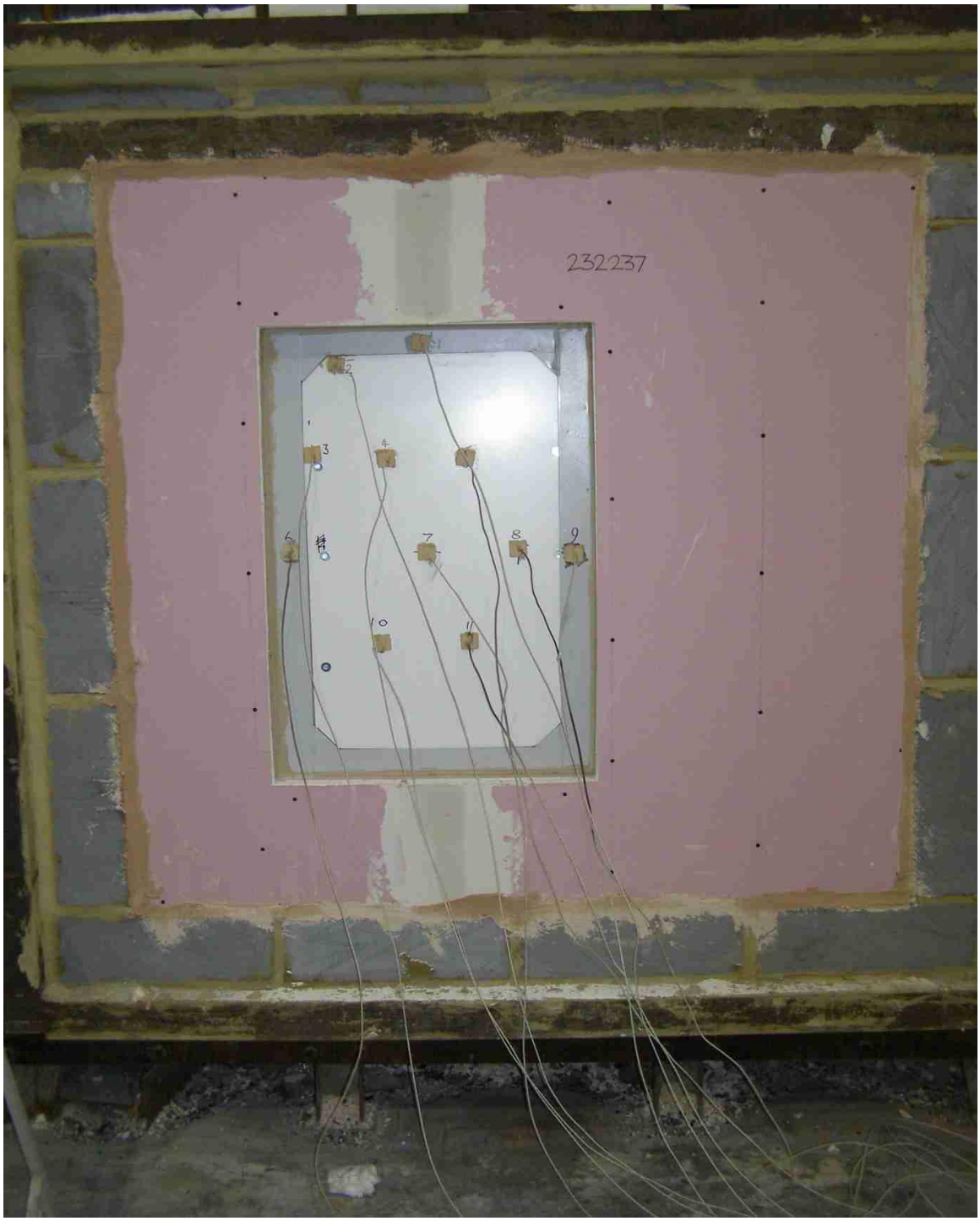


Photo 7 Unexposed face of test construction before test

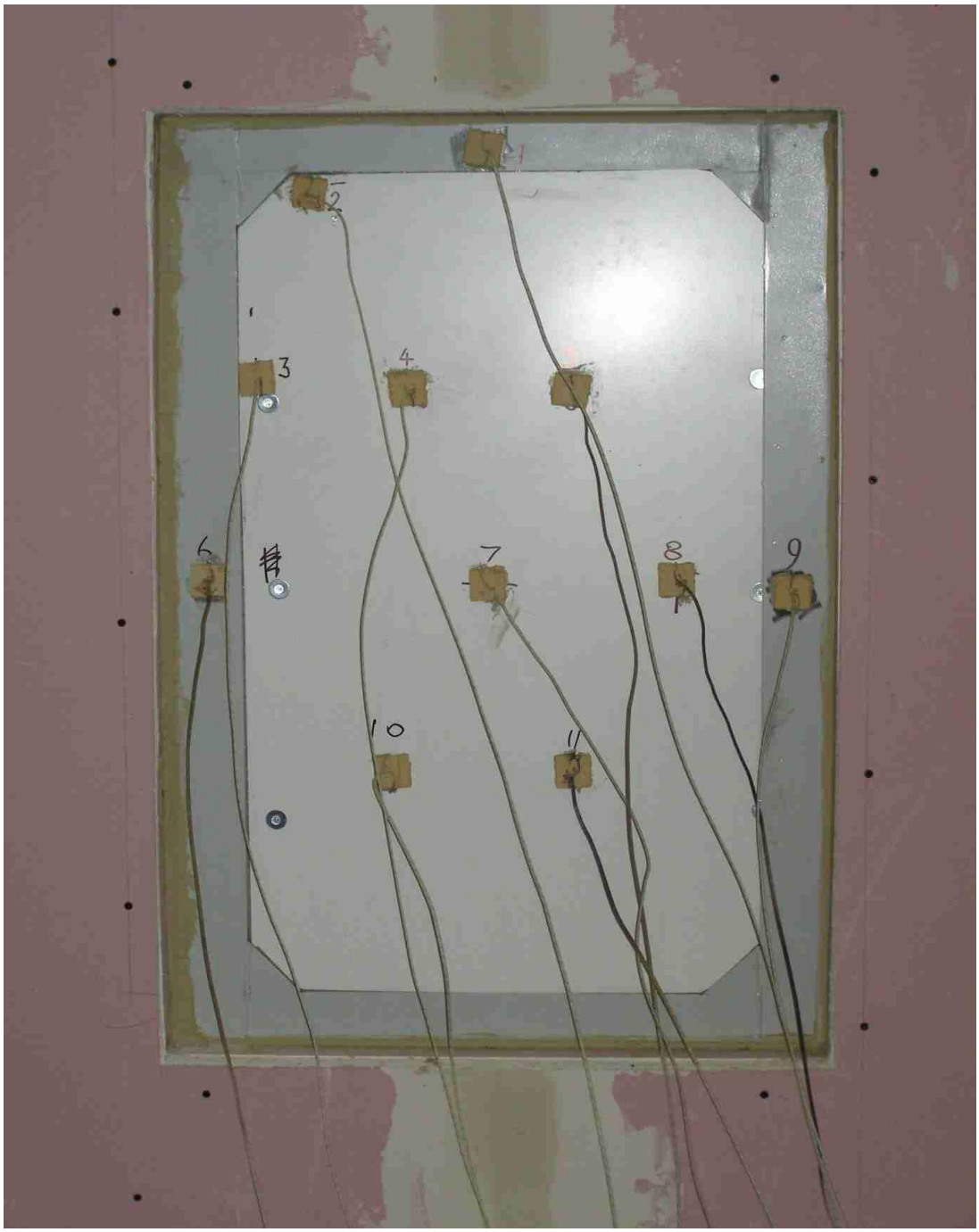


Photo 8 Unexposed face of access panel before test

Photo 9 Unexposed face of access panel after test

Photo 10 Exposed face of access panel after test