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

Prepared for:
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UKAS TESTING

0578

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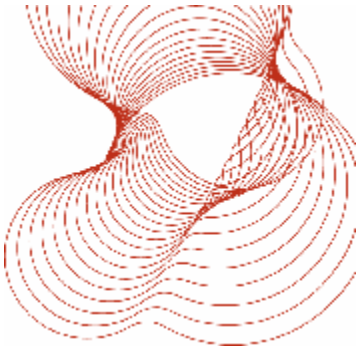

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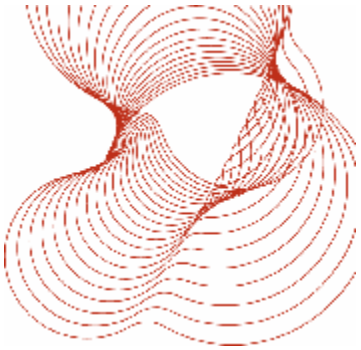


Summary

A double-leaf steel/plasterboard access panel incorporated in a steel-framed plasterboard partition, was submitted to a fire resistance test carried out in accordance with BS 476 : Part 22 : 1987 (Method 6) on 19 March 2007 for a duration of 120min.

The access panel, nominally 2m tall x 1.8m wide, comprised two preformed steel door leaves, 57mm thick, manufactured from powder coated Zintec steel sheet incorporating a sheet of 12.5mm-thick Megadeco plasterboard on the unexposed face The leaves were hung in a steel frame incorporating smoke seals.

The access panel was incorporated in a partition comprising two layers of 15mm-thick Lafarge Firecheck plasterboard on each face of a 70mm-deep steel-stud frame. The access panel opened towards the furnace and in this orientation achieved the following fire resistance:

Insulation: 10min

Integrity: 120min

1 Objective

A test was carried out in accordance with BS 476 : Part 22 : 1987[1], at the request of LPCB on behalf of Fire Proofing Services Ltd., to determine the fire resistance of a double-leaf hinged access panel in a plasterboard partition. Legal ownership of this report belongs to Fire Proofing Services Ltd..

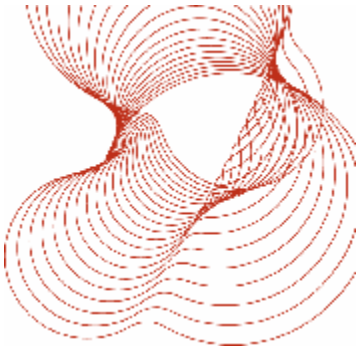
2 Test construction

All references to exposed means exposed to the fire, unexposed means the non-fire face. All references to left-hand and right-hand are as viewed from the unexposed face.

2.1 Supporting construction

A Lafarge drywall partition, 130mm thick, was constructed within the opening (nominally 3m x 3m) of a steel reinforced concrete test frame as follows:

Galvanised steel channel labelled “CORMET LAFARGE UT72/RX __N14195 3000mm D 0457355 CE GLOVES ADVISED” was secured to the test frame along the base and soffit using drywall screws and plugs at nominally 600mm centres. Galvanised steel studs, 6mm x 30mm x 70mm x 33mm x 6mm and



labelled “0503 REALYS YS210 ARROW 70 3000 CE EN1495”, were friction-fit located vertically between the channels at nominally 600mm centres.

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 (without tape) finished the joints in the outer layer of plasterboard.

An aperture, 2.01m tall x 1.81m wide, was located centrally in the partition bounded at the sides of the aperture by the studs. Additional steel channel horizontal members bounded the aperture at the top and bottom fixed to these studs. The inside face of the aperture was 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 Passive panel door leaf

The passive door leaf measured 1992mm high x 921mm wide x 34mm thick on the unexposed face and 1992mm high x 897mm wide x 23mm thick on the exposed face (a total of 57mm thick), it consisted of a 1.0mm-thick Zintec steel skin strengthened with two pre-formed 1.0mm-thick vertical and horizontal stiffeners welded near the sides and top and bottom edges of the door leaf. A stepped stop was formed in the leading vertical edge. The stop was 35mm wide on the non-fire side and 10mm wide at approximate mid-thickness of the leaf.

Lafarge Megadeco wallboard, 12.5mm thick, was fitted to the rear of the door leaf with 32mm-long drywall screws and washers. A Zintec folded steel rear protection plate, 1.0mm thick was fitted to the perimeter of the rear face of the door covering the edges of the Megadeco board and the face over a width of 100mm.

The door hinge consisted of a 1.5mm-thick mild-steel continuous hinge welded to the inside face of the door tray and fitted to the panel frame using M6 bolts and nuts with washers.

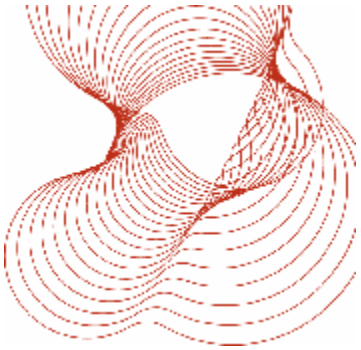
An Emka locking system was fitted in the leading leaf edge. It comprised a 2-point locking system using 8mm-diameter rods locking into the frame top and bottom, and was activated by a chromed steel handle.

Two white plastic plugs were inserted into two holes in the top and bottom edge of the door leaf.

2.2.2 Active panel door leaf

The active door leaf measured 1992mm high x 856mm wide x 34mm thick on the unexposed face and 1992mm high x 898mm wide x 23mm thick on the exposed face (a total of 57mm thick), it consisted of a 1.0mm-thick Zintec steel skin strengthened with two pre-formed 1.0mm-thick vertical and horizontal stiffeners welded near the sides and top and bottom edges of the door leaf.

Lafarge Megadeco wallboard, 12.5mm thick, was fitted to the rear of the door leaf with 32mm-long drywall screws and washers. A Zintec folded steel rear protection plate, 1.0mm thick was fitted to the perimeter of the rear face of the door covering the edges of the Megadeco board and the face over a width of 100mm.



The door hinge consisted of a 1.5mm-thick mild-steel continuous hinge welded to the inside face of the door tray and fitted to the panel frame using M6 bolts and nuts with washers.

A Emka locking system was a 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 steel approximately 5mm thick x 35mm wide.

2.2.3 Panel frame

The frame provided an aperture 1945mm high x 1725mm wide into which the door leaf closed. The frame consisted of a 1.2mm-thick Zintec steel section with M6 bolts welded to the hinge side 50mm in from each edge and then at 470mm centres. The 25mm-wide front flange was mitred at each corner. The frame was fixed into the aperture in the partition at typically 450mm centres with screws being 54mm-long self-drill/tap bugle-head bright-steel.

Polypropylene smoke seals were fitted to the inside of the rear frame flanges and also to the stop provided on the passive leaf. The seals were grey flexible foam self-adhesive strip, 10mm wide x 4mm thick.

2.2.4 Miscellaneous

All Zintec steel was powder coated white.

Firetherm Intumastic ADL Acoustic dry lining fire resistant sealant was used to seal the frame/partition junction on all four sides.

The door opened towards the furnace.

The test assembly was constructed on approximately 14 and 15 September 2007.

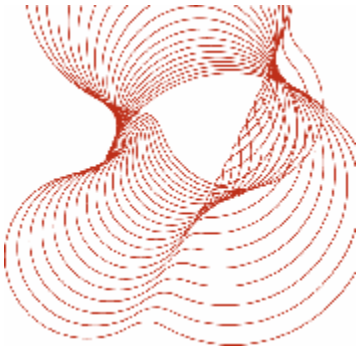
The gap between the access panel door leaf and the frame was measured to range between 1.5mm and 2.0mm along the top edge, 1.5mm and 2mm along the right-hand hinge side, and was 2mm along the left-hand hinge side and 1mm along the bottom edge. The gap between the leaves on the exposed face was 2mm.

The test construction is shown in Figures 1 -6, and also before test in Photos 1-8. The label “Airseal” in Figure 3 should display “Smoke seal”. Figure 1 shows the active leaf on the right-hand side, it should be on the left-hand side.

3 Test procedure

3.1 General

The test was carried out on 19 March 2007 and was witnessed by Messrs T Beasley and I Greaves of Fire Proofing Services Ltd., Mr S Warriner of Lafarge Plasterboard Ltd and Mr A Baker of LPCB. The ambient temperature at the start of the test was 11ºC.



3.2 Operability test

Prior to the fire resistance test both leaves of the door underwent 25 cycles of manual operation of being fully opened, closed and locked in accordance with clause 3.3.6 of LPS 1056 Issue 6[3].

3.3 Furnace control

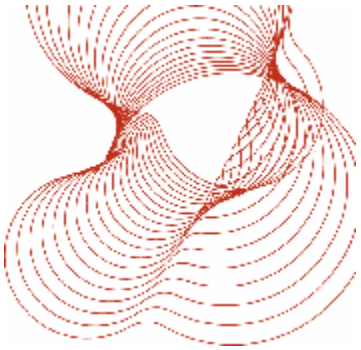
The furnace temperature was measured by means of sixteen bare-wire chromel/alumel thermocouples arranged symmetrically in the furnace in four rows of four with their measuring junctions 100mm away from the exposed face of the specimen. The furnace was controlled so that the average temperature followed the time temperature relationship specified in BS 476 : Part 20 : 1987[2]. The mean furnace temperature recorded is plotted against time in Graph 1.

The furnace pressure was monitored at a point 2.4m above the base of the partition. In accordance with the standard[2] after the first 5min of the test the pressure in the furnace was maintained 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.

3.4 Temperature measurements on unexposed face

Twelve 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.

Thermocouple	Location
1	At centre of top frame member
2	Near upper left-hand corner of left-hand leaf
3	At top of left-hand leaf centrally
4	Near upper left-hand corner of right-hand leaf
5	At centre of upper left-hand quarter section of access panel
6	At centre of upper right-hand quarter section of access panel
7	At mid-height of left-hand frame member
8	At centre of leaf
9	Close to leading edge of left-hand leaf at mid height
10	At mid-height of right-hand frame member
11	At centre of lower left-hand quarter section of access panel
12	At centre of lower right-hand quarter section of access panel



The mean unexposed face temperature was calculated from the average of thermocouples 5, 6, 8, 11 and 12.

3.5 Deflection measurements

A displacement transducer was connected to the mid-height of the leading edge of the left-hand leaf.via a fine steel wire in order to continuously measure horizontal deflection at that point during the test.

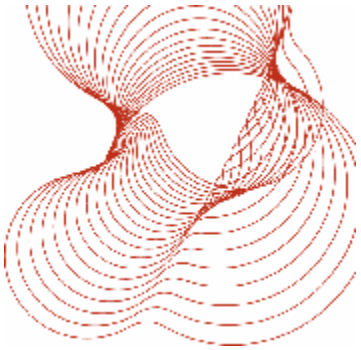
4 Results

4.1 Observations

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

Table 2 Observations

Time mins	Observation
0	Test started
6	Smoke issuing from leaf/frame interface at 600mm below top of right-hand side of panel
6	Smoke issuing between leaves over most of their height
6	Smoke issuing from leaf/frame interface at 500mm below top of left-hand side of panel
9	Frame moved within partition towards furnace up to approximately 15mm at mid height of panel
9	Frame moved within partition towards furnace up to approximately 10mm at 600mm below top of panel
11	Smoke deposits discoloured face of leaves at 500mm below top of left-hand side of panel, 600mm below top of right-hand side of panel, and right-hand edge of left-hand leaf over its full height
16	Top edge of leaves bowed towards furnace up to maximum of approximately 6mm at their centres
18	Gap, up to approximately 8mm wide, developed between left-hand leaf and frame



Time	Observation
19	Handle to passive leaf drooping
29	Left-hand edge of right-hand leaf bowed towards furnace between top and mid-height up to 40mm, and between bottom and mid-height up to 25mm
31	Megadeco become brown coloured over most of its face
31	Paper face of Megadeco charred and flaking away at right-hand edge of right-hand leaf over its upper half
37	Similar charring and flaking of paper face of Megadeco occurring on left-hand leaf
57	Buckle developed in right-hand edge of right-hand leaf and also in adjacent frame at 200mm above thermocouple 10
65	Very bright spot of tiny flaming occurred at centre of door just behind the right-hand leaf leading edge
79	Left-hand edge of left-hand leaf become angled towards furnace increasing the gap between the leaf and frame up to approximately 20mm
120	Test stopped.

There was no failure of integrity throughout the test.

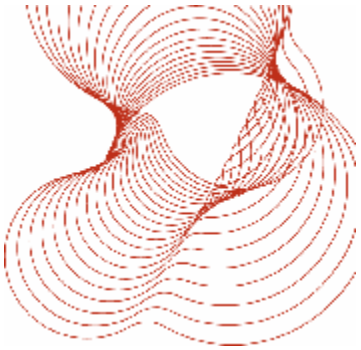
The construction after test is shown is Photos 9 and 10.

4.2 Temperatures recorded on unexposed face

The unexposed-face temperature limit was first exceeded (180ºC maximum rise) by thermocouple 1 after 10min. The mean and individual temperatures recorded are plotted against time in Graphs 2 – 4.

4.3 Deflection recorded

The horizontal deflection recorded at the centre of the access panel is plotted against time in Graph 5. The maximum deflection measured was 100.7mm recorded at the end of the test.



5 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.

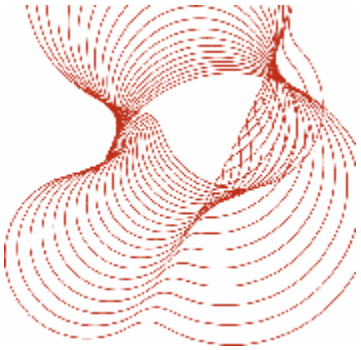
6 Conclusion

A double-leaf steel/plasterboard access panel in a plasterboard partition, as described in this report, was submitted to a fire resistance test carried out in accordance with BS 476 : Part 22 : 1987 (Method 6) for a duration of 120min.

The access panel opened towards the furnace and in this orientation achieved the following fire resistance:

Insulation: 10min

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.

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.

3 Test and Evaluation Requirements for the LPCB Approval and Listing of Fire Doorsets, Lift Landing Doors and Shutters. Loss Prevention Standard 1056 : Issue 6.1, BRE Certification 2005, Garston, 2005.

8 Figures

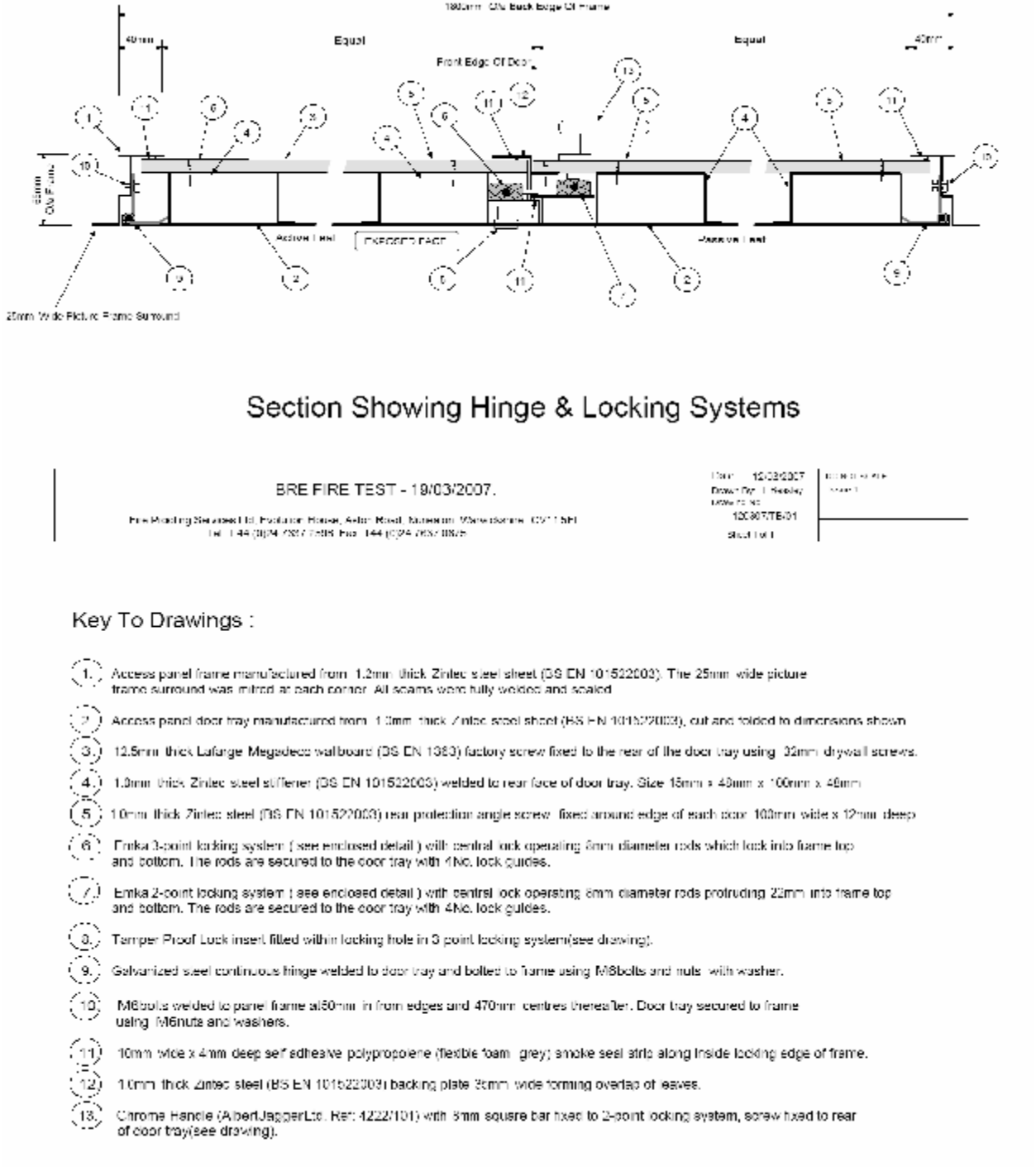
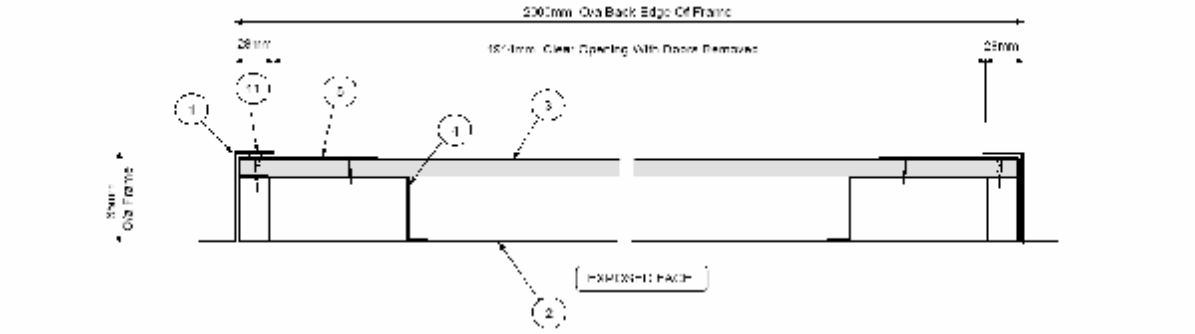


Figure 1 Details of door leaf



Longitudinal Section Through Access Panel

BRE FIRE TEST - 19/03/2007.

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FIRE TEST PANEL DESCRIPTION
Double Door Wall Access Panel

Access Panel Door Tray

Each door tray consisted of a 1.0mm thick Zintec Steel skin, strengthened with pre formed 1.0mm thick vertical and horizontal stiffeners welded to the sides and top and bottom edges of each door tray (see drawing and key).
A 12.5mm thick Lafarge Megadeco wallboard was screw-fixed to the rear of each door tray using 32mm drywall screws & washers.
The door hinge consisted of a 1.5mm thick mild steel continuous hinge welded to the inside face of the door tray, which was fitted to the panel frame using M6bolts and nuts with washers.
The main locking device was a 3-point locking system using 8mm diameter rods locking into the frame top and bottom, with a central lock on the locking side. A tamper proof lock insert was fitted to the central lock hole. The passive door was locked from the rear using a 2-point locking system complete with a chrome handle.
The passive door was fitted with a 7" section rear backing plate(see drawing - 12)
19mm Diameter white plastic dome plug spacers were inserted into two holes top and bottom of each door tray edge. Holes positioned approx 130mm in from door sides
Polypropylene smoke seals were fitted to the inside of the rear flanges on the frame and central backing plate (see drawing)

Access Panel Frame.

This consisted of a 1.2mm thick Zintec Steel section with M6bolts welded to the hinge side 50mm in from each edge and then at 472mm centres. The 25mm wide front flange was mitred in each corner.
The panel frame had a polypropylene continuous smoke seal around the inside rear flange.

Figure 2 Details of door leaf

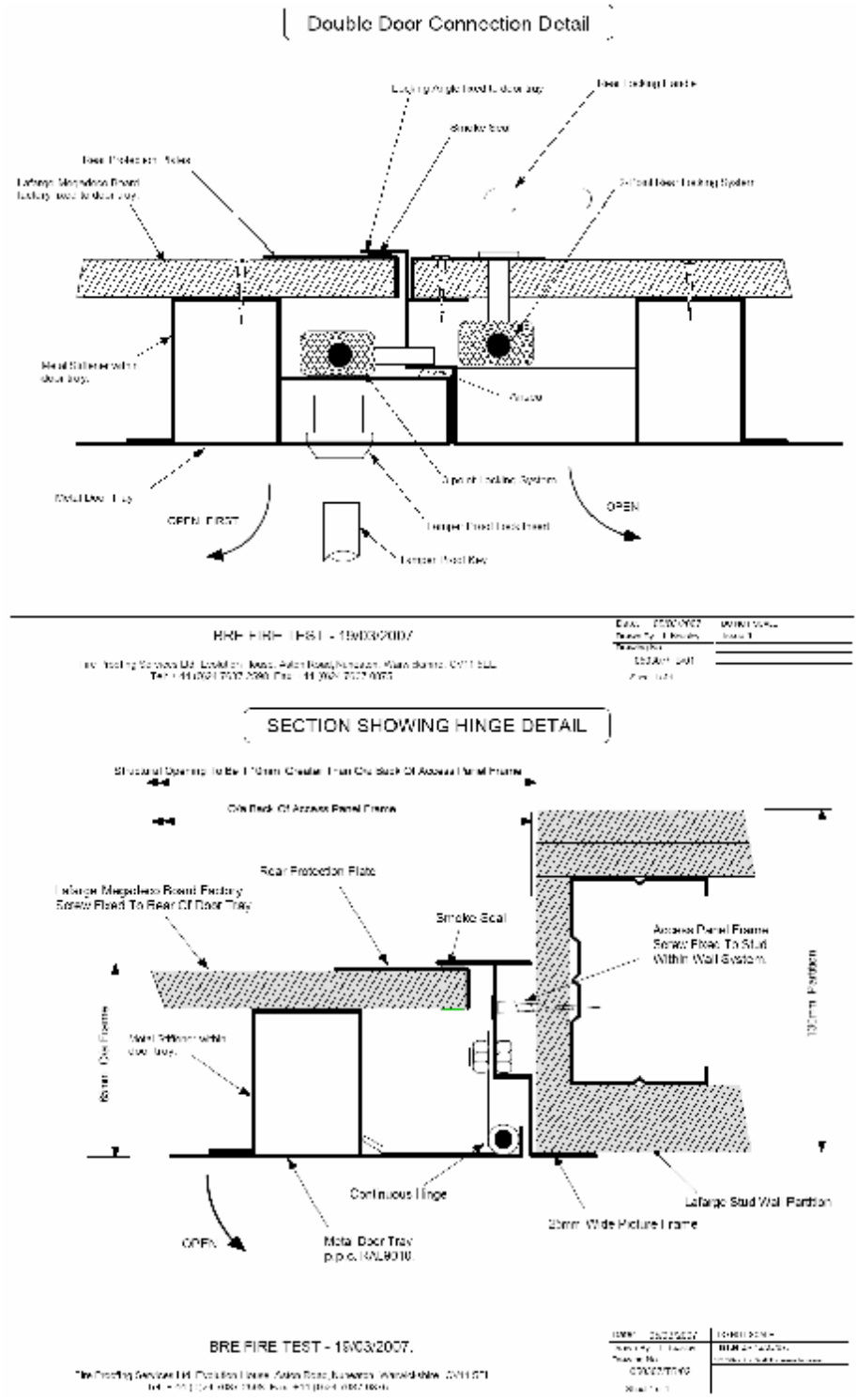


Figure 3 Horizontal sections through door in partition

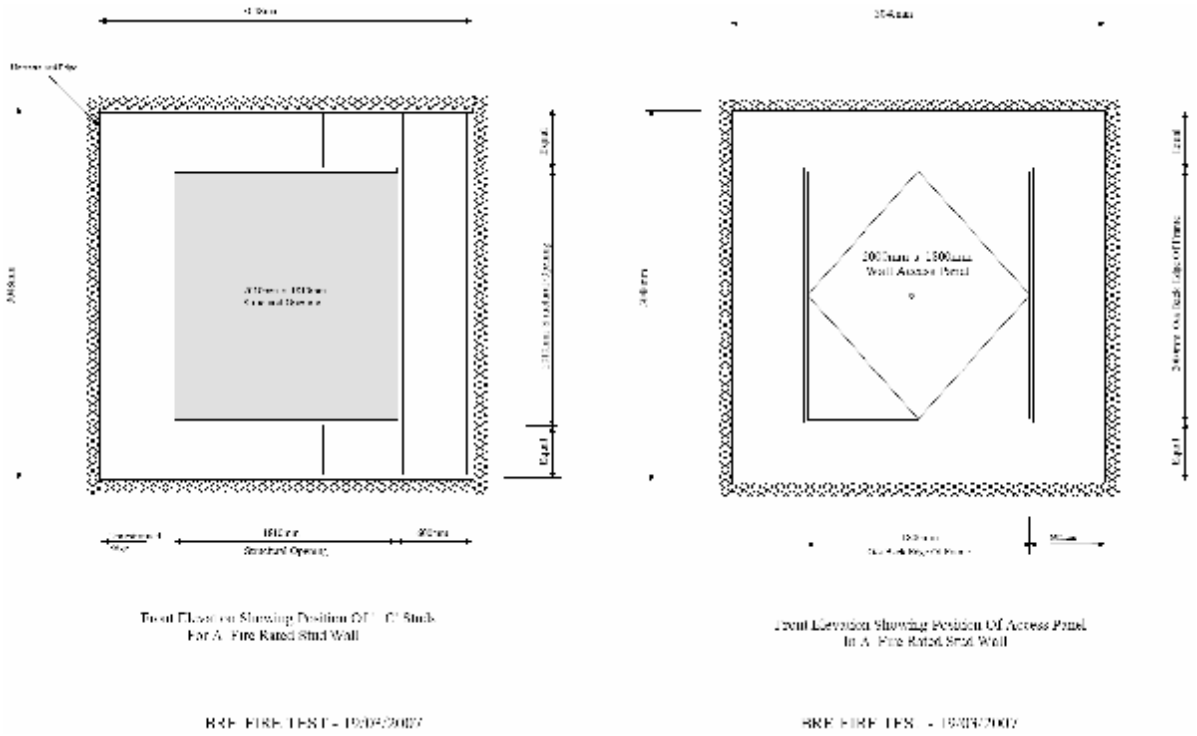
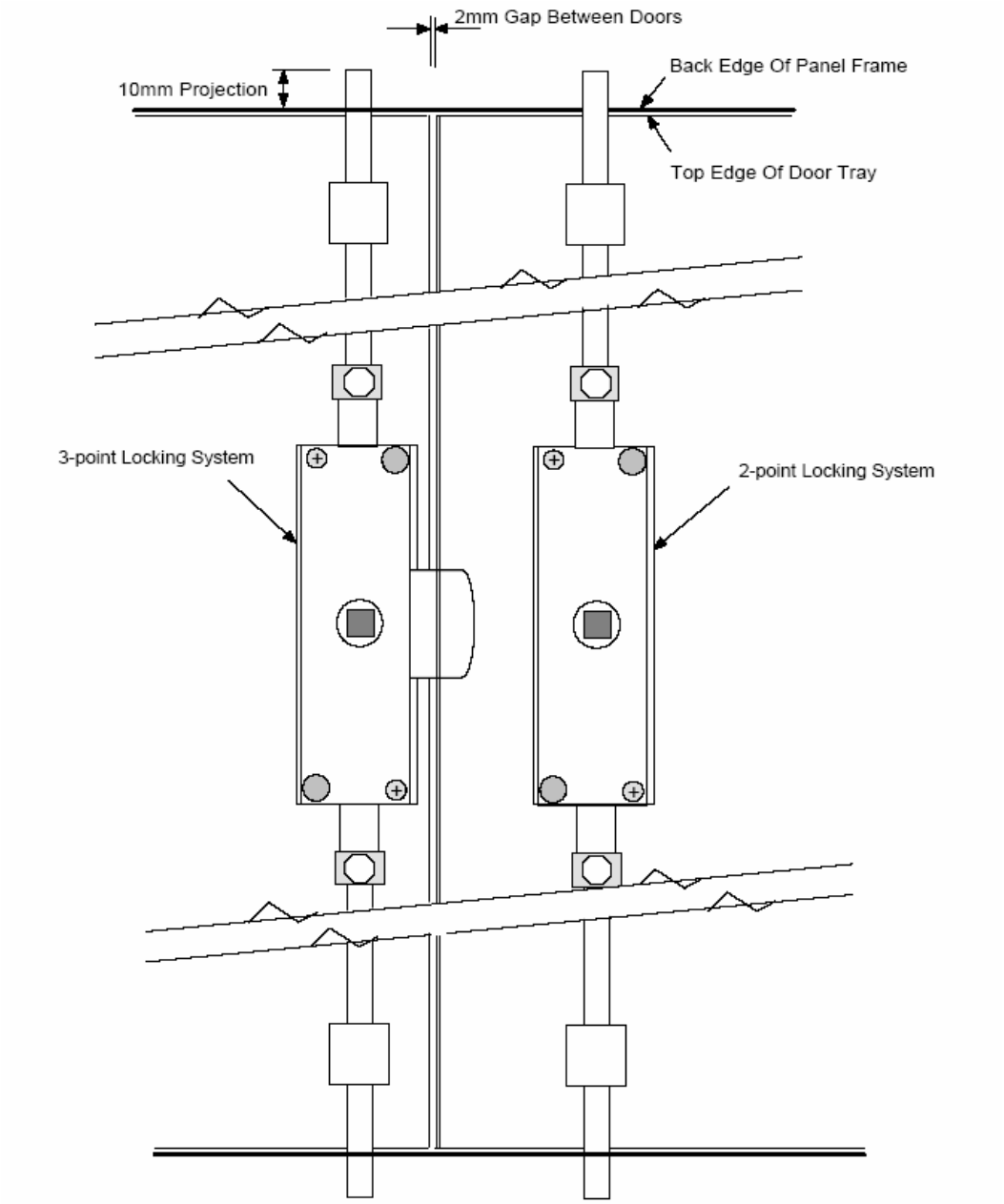


Figure 4 Partition arrangement



REFLECTIVE REAR VIEW OF ACCESS PANEL SHOWING LOCKING POSITIONS

Note: The locking systems were enclosed within the leading edges of the leaves

Figure 5 Rear view of access panel showing locking positions

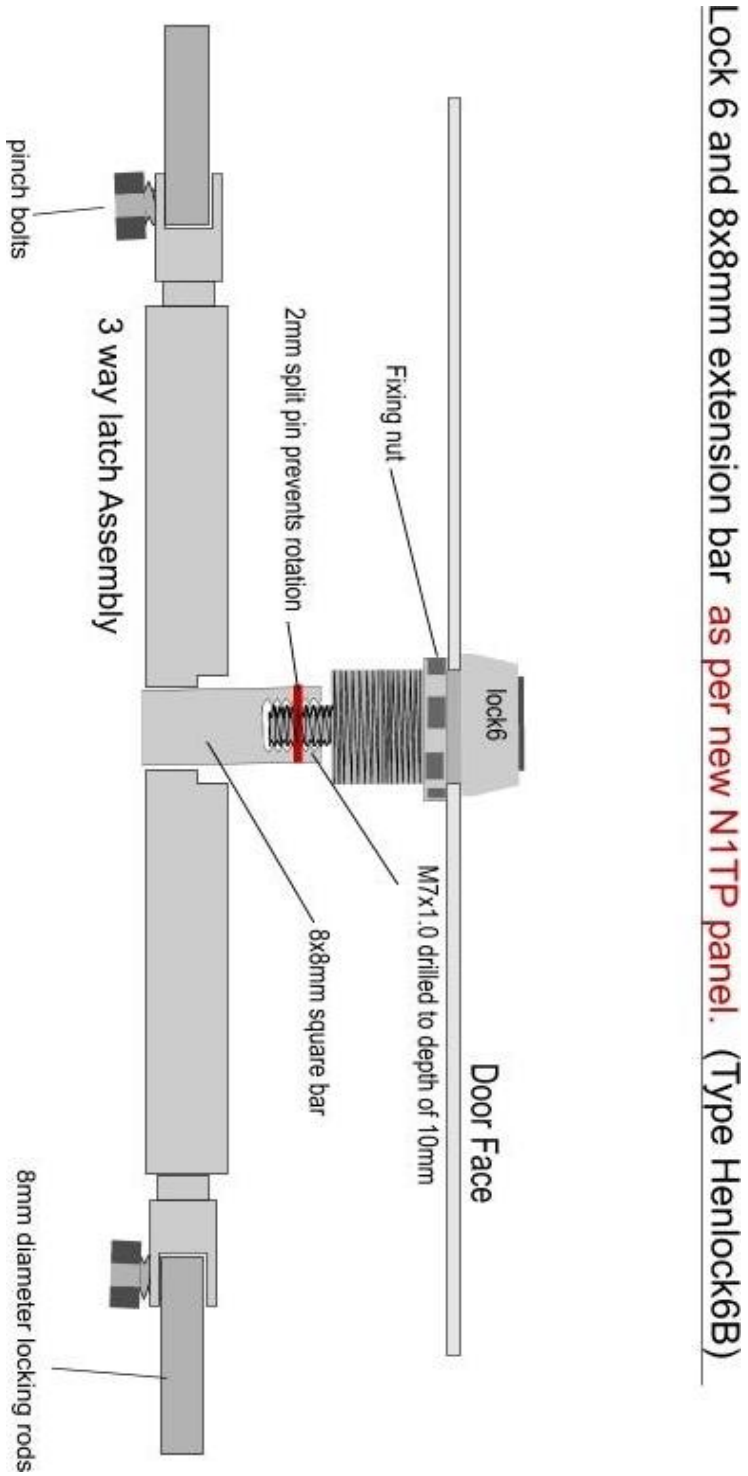
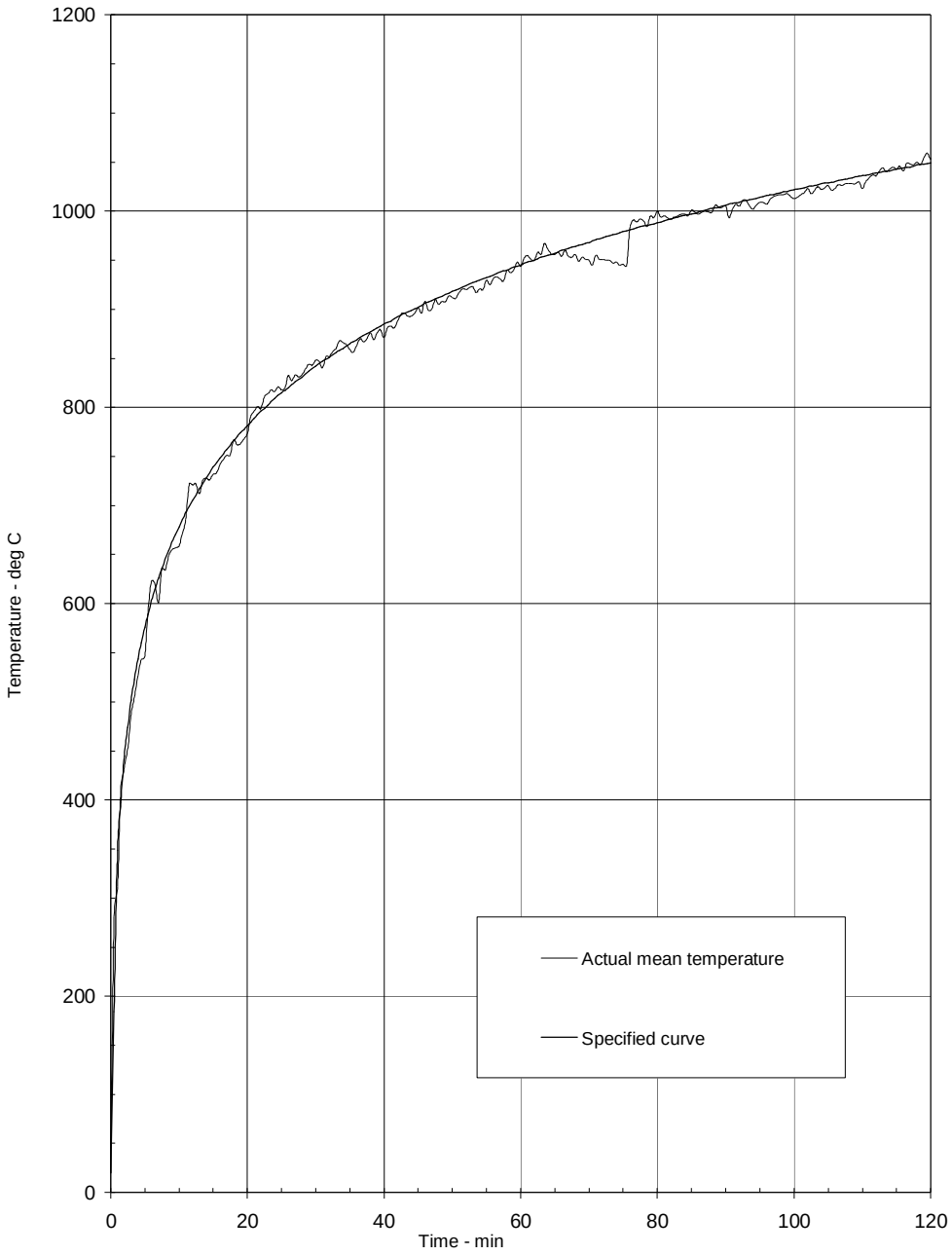
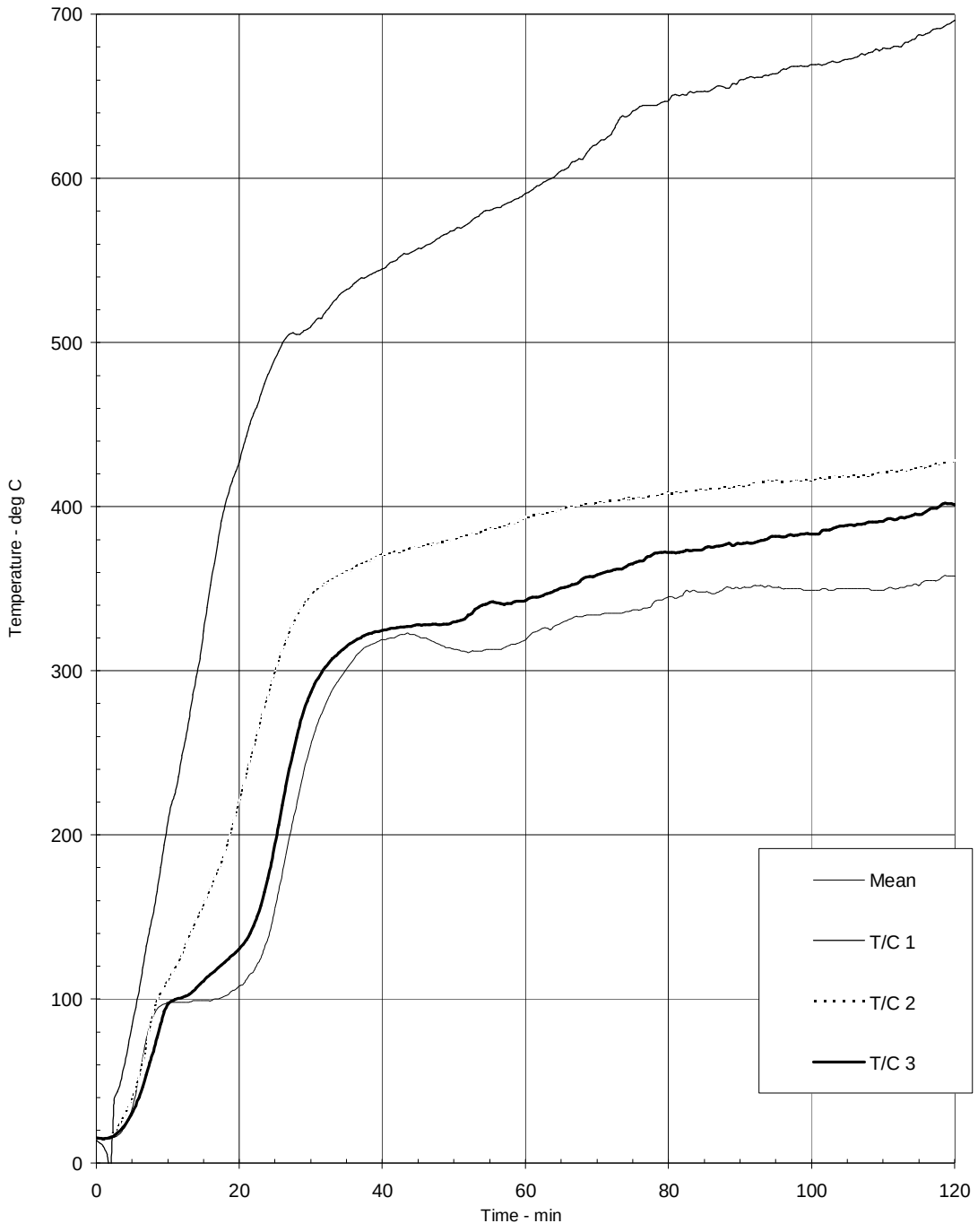


Figure 6 Locking system

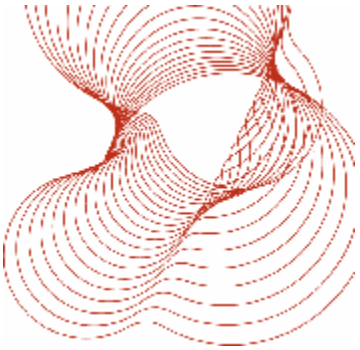
9 Graphs

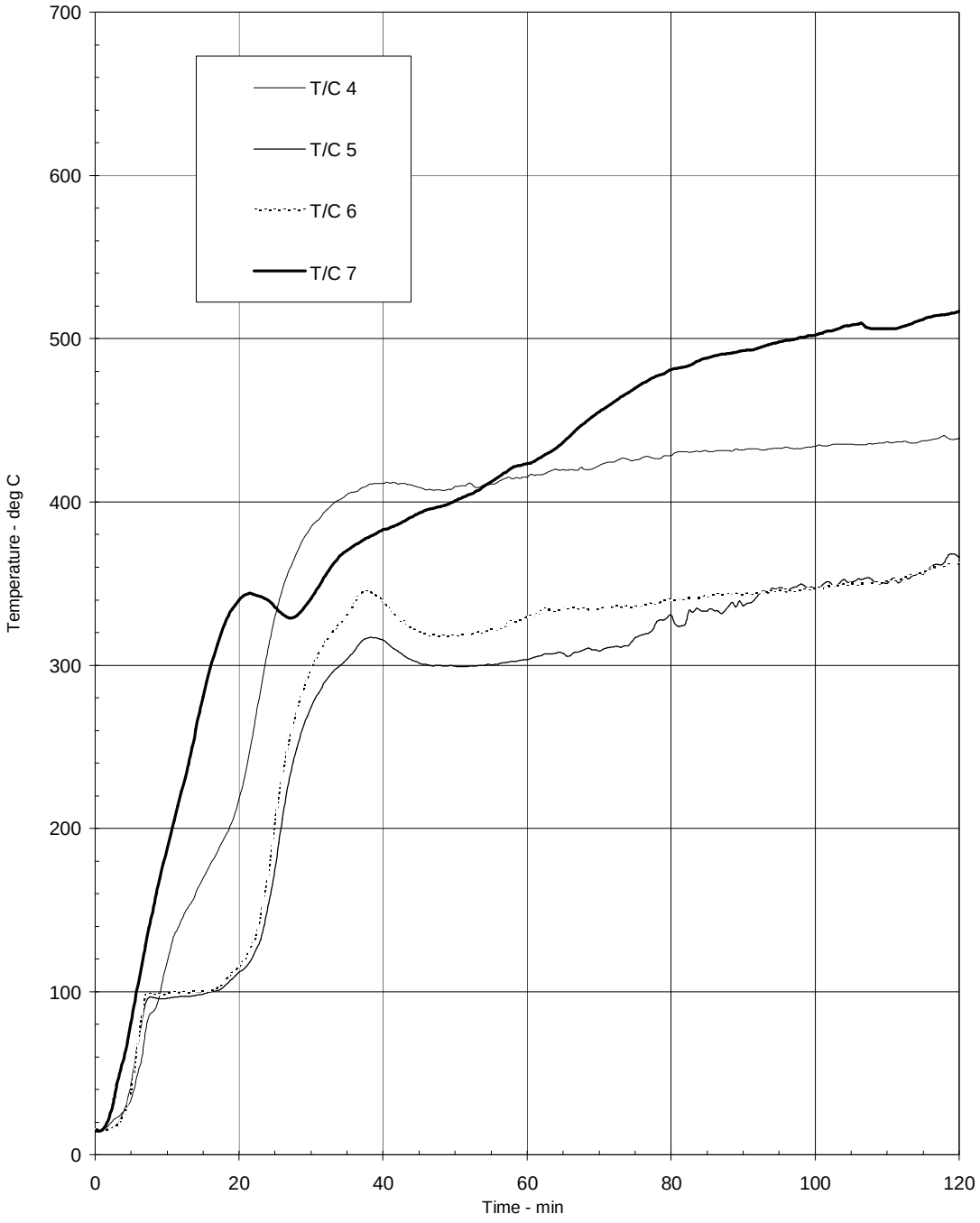


Graph 1 Furnace temperature

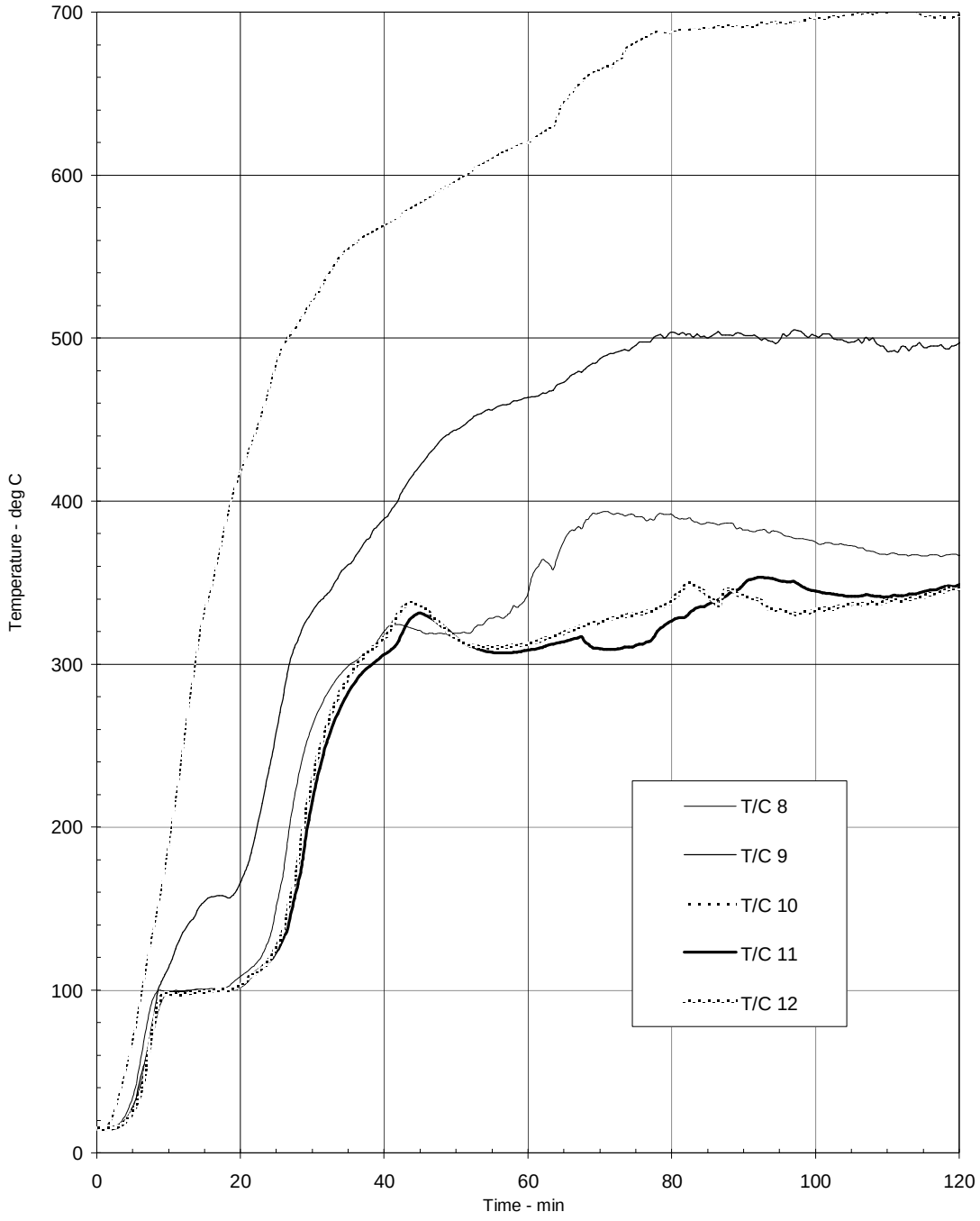


Graph 2 Temperatures recorded on unexposed face

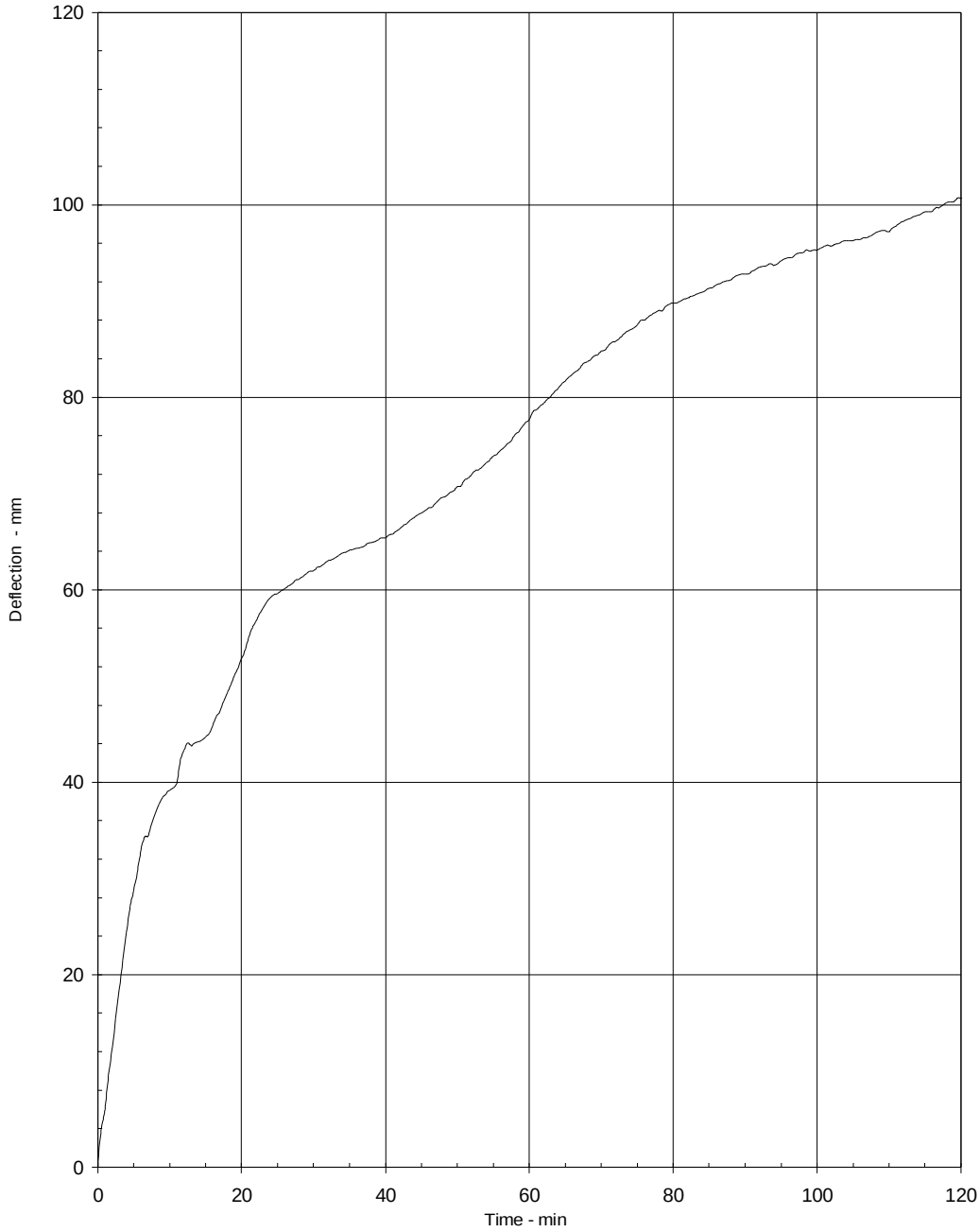




Graph 3 Temperatures recorded on unexposed face



Graph 4 Temperatures recorded on unexposed face



Graph 5 Deflection recorded

10 Photographs

Photo 1 Open access panel active leaf before test

Photo 2 Open access panel active leaf before test

Photo 3 Access panel before test

Photo 4 Base of passive leaf of **a**ccess panel before test

Photo 5 Base of passive leaf of **a**ccess panel before test

Photo 6 Top of passive leaf of **a**ccess panel before test

Photo 7 Exposed 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 construction after test