Fire resistance test in accordance with European Standard EN 1634: Part 1 : 2000 on a double-leaf access panel.

Prepared for:
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4th February 2008

Test report number 236024

0578

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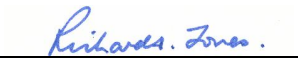
Signature 

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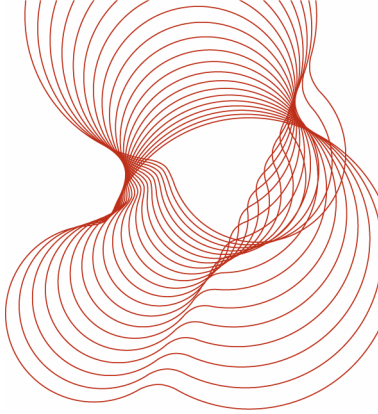
Contents



SUMMARY

A double-leaf steel / plasterboard access panel (mounted in a steel frame) fixed into a 210mm-thick brick wall, was subjected to a fire resistance test, in accordance with BS EN 1634 : Part 1 : 2000 on 23rd May 2007.

The access panel, nominally 1990mm high x 1790mm wide, comprised two leaves both constructed from polyester powder coated 1.2mm-thick Zintec steel skin on one side and 12.5mm-thick Megadeco plasterboard on the other side with 50mm thick Superwool 607 insulation between the faces. The panel leaves were hung in a steel frame incorporating a smoke seal and intumescent strip, both leaves opening towards the furnace.

The specimen when tested in the orientation described was found to have the following fire resistance:

Integrity -	Sustained flaming	264 minutes (no failure, the test having been discontinued at the request of the sponsor's representative).
	Gaps	264 minutes (no failure, the test having been discontinued at the request of the sponsor's representative).minutes
	Cotton pad:	45 minutes
Insulation		36 minutes.

1 OBJECTIVE

To determine, at the request of Fire Proofing Services Ltd., the fire resistance of a double-leaf access panel installed in a 210mm thick brick wall and tested in accordance with BS EN 1634: Part 1 : 2000[1].

2 CONSTRUCTION

2.1 General

The test construction comprised a double-leaf hinged steel / plasterboard door and steel frame assembly supplied by Fire Proofing Services Ltd, mounted into an aperture 2.0m high x 1.8m wide, in a 210mm-thick brick wall. The doorset provided a clear opening, 1920mm high x 1690mm wide, and was erected so that both leaves opened towards the furnace.

BRE had no involvement in the selection of the test specimen

Details of the doorset construction were supplied by the sponsor and are given in Figures 1 to 5. As the doors were supplied fully constructed, the description of the construction is taken from written details supplied by the sponsor. These were verified where possible by a visual surface examination of the specimen.

Although the standard requires the sill to be extended, the door set in practice is never provided with a sill, as it is mounted above floor level. As such, the sill was not extended.

The test construction before the test is shown in Photo's 1 and 2.

2.2 Access panel doors

Each door tray consisted of a 1.2mm thick Zintec steel skin, strengthened with pre-formed 1.5mm thick vertical and horizontal stiffeners welded to the sides, centre and top and bottom edges of each door tray.

A 12.5mm thick Lafarge Megadecco wallboard and Zintec steel backing plate were screw-fixed to the rear of each door tray using 32mm drywall screws. The door cavity space between the Lafarge board and inner face of the door was filled with 50mm thick Superwool 607 insulation.

Each 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 M6 bolts 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 swivel lidded escutcheon 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 "Z" section real backing plate.

White plastic dome plug spacers (16mm diameter) were inserted into the two holes top and bottom of each door tray edge, the holes positioned approximately 100mmin from the door sides.

Polypropylene smoke seals were fitted to the inside of the rear flanges on the door frame, and central backing plate.

2.3 Access panel frame

This 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 300mm centres. The 25mm wide front flange was mitred in each corner.

The panel frame had a polypropylene continuous smoke seal and intumescent strip around the inside rear flange.

2.4 Dimensions between door leaves and frame and between leaves

The gap between the door leaf edges and the frame and between the door leaves (when closed) was measured at a number of locations, in accordance with the test standard. The measurements and their respective positions are given in Figures 6 to 8.

3 Test Procedure

3.1 General

The test was carried out on 23rd May 2007 in accordance with European standard EN 1634: Part 1 : 2000[1] (fire resistance tests for door and shutter assemblies). The test was witnessed by Mr T. Beasley, Mr. I Greaves, Mr. D. Blenkinsop and Ms. W. Bradgate representing the sponsor, and by Mr. A Baker representing BRE Certification. The door was tested opening towards the furnace. The ambient temperature at the start of the test was 18°C.

3.2 Furnace control

The furnace temperature was controlled by eight plate thermometers arranged symmetrically within the furnace so that the mean temperature recorded followed the time/temperature relationship specified in European standard EN 1363-1:1999[2].

A pressure sensing head 2.4m above the base of the furnace monitored the pressure in the furnace. The pressure conditions within the furnace were maintained so that a pressure of 20Pa existed at the top of the door leaves.

3.3 Specimen temperature measurements

The temperature of the unexposed face of the doorset was monitored using 20 chromel/alumel thermocouples each soldered to a copper disc and covered with an insulating pad attached to the test specimen. The position of the thermocouples is given in Table 1 and shown in Photo 2.

Table 1. Location of surface thermocouples.

Thermocouple	Location
1	On the top of the frame, 50mm from the left hand corner.
2	On the top of the frame, at mid-span (but 100mm away from the door joint).
3	On the top of the frame, 50mm from the right hand corner.
4	On the top left of the passive door leaf, 100mm from the side and top of the leaf.
5	On top right of the passive door leaf , 100mm from the side and top of the leaf.
6	On the top left of the active door leaf, 100mm from the side and top of the leaf.
7	On top right of the active door leaf , 100mm from the side and top of the leaf.
8	In the centre of the top left quarter of the doorset (on the passive leaf).
9	In the centre of the top right quarter of the doorset (on the active leaf).
10	Attached to the left-hand side of the door frame, at mid-height.
11	Attached to the passive door leaf at mid-height, 100mm from the left hand side.
12	Attached to the passive door leaf at mid-height, 100mm from the right hand side.
13	Attached to the active door leaf at mid-height, 100mm from the left hand side.
14	At the centre of the doorset (on the active leaf).
15	Attached to the active door leaf at mid-height, 100mm from the right hand side.
16	Attached to the right hand side of the door frame, at mid-height.
17	At the centre of the lower left hand quarter of the doorset (on the passive leaf).
18	At the centre of the lower right hand quarter of the door leaf (on the active leaf).
19	On top mid-span of the passive door leaf, 100mm from the top of the leaf.
20	On top mid-span of the active door leaf, 100mm from the top of the leaf.

Thermocouples 8. 9, 14, 17 and 18 were used to determine the mean temperature rise of the door leaves, as specified by the standard.

3.4 Deflection

Two transducers activated by fine taut wires were attached to the top of each door leaf, at mid width to continuously monitor deflection at these points throughout the test. Deflection measurements were also made at the positions given in Table 2. For these, deflection measurements of the frame and leaves were made with reference to the brickwork, or by reference to taut steel wires fixed horizontally across the front of the doorset.

Table 2. Manual deflection measuring points.

Measurement Point	Location
a	At the top left corner of the passive door.
b	At the top mid-span of the passive door.
c	At the top right corner of the passive door
d	At the top left corner of the active door.
e	At the top of the active door leaf, at mid-span.
f	At the top right corner of the active door.
g	At mid height of the passive door leaf.
h	At mid height at the joint between active and passive leaves.
i	At mid height of the active door leaf.
j	At the bottom right corner of the passive leaf.
k	At the bottom of the passive leaf at mid span.
l	At the bottom, at the joint between active and passive leaves.
m	At the bottom of the active leaf at mid span.
n	At the bottom left corner of the active leaf.

Additionally, any door frame movement relative to the supporting construction was recorded.

4 RESULTS

4.1 Observations

The observations made during the test are given in Table 3 and unless stated are of the unexposed face.

Table 3 Observations.

Time min	Observation
0:00	Test started.
1½	Considerable smoke is coming from the top edges of the door leaves.
11	Considerable smoke is still coming from the top of the door leaves, and also from the joint between the leaves.
14	Slight smoke is coming from the bottom of the door leaves.
20	An occasional spark is coming out from between the door leaves, and a gap (not through to the furnace) of approximately 8mm has formed between the leaves. The centre latch on the active leaf is no longer engaging with the passive leaf due to deformation of the doorset.
25	A red glow is visible at the joint between the door leaves. No failure by cotton pad at this location. Some pieces of the seal from between the leaf and frame are falling from the top of the doorset.
35	No failure by cotton pad at the red glow between the door leaves.
40	A red glow is visible between the right hand side frame and supporting construction at mid height. No failure by cotton pad at any location on the specimen.
45	**Integrity failure** by cotton pad at the joint between door leaves at mid height.
58	Intermittent flaming is occurring between the door leaves, approximately 200mm from the top of the doorset.
65	The intermittent flaming observed at 58 minutes is occurring with increasing frequency, but is not continuous and was not considered to be a failure of integrity.
73	The frequency of the intermittent flaming observed at 65 minutes is reducing.
75	Some bright flashes typical of combustion of galvanising are occurring near the centre latch area of the leaves.
78	The intermittent flaming from the door leaves has now ceased.
91	More galvanising is burning below the centre latch area of the leaves.

Time min	Observation
107	No significant visible changes.
115	No significant visible changes, including deflection.
129	No significant visible changes.
175	No significant visible changes.
264	No further significant visible changes were observed. Test stopped.

The specimen after the test is shown in Photo's 3 and 4.

4.2 Temperature measurements

4.2.1 Furnace temperature

The mean furnace temperature, together with the specified curve is plotted against time in Graph 1.

4.2.2 Door leaves surface temperatures

The mean, maximum and individual temperatures recorded on the door leaves are given in Graphs 3, 4, 6 and 7. The mean and maximum temperature rise limits for insulation of the door leaves (140^{O}C and 180^{O}C respectively) were exceeded after 74 and 36 minutes.

4.2.3 Door frame surface temperatures

The maximum and individual temperatures recorded on the door frame are given in Graphs 3 and 5. The maximum temperature rise limit for insulation on the door frame (360^{O}C rise) was exceeded after 54 minutes.

4.3 Deflection measurements

The deflection of the door leaves relative to the door frame are given in Table 4 below. Values are given in mm, and the location of the measurements are given in Table 2 on page 9. Where no results are given, this indicated that there was no significant movement, or measurement was not possible due to heat radiating from the specimen.

All deflection recorded was towards the furnace.

Table 4 Deflection of door leaves.

Time min	b	e	g	k	m
0	0	0	0	0	0
5	10	10	--	--	--
11	--	--	--	5	7
19	12	9	--	--	--
22	--	--	12	6	9
70	15	5	--	15	15

There was no significant deflection of the door leaves relative to the door frame at locations a, c, d, f, I, j, l and n. After approximately 70 minutes, there was little movement of the door leaves relative to the frame.

Deflection (in mm) of door frame at mid height, relative to the supporting construction is given in Table 5 below. The deflection at the centre of the doorset is given relative to a taut steel wire located in front of the specimen at mid height.

Table 5 Deflection of door frame.

Time	Left hand side	Right hand side	Centre of doorset
0	0	0	0
4½	5	5	--
9	--	--	17
10	7	17	--
12	9	22	--
14	--	--	30
24	8	33	45
32	9	33	54
46	--	--	78
55	--	--	93
70	7	40	--

Time	Left hand side	Right hand side	Centre of doorset
77	--	--	107
107	9	56	115
129	9	50	115
183	8	50	126
210	9	50	131
240	--	--	135

4.4 Furnace pressure

The pressure recorded at the top of the door leaves is plotted against time in Graph 2.

5 PERFORMANCE CRITERIA

The standards[1, 2] specify that the result be given as the elapsed times during the test for which the test specimen continues to maintain its separating function (integrity) and, separately, also without developing temperatures on the unexposed face exceeding a specified limit (insulation).

Integrity failure is deemed to have occurred when:

a) ignition of a cotton pad applied over the specimen occurs;

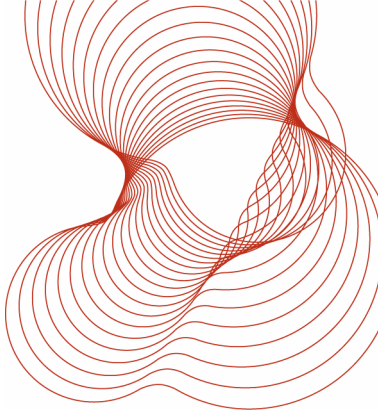
b) a 25mm-diameter gap gauge can be passed through the specimen and project into the furnace; or a 6mm-diameter gap gauge can be passed similarly through the specimen and be moved a distance of 150mm along the gap, except between the door leaf and sill;

c) sustained flaming on the unexposed face occurs.

Insulation failure is deemed to have occurred when:

a) the mean temperature on the unexposed face increases by more than 140°C above its initial value.

b) the maximum temperature, measured at the specified locations on the unexposed face, increases above the initial mean temperature by more than 180°C with the exception that the limit for the temperature rise on the frame of the door is 360°C.



6 CONCLUSION

A double-leaf steel / plasterboard access panel (mounted in a steel frame) fixed into a 210mm-thick brick wall, as described in this report, was subjected to a fire resistance test, in accordance with BS EN 1634 : Part 1 : 2000 on 23rd May 2007.

The specimen when tested in the orientation described was found to have the following fire resistance:

Integrity -	Sustained flaming	264 minutes (no failure, the test having been discontinued at the request of the sponsor's representative).
	Gaps	264 minutes (no failure, the test having been discontinued at the request of the sponsor's representative).minutes
	Cotton pad:	45 minutes
Insulation		36 minutes.

This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outlined in European standard EN 1363-1[2], and where appropriate, European standard EN 1363-2[3]. Any significant deviation with respect to size, constructional details, loads, stresses, edge or end conditions other than those allowed under the field of direct application in the relevant test method is not covered by this report.

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty on measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

7 FIELD OF DIRECT APPLICATION OF TEST RESULTS

7.1 General

The field of direct application of results is restricted to governing the allowable changes to the test specimen following a successful fire resistance test. These variations can be introduced automatically without the need for the sponsor to seek additional evaluation, calculation or approval.

7.2 Materials and construction

7.2.1 General

Unless otherwise stated in the following text, the construction of the door assembly shall be the same as that tested. The number of leaves and the mode of operation(e.g. sliding, swinging, action or double action) shall not be changed.

7.2.2 Specific restrictions on materials and construction (steel constructions)

The dimensions of steel wrap around frames may be increased to accommodate increased supporting construction thicknesses. The thickness of the steel may also be increased by up to 25%.

The number of stiffening elements for uninsulated doors and the number and type of fixing of such members within the panel fabrication may be increased proportionally with the increase in size but shall not be reduced.

7.2.3 Decorative finishes (paint)

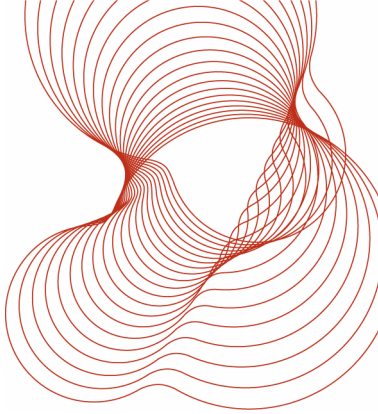
Where the paint finish is not expected to contribute to the fire resistance of the door alternative paints are acceptable and may be added to door leaves or frame products for which unfinished specimens were tested. Where the paint finish contributes to the fire resistance of the door (e.g. intumescent paints) then no change shall be permitted.

7.2.4 Frames

The number of fixings used to attach fire resisting doors to supporting constructions may be increased but shall not be decreased and the distance between fixings may be reduced but shall not be increased.

7.2.5 Hardware

Changes in hardware are permitted provided that the alternative hardware has been demonstrated in another doorset of similar configuration. The number of any movement restrictors such as locks, latches, and hinges may be increased but shall not be decreased.



7.3 Permissible size variations

7.3.1 General

Doors of sizes different from those of tested specimens are permitted within certain limitations but the variations are dependant on product type and the length of time that the performance criteria are fulfilled.

7.3.2 Test periods

The amount of variation of size permitted is dependent on whether the classification time was just reached (category A) or whether an extended time (category B) in accordance with the following values was fulfilled before the test was concluded.

For category B:

Classification time	All performance criteria fulfilled for at least
15 minutes	18 minutes
20 minutes	24 minutes
30 minutes	36 minutes
45 minutes	52 minutes
60 minutes	68 minutes
90 minutes	100 minutes
120 minutes	132 minutes
180 minutes	196 minutes
240 minutes	260 minutes

7.3.3 Size variation related to product type

7.3.3.1 General

The rules to cover increase or decrease of size without additional considerations are applicable only to five main product groups:

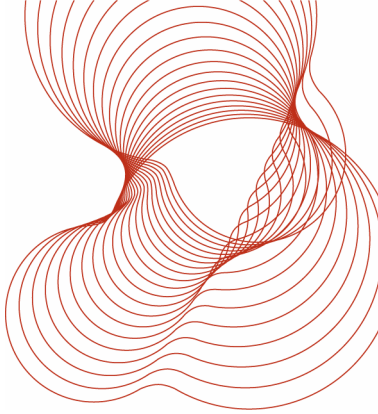
i) hinged and pivoted doors;

ii) horizontally sliding and vertically sliding doors including sectional doors;

iii) steel single skin folding shutters (uninsulated);

iv) other sliding folding doors;

v) rolling shutter doors.



No increases in size are permitted for doors satisfying the radiation criterion unless the insulation criteria is also satisfied. This is because any increase in size will increase the radiation received at a fixed distance away from the door. There are calculation methods which can be used to determine acceptable size increases for such doors; however, these are beyond the scope of direct application. Doors that satisfy both the radiation and insulation criteria may have their sizes increased as outlined in annex B of BS EN 1634-1:2000[1]. This is accepted because the increase in radiation resulting from a size increase allowed under this section, for an insulated door, will be such that it will still satisfy the radiation criterion. Size decreases are permitted for both doors which satisfy radiation and those which satisfy insulation and radiation.

Permissible variations for each product group are detailed in annex B of BS EN 1634-1:2000[1] and in section 8.4.2 for hinged and pivoted doors.

Size increases for products which do not fall into one of the five groups given above are the subject of extended application.

7.3.3.2 Hinged and pivoted doors

a) Limits for permitted size variations

Category A allowances	Category B allowances
Unlimited size reduction is permitted for all types except insulated steel doors where a reduction to 50% width and 75% height of the tested specimen is the limit of variation. Size increase is not permitted	Unlimited size reduction is permitted for all types except insulated steel doors where a reduction to 50% width and 75% height of the tested specimen is the limit of variation. Size increase is permitted except for those which satisfy integrity with radiation requirements up to: 15% height 15% width 20% area

For category 'A' tests with no overrun of classification period no increase is allowed. Unlimited reductions from the tested specimen are permitted with the exception of insulated metal doors where the size reduction is limited.

For category 'B' tests (with overrun in accordance with 8.3.2) increases are only permitted provided that the door is tested with the gaps set between the middle value and the maximum value within the range of gaps given by the sponsor. If the gaps were not set accordingly then no size increases are permitted using category 'B' time extensions. However, the test result is still applicable to door or shutter assemblies with gaps less than the average of the medium and maximum measured values.

b) Other changes

For smaller door sizes the relative positioning of movement restrictors (e.g. hinges, latches, etc) shall remain the same as tested or any change to the distances between them will be limited to the same percentage reduction as the decrease of specimen size.

For larger door sizes the following shall also apply:

- the height of the latch above floor level shall be equal to or greater than the tested height, and such increase in height shall be at least proportional to the increase in door height;

- the distance of the top hinge from the top of the door shall be equal to or less than that tested;

- the distance of the bottom hinge from the bottom of the door shall be equal to or less than that tested;

- where three hinges or distortion preventers are used, the distance between the bottom of the door and centre restraint shall be equal to or greater than that tested.

7.4 Asymmetrical door assemblies

7.4.1 General

EN 1363-1[2]states that for separating elements required to be fire resisting from both sides, two specimens shall be tested (one from each direction) unless the element is fully symmetrical. However, in some cases it is possible to develop rules whereby the fire resistance of an asymmetrical door assembly tested in one direction can apply when the fire exposure is from the other direction. The possibility to develop such rules increases if the consideration is limited to certain types of door assembly and on the criteria being applicable, e.g. integrity only doors. The following rules represent the minimum level of common agreement which shall be followed. The rationale behind the rules is given in annex C of BS EN 1634-1:2000[1].

7.4.2 Specific rules

The rules governing the applicability of tests carried out in one direction to other directions are based on the following premises:

- That the door leaves are themselves of symmetrical construction with the exception of the edges, e.g. double rebated doors.
- That any restraining /supporting ironmongery is of sufficiently high melting point so that it will not melt when exposed to the heat of the test.
- That there is no change in the number of leaves or the mode of operation, e.g. sliding, swinging, single action or double action.

Table 6 lists the type of door assembly for which the rules can be generated and gives the direction in which it should be tested to cover the opposite direction. The separate columns for the integrity and insulation criteria reflect the different ability to make rules for integrity only doors as opposed to those, which satisfy both criteria. A "**ü**" means that it is possible to identify the direction of test, which covers the opposite direction. An "**X**" means that it is not possible to identify the direction which will cover the opposite direction.

Table 6: Type of door assembly and direction to be tested to cover the opposite direction

Type of door assembly.	Direction to be tested to cover opposite direction.	Integrity.	Insulation.	Radiation (if required)
Hinged, metal leaf, metal frame (not pivoted)	Opening away from furnace	**ü**	**X**	**ü**

7.5 Supporting constructions

7.5.1 General

The fire resistance of a door assembly tested in one form of standard supporting construction may or may not apply when it is mounted in other types of construction. Generally, the rigid and flexible types are not interchangeable and rules governing the direct application within each group are given in 7.5.2 to 7.5.4. However, in some cases it is possible for the result of a test on a particular type of door assembly tested in one form of standard supporting construction to be applicable to that door assembly when mounted in a different type of standard supporting construction. Specific rules governing the situation for hinged and pivoted door assemblies are given in 7.5.5.The rationale behind the rules is given in annex C of BS EN 1364-1:2000.

7.5.2 Rigid standard supporting constructions (high density

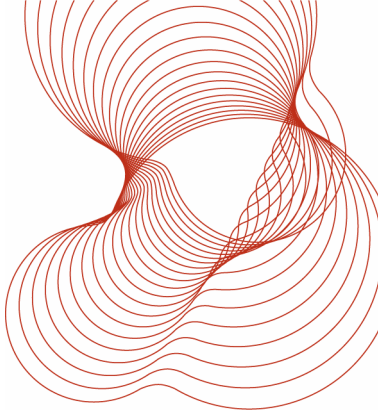
The fire resistance of a door assembly tested in a rigid standard supporting construction as specified in EN 1363-1[2] can be applied to a door assembly mounted in the same manner in a wall of the rigid type as follows:

a) masonry or lightweight concrete with a density of at least 800kg/m^3 having thicknesses of at least:

- 100mm for a fire resistance period up to 90 minutes;

- 150mm for a fire resistance period in excess of 90 minutes;

b) solid concrete or concrete blocks with a density of at least 1200kg/m^3 with thickness requirements as in a).



7.5.3 Rigid standard supporting constructions (low dwnsity)

The fire resistance of a door assembly tested in a rigid standard supporting construction as specified in EN 1363-1 can be applied to a door assembly mounted in the same manner in a wall provided the density and thickness of the wall are equal to or greater than that in which it was tested.

7.5.4 Flexible standard supporting constructions

The fire resistance of a door assembly tested in one of the flexible standard supporting constructions specified in EN 1363-1[2] can be applied to a door mounted in the same manner in a wall or partition which is of the board covered type with studs made from steel or timber.

The fire resistance of the door is only applicable to a door mounted in a partition with a fire resistance equal to or greater than the partition in which it was tested.

The fire resistance of the partition shall have been established separately in a previous test.

7.5.5 Specific rules for hinged or pivoted assemblies

For insulated metal door leaves hung in metal frames there is no applicability of results in rigid standard supporting construction to flexible constructions or vice versa. To cover rigid and flexible types, tests shall be undertaken in each type of standard supporting construction.

For uninsulated steel doors, the test result of a test in a rigid standard supporting construction is applicable to that door assembly mounted in a flexible construction, but not vice versa.

The rules above assume that the fixing methods used in each type of supporting construction are appropriate to that construction.

7.6 Associated supporting constructions

The fire resistance of a door tested in an associated supporting construction has no field of direct application. The applicability of the result to other supporting constructions shall be the subject of extended application.

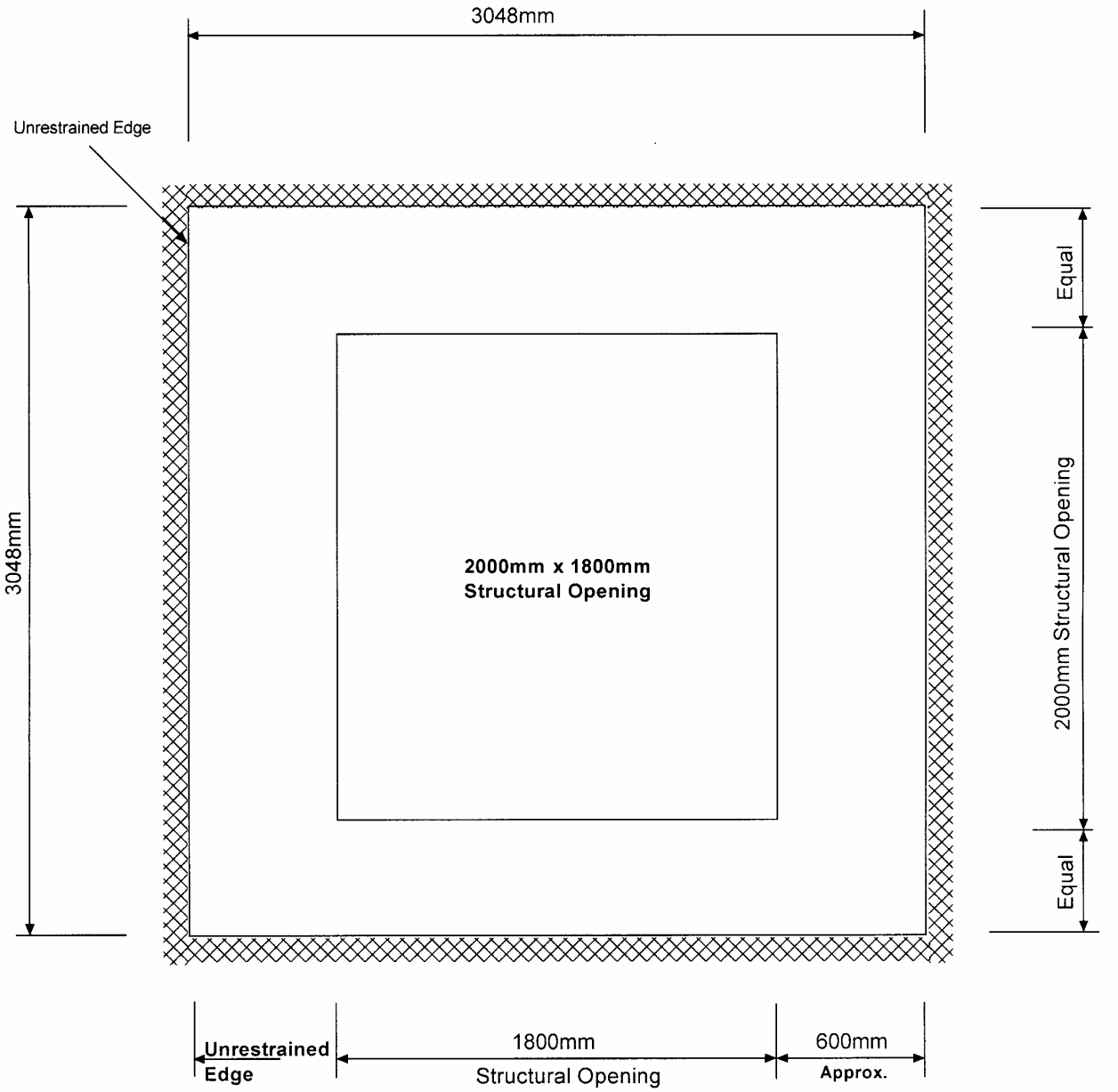
8 REFERENCES

1 Fire resistance tests for door and shutter assemblies. Part 1: Fire doors and shutters. European standard BS EN1634-1:2000 dated February 2000. British Standards Institution, London, 2000

2 Fire resistance tests. Part 1: General requirements. European standard BS EN 1363-1:1999 dated August 1999. British Standard Institution, London, 1999.

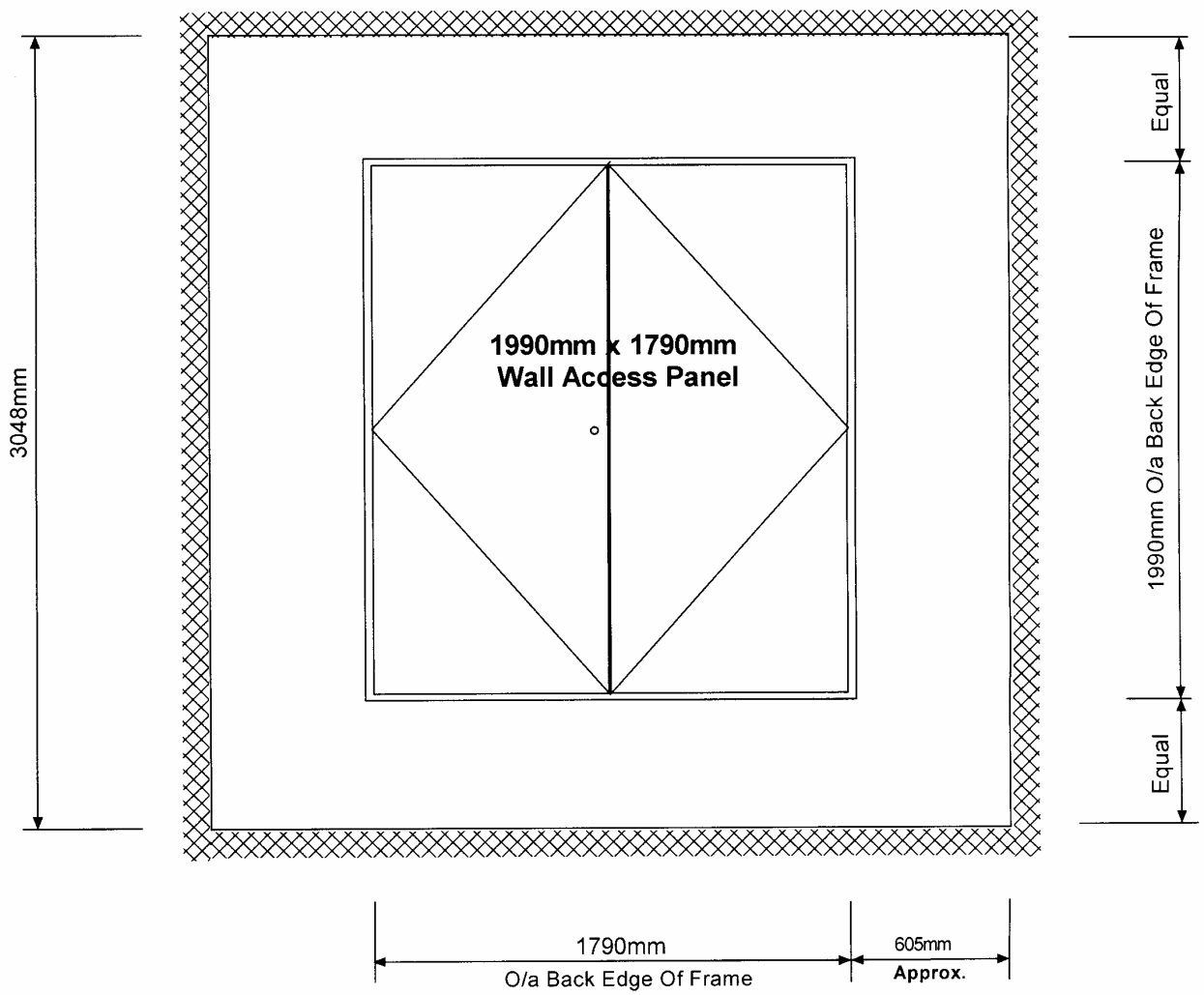
3 Fire resistance tests for door and shutter assemblies. Part 1: Fire doors and shutters. European standard BS EN1363-2: dated August 1999. British Standard Institution, London, 1999.

9 FIGURES



Front Elevation Showing Structural Opening Within Brickwork Wall In Test Rig.

Figure 1



Front Elevation Showing Position Of Access Panel In Brickwork Wall

Figure 2

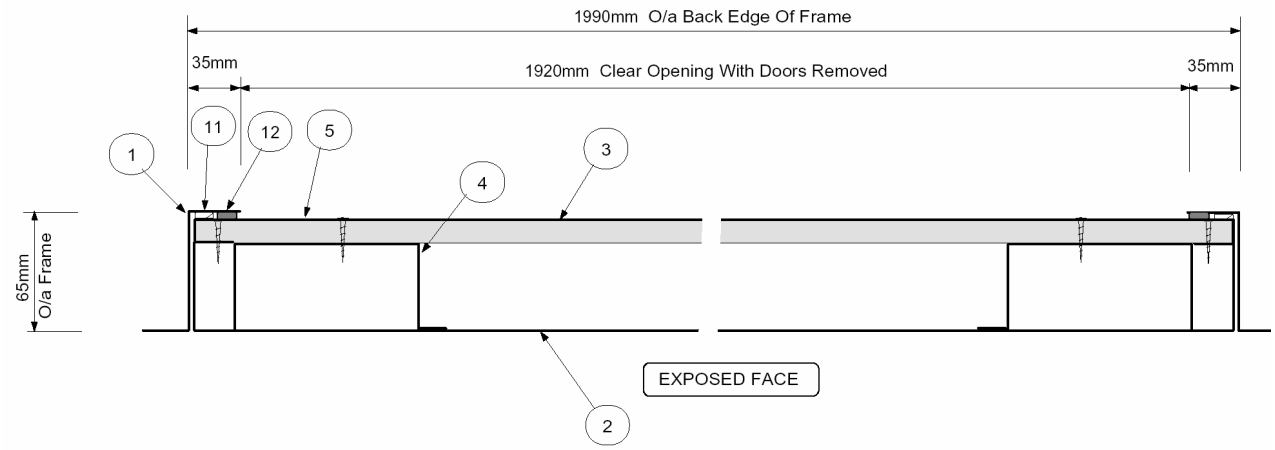


Figure 3 Longitudinal section through access panel.

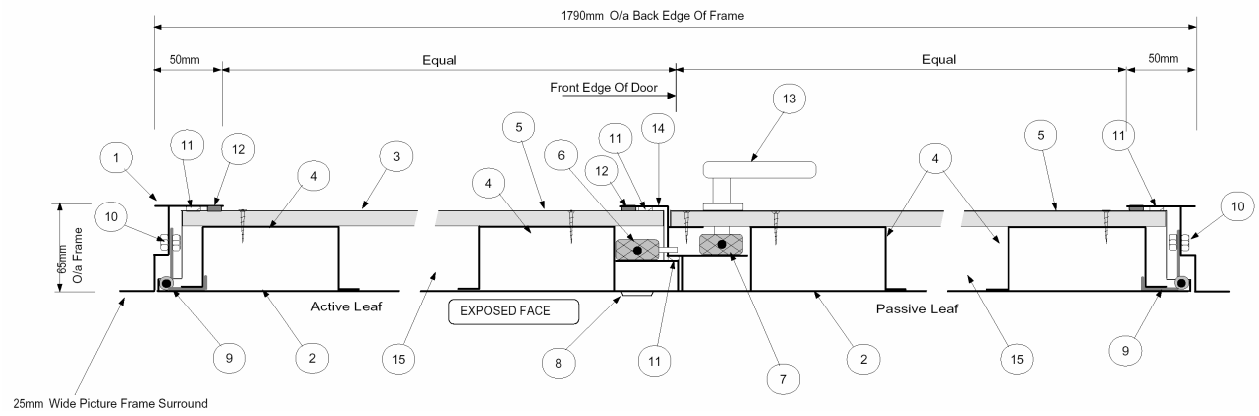


Figure 4 Section showing hinge and locking systems.

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.
2. Access panel door tray manufactured from 1.2mm 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. 1.5mm thick Zintec steel stiffener (BS EN 101522003) welded to rear face & centre of door tray. Size 15mm x 48mm x 100mm x 48mm
5. 1.2mm thick Zintec steel (BS EN 101522003) rear protection plate screw -fixed to rear of each door (with 12mm deep return edge).
6. Emka 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. Emka 2-point locking system (see enclosed detail) with central lock operating 8mm diameter rods protruding 22mm into frame top and bottom. The rods are secured to the door tray with 4No. lock guides.
8. Swivel lidded Metal Escutcheon screw fixed over lock hole (Albert Jagger Ref: 2296/002).
9. Galvanized steel continuous hinge welded to door tray and bolted to frame using M6 bolts and nuts with washer.
10. M6 bolts welded to panel frame at 50mm in from edges and 300mm centres thereafter. Door tray secured to frame using M6 nuts and washers.
11. 10mm wide x 4mm deep self adhesive polypropolene (flexible foam grey) smoke seal strip along inside locking edge of frame.
12. 2No. 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).
13. Chrome Handle (Albert Jagger Ltd, Ref: 4222/101) with 8mm square bar fixed to 2-point locking system, screw fixed to rear of door tray(see drawing).
14. 1.5mm thick Zintec steel (BS EN 101522003) backing plate 35mm wide forming overlap of leaves.
15. 50mm Thick Superwool 607 Blanket insulation (Thermal Ceramics) within door cavity.

Figure 5 Key to diagrams in Figures 3 and 4.

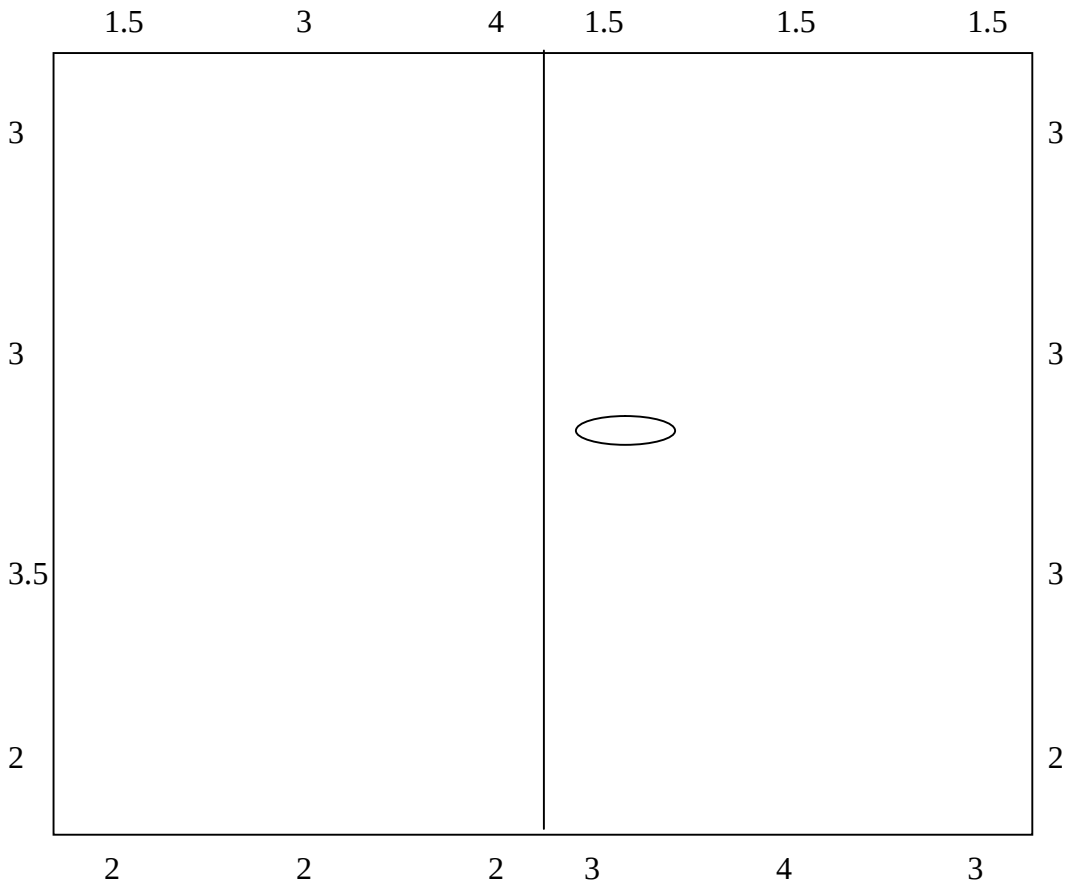


Figure 6 Sketch showing gaps (in mm) between door leaves and frame recorded on the unexposed face.

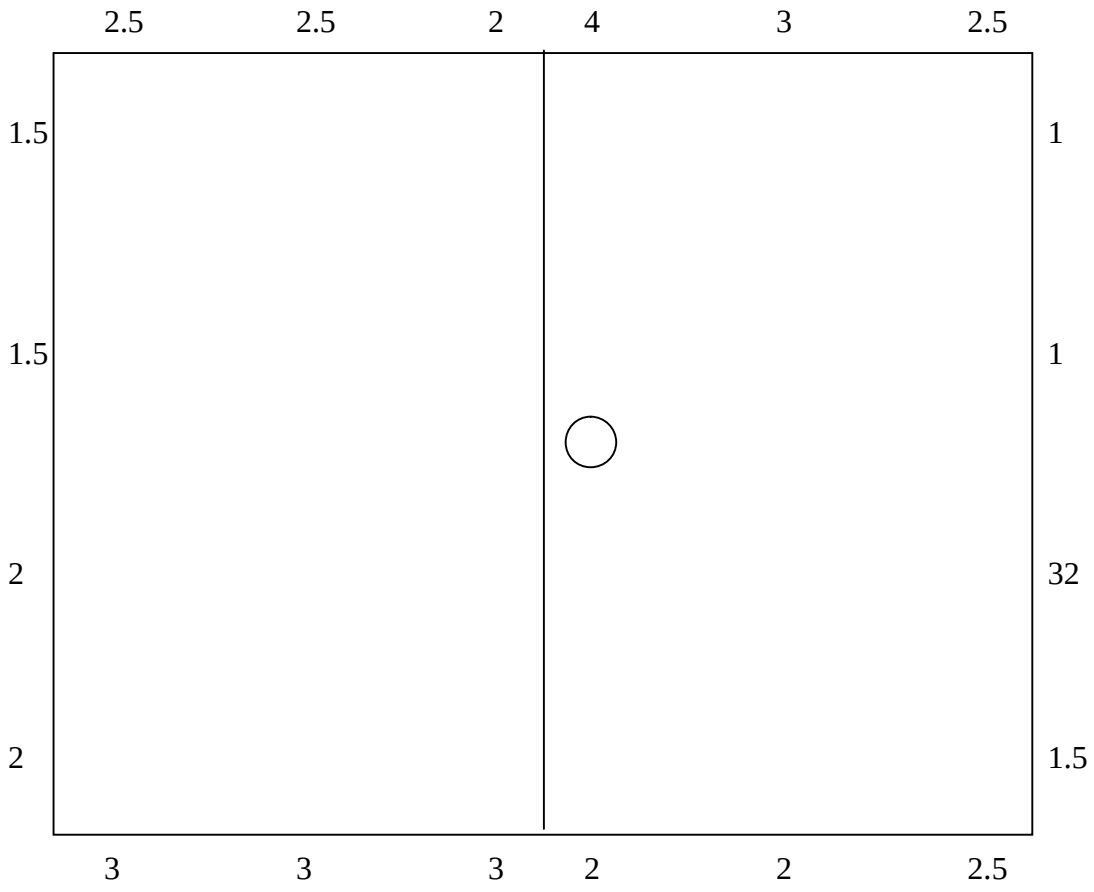
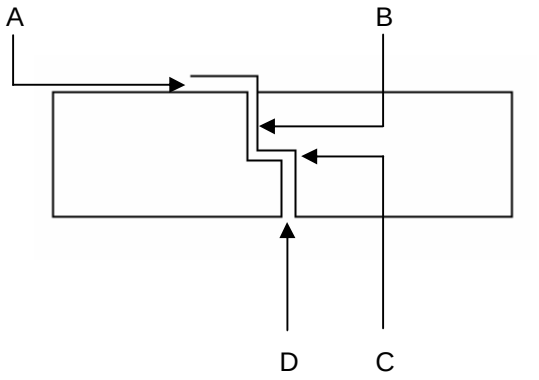


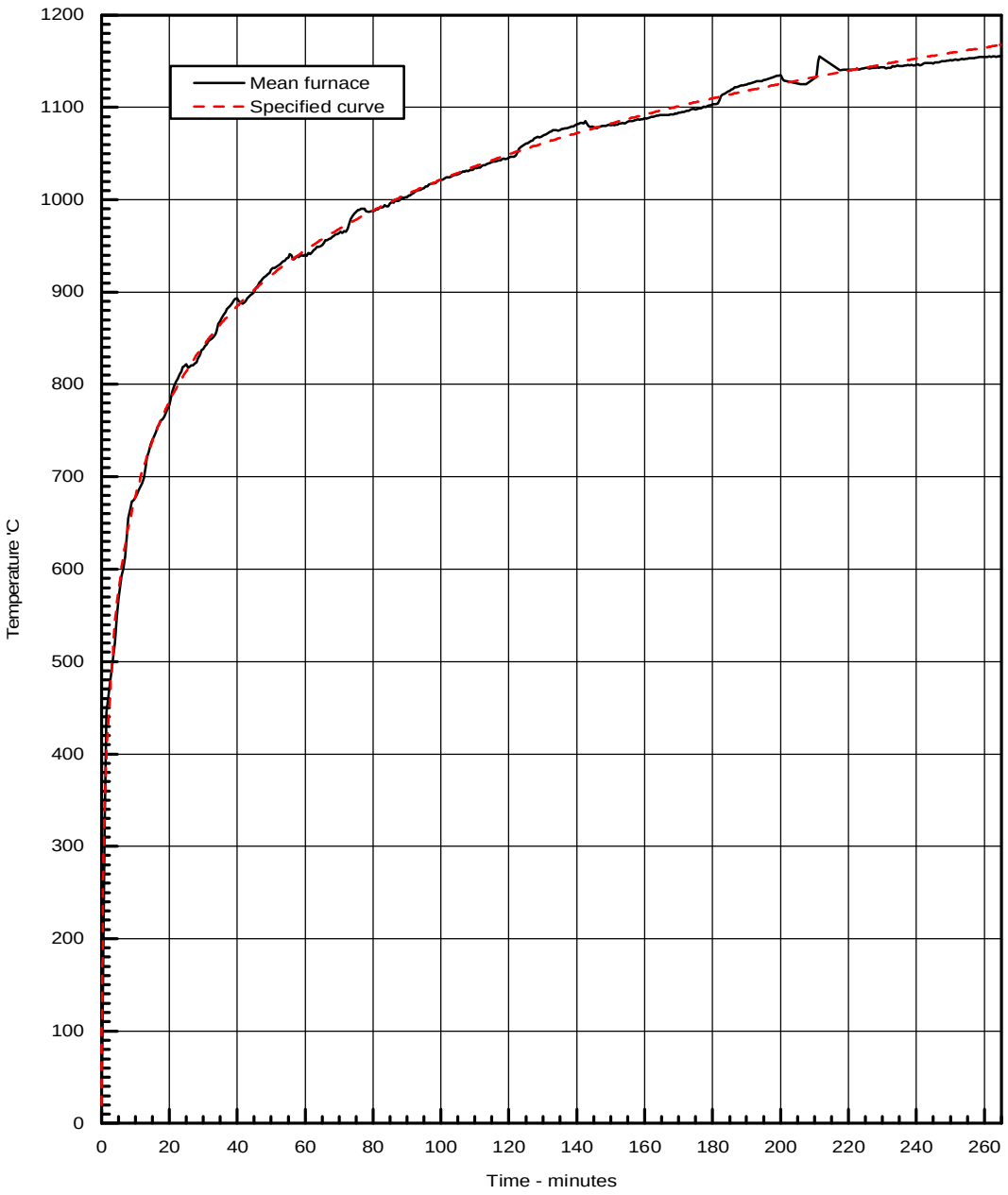
Figure 7 Sketch showing gaps (in mm) between door leaves and frame recorded on the exposed face.



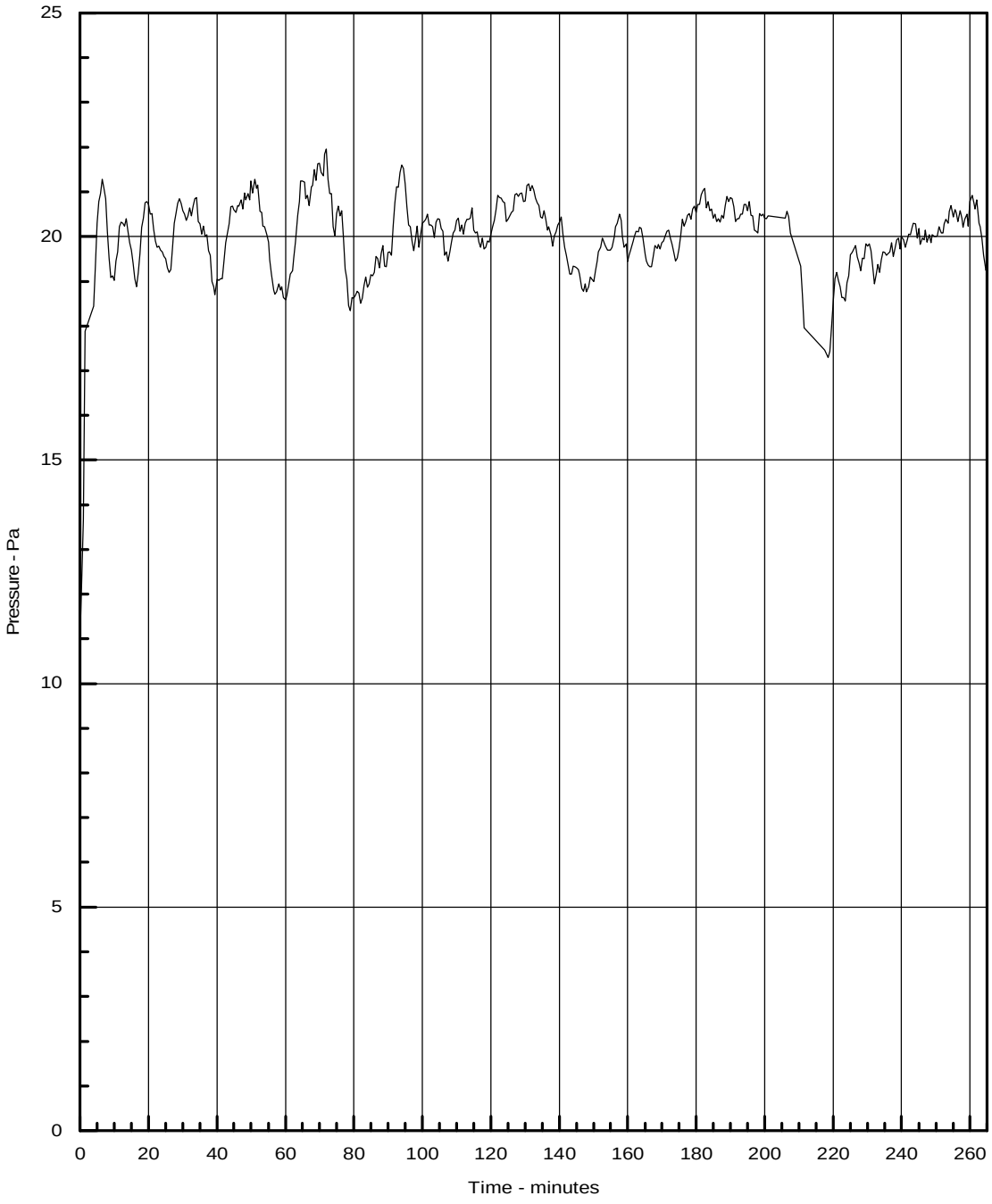
Height of measurement on door leaves.	Gaps at positions A - D			
	A	B	C	D
Near top	4	8.5	6	1.5
Above centre	1.5	9.5	6	2
Below centre	2.5	8.5	6	3
Near bottom	4	8	6	4

Figure 8 Sketch (not to scale) showing gaps (in mm) measured at meeting point between door leaves.

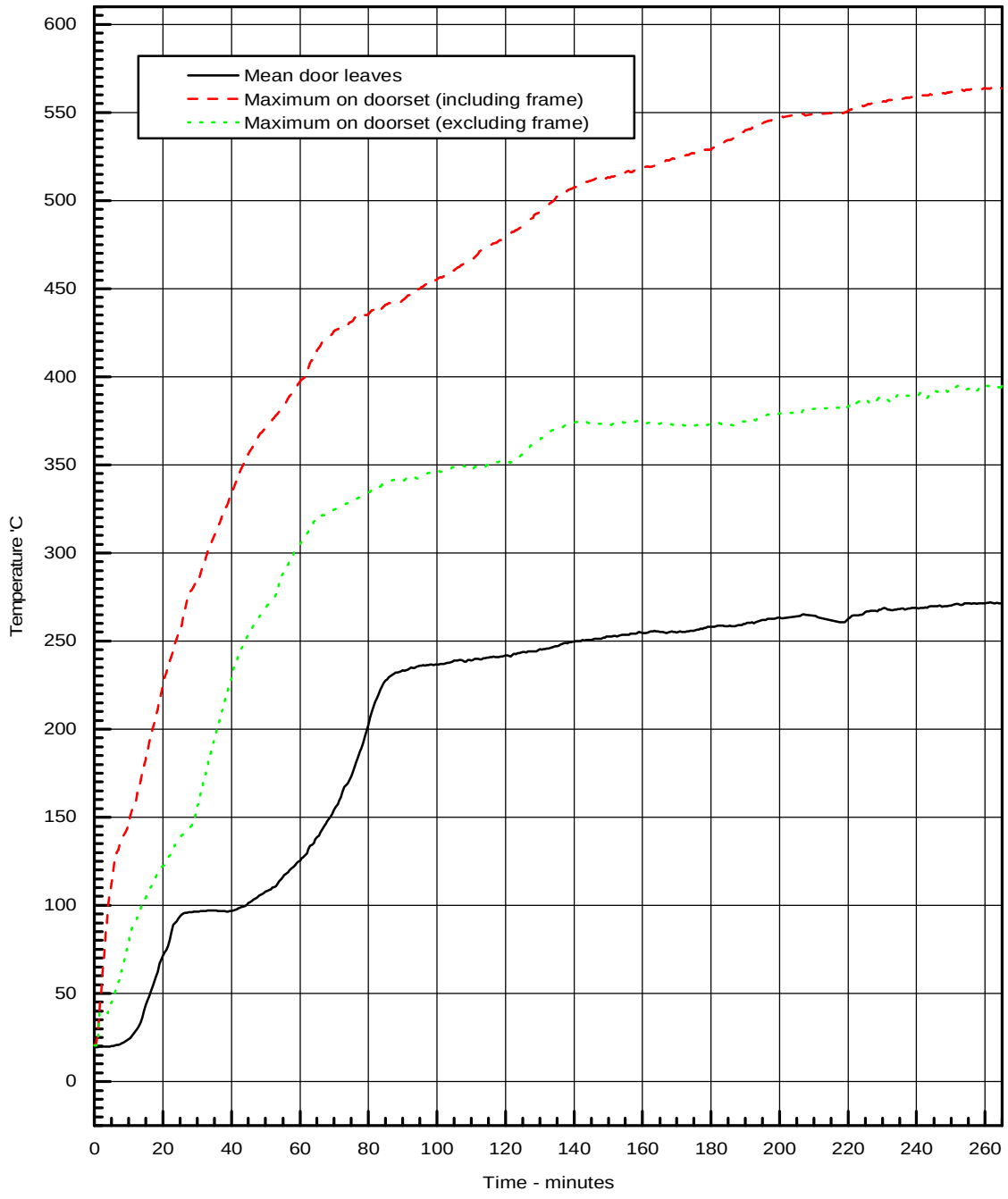
10 GRAPHS



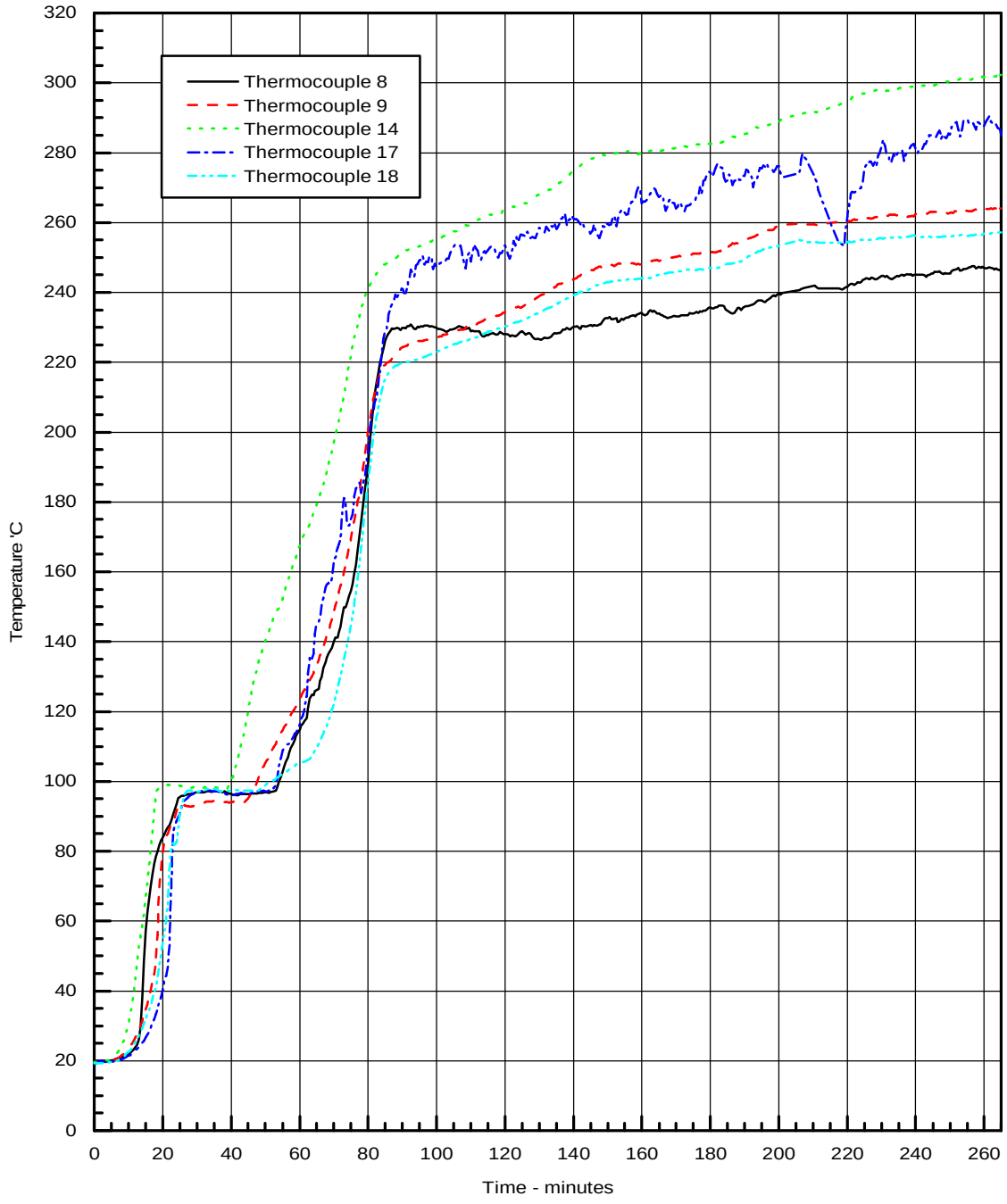
Graph 1 Mean furnace temperature with specified curve for comparison.



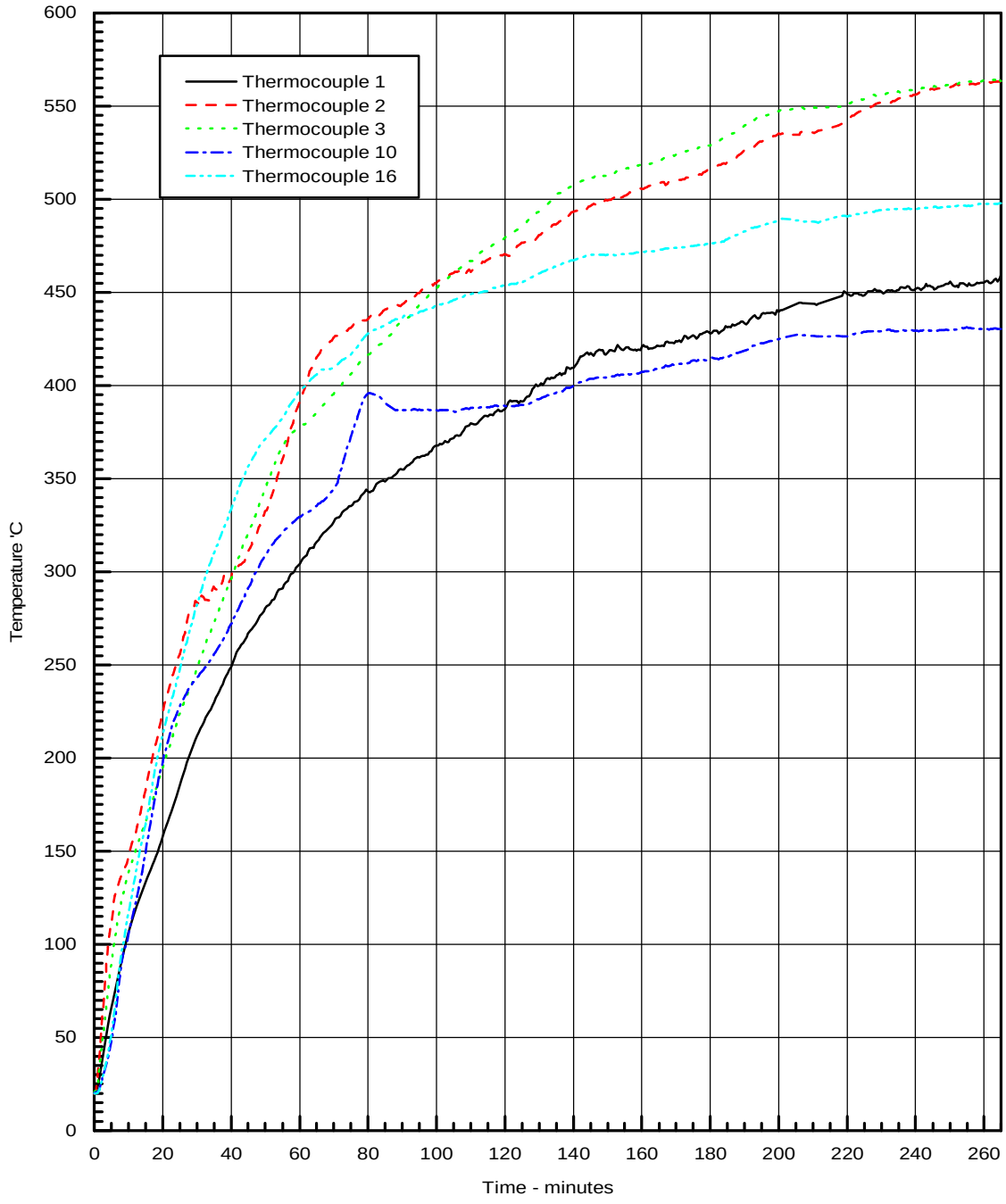
Graph 2 Furnace pressure recorded at the top of the doorset.



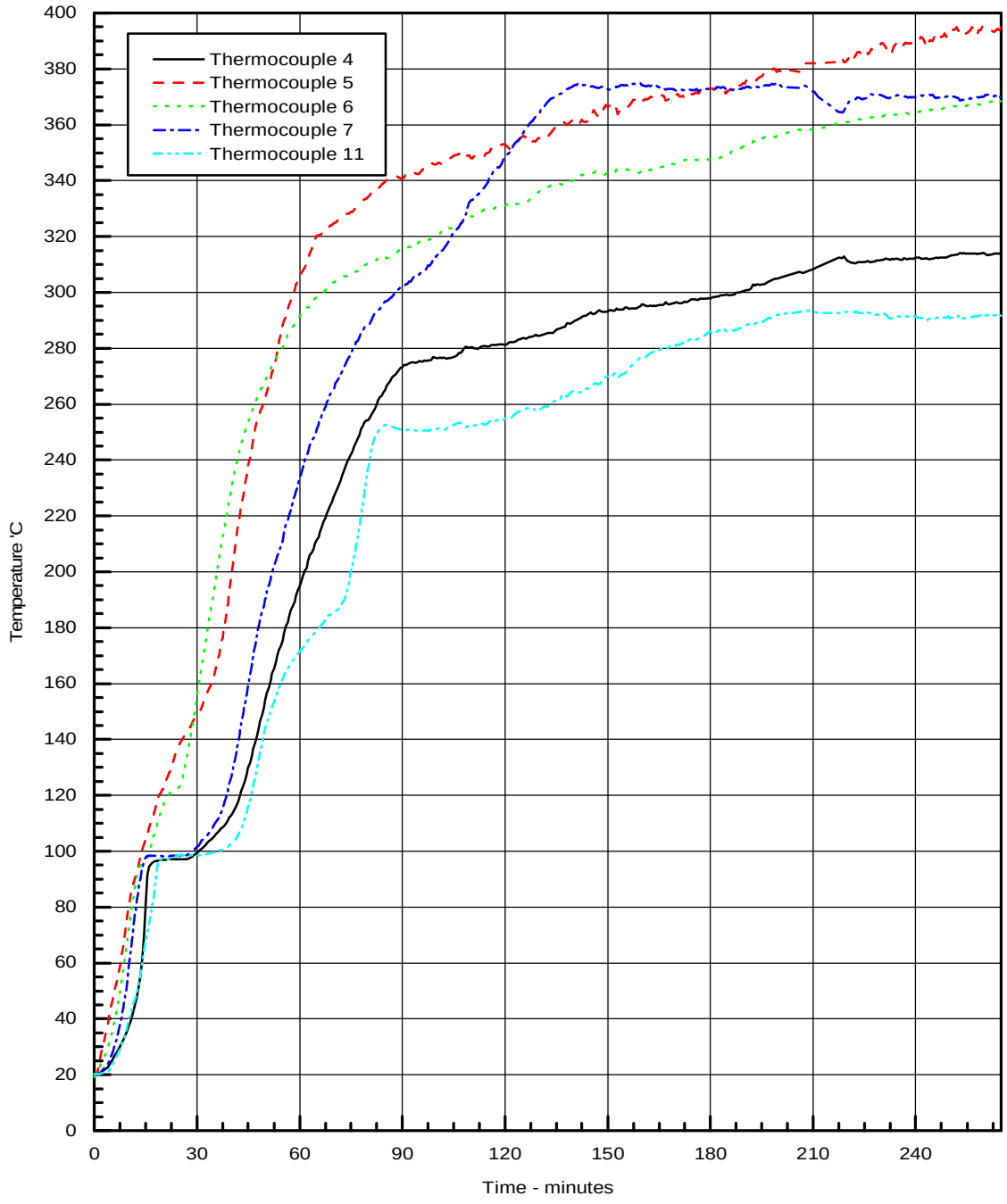
Graph 3 Mean and maximum temperatures recorded on the doorset.



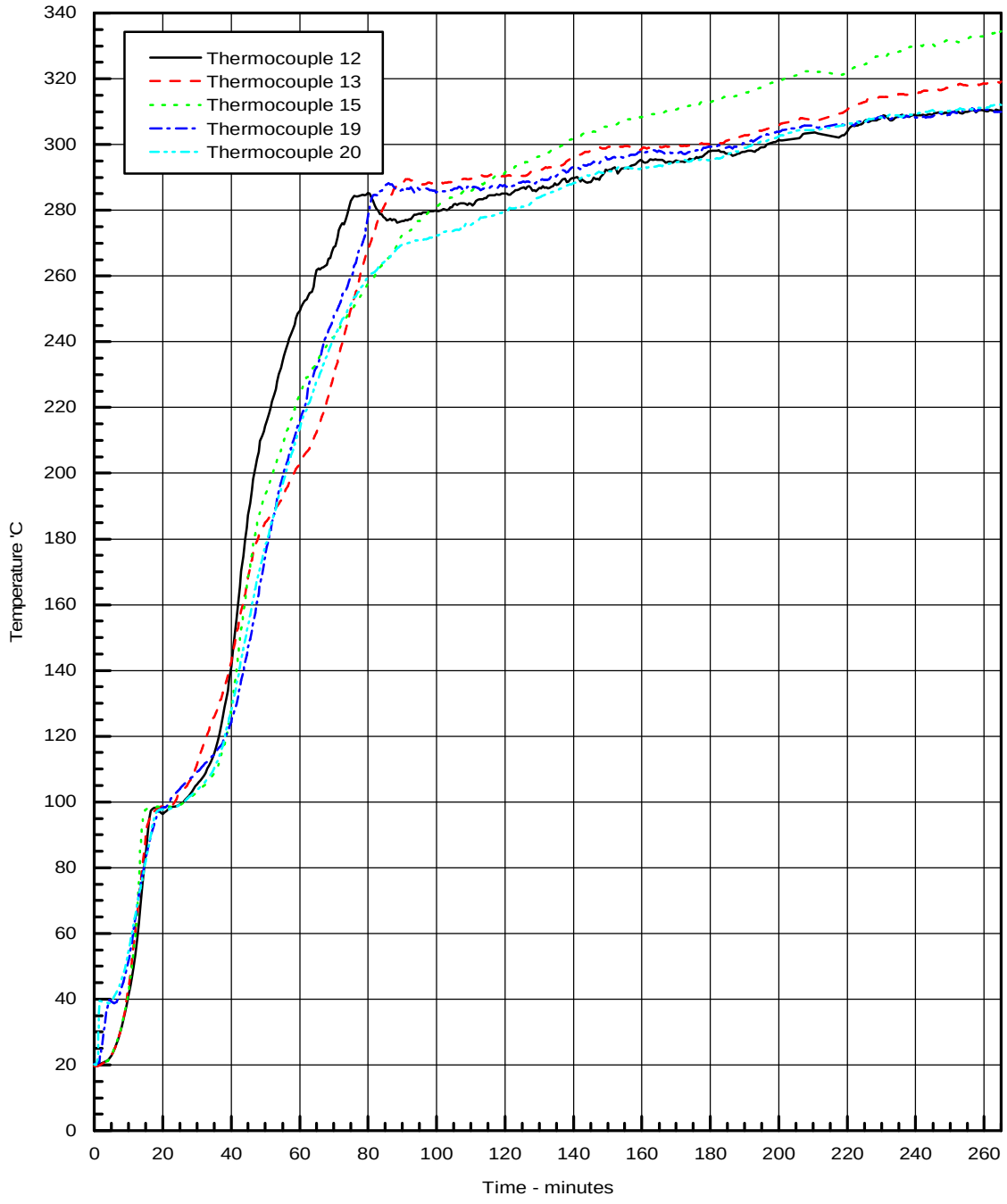
Graph 4 Individual temperatures used to derive the mean surface temperature of the door leaves.



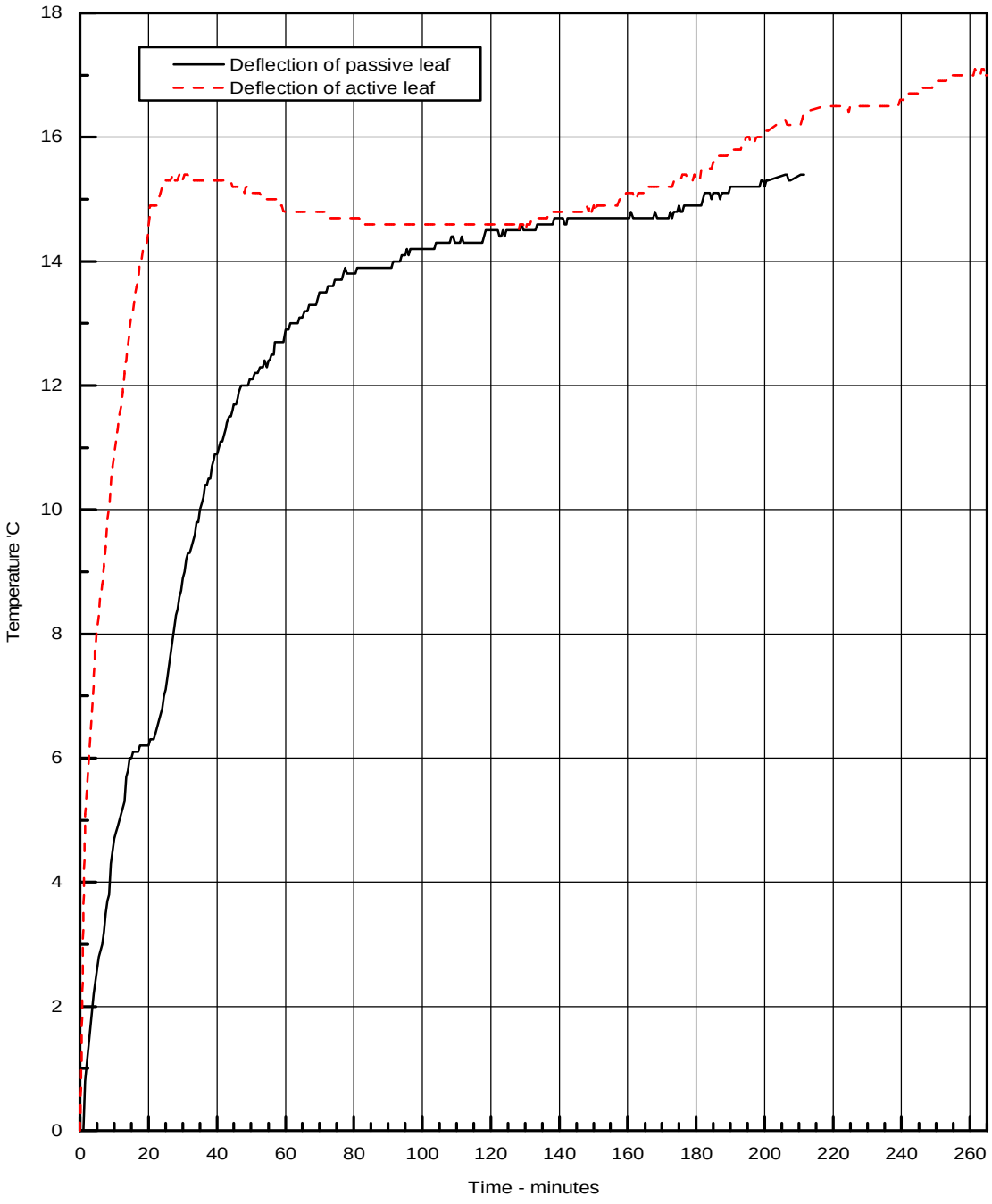
Graph 5 Individual temperatures recorded on the door frame.



Graph 6 Individual temperatures recorded on the door leaves by thermocouples 4 to 7 and 11.



Graph 7 Individual temperatures recorded on the door leaves by thermocouples 12, 13, 15, 19 and 20.



Graph 8 Deflection recorded at the top mid width of each door leaf.

11 PHOTOGRAPHS

Photo 1 Exposed face of doorset before test.

Photo 2 Unexposed face of doorset before test, showing surface thermocouple locations.

Photo 3 Unexposed face of doorset at end of test.

Photo 4 Exposed face of doorset after test.

==========REPORT ENDS==========