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CONFIDENTIAL

Test Report : RF95082

A fire resistance test performed on three single leaf, single acting doorsets

Test conducted in accordance with BS 476 : Part 22 1987

Test Date: 19 September 1995

TEST FOR: HISTORIC ROYAL PALACES AGENCY
FIRE SAFETY TEAM
APARTMENT 2
HAMPTON COURT PALACE
EAST MOLESEY
SURREY
KT8 9AU

A fire resistance test performed on three single leaf, single acting doorsets. Tested in accordance with BS 476 : Part 22 : 1987.

1. Introduction

The doorsets were supplied for test by the client and delivered on 13 September 1995. TRADA Technology Limited (TTL) constructed a timber stud/plasterboard clad partition and installed the doorsets into the partition.

2. Specification

2.1 Door leaves

The left leaf was designated doorset A and measured 1980mm high x 760mm wide x 44mm thick. The middle leaf was designated doorset B and measured 1980mm high x 760mm wide x 44mm thick. The right leaf was designated doorset C and measured 1980mm high x 760mm wide x 44mm thick. All leaves were hung to open towards the furnace. The latches were disengaged for the test. All doorleaves were of two panel design.

2.1.1 Door A

Materials	Species/type	Dimensions (mm)	Density (kg/m³)	Moisture (% w/w)
Stiles	hemlock	77 wide x 44 thick	500**	9-12
Rails				
Top	hemlock	77 wide x 44 thick	500**	9-12
Middle	hemlock	152 wide x 44 thick	500**	9-12
Bottom	hemlock	154 wide x 44 thick	500**	9-12
Panels	Plywood core	Plywood - 12 thick	-	9
	Sealmaster Limited Fireface with a hardwood veneer fitted to each side of panels and butted up to beading	Fireface - 2.5 thick	-	-
		Veneer - 0.8 thick	-	-
Adhesive	Evostick 528 used to bond Fireface to plywood panel	-	-	-
Panel beading	Unexposed face - integral hemlock	14 wide x 10 deep	500**	9-12
	Exposed face - planted - hemlock	14 wide x 10 deep	500**	9-12
Fixings	Steel pins at 150 centres at 45°	32 long	-	-

* Stated density, not checked by laboratory

** Nominal density

2.1.2 Door B

Materials	Species/type	Dimensions (mm)	Density (kg/m³)	Moisture (% w/w)
Stiles	hemlock	77 wide x 44 thick	500**	9-12
Rails Top	hemlock	77 wide x 44 thick	500**	9-12
Middle	hemlock	152 wide x 44 thick	500**	9-12
Bottom	hemlock	154 wide x 44 thick	500**	9-12
Panels	Plywood core	Plywood - 12 thick	-	9
	Sealmaster Limited Fireface fitted with hardwood veneer fitted to each side of panels and extending behind beading.	Fireface - 2.5 thick	-	-
		Veneer - 0.8 thick	-	-
Adhesive	Evostick 528 used to bond Fireface to plywood panel	-	-	-
Panel Beading	Unexposed face - integral hemlock	14 wide x 10 deep	500**	9-12
	Exposed face - planted - hemlock	14 wide x 10 deep	500**	9-12
Fixings	Steel pins at 150 centres at 45°	32 long	-	-

** Nominal density

2.1.3 Door C

Materials	Species/type	Dimensions (mm)	Density (kg/m³)	Moisture (% w/w)
Stiles	hemlock	77 wide x 44 thick	500**	9-12
Rails Top	hemlock	77 wide x 44 thick	500**	9-12
Middle	hemlock	152 wide x 44 thick	500**	9-12
Bottom	hemlock	154 wide x 44 thick	500**	9-12
Panels	Plywood core	Plywood - 12 thick	-	9
	Scalmaster Limited Fireface with a hardwood veneer fitted to each side of panels and butted up to beading	Fireface - 2.5 thick	-	-
		Veneer - 0.8 thick	-	-
Adhesive	PVA adhesive used to bond fire face to panel	-	-	-
Panel beading	Unexposed face - integral hemlock	14 wide x 10 deep	500**	9-12
	Exposed face - planted - hemlock	14 wide x 10 deep	500**	9-12
Fixings	Steel pins at 150 centres at 45°	32 long	-	-

* Stated density, not checked by laboratory
** Nominal density

2.2. Door frames of all doors

Materials	Species/type	Dimensions (mm)	Density (kg/m³)	Moisture (% w/w)
Head & Jambs	European redwood	95 x 32	Minimum 450*	11-12
Stops	European redwood - planted	12 deep	Minimum 450*	11-12
Architrave	Plasterboard	12.5 thick	-	-
Threshold	Non-combustible	-	-	-

* Stated density, not checked in laboratoty

2.3 Door perimeter gaps

The gaps between the edge of the doors and frame were measured prior to test. A total of 36 readings were taken. The measurements (in mm) are given in Figure 8.

2.4 Ironmongery of all doors

	Make/type	Size (mm)	Location
Hinges	3No steel butt hinges	100 x 32	150, 940 and 1730 from the top of leaf head
Closer	Dorma TS73S	-	Fitted to the exposed face
Latch	Union tubular mortise latch - disengaged	-	1175 from leaf head
Furniture	Aluminium lever handles	-	1120 from leaf head

2.5 Intumescent materials

2.5.1 Door A

	Make/type	Size (mm)	Location
Door edges	None		
Frame reveal	Intumescent Seals Ltd, Therm-A-Flex	20 x 1 thick	Surface mounted centrally in frame reveal, fully interrupted at ironmongery positions
Around hinges	None	-	-
Under hinge flap	None	-	-
Around latch	None	-	-
Under latch keep	Above intumescent strip fully interrupted	-	-
Smoke seal	None	-	-
Around panel perimeter	Sealmaster Limited Masterseal mastic	-	Around panel perimeter

2.5.2 Door B

	Make/type	Size (mm)	Location
Door edges	None		
Frame reveal	Intumescent Seals Ltd, Therm-A-Flex	34 x 1 thick	Surface mounted, butted up to the exposed edge, partially interrupted at hinge positions
Around hinges	Above strip extending 4mm past hinges	-	-
Under hinge flap	None	-	-
Around latch	None	-	-
Under latch keep	Above intumescent strip fully interrupted	-	-
Smoke seal	Lorient Polyproducts Limited half Batwing	12 x 12	Fitted to doorstop on closing and top edge. Fitted to frame on hanging edge
Around panel perimeter	None	-	-

2.5.3 Door C

	Make/type	Size (mm)	Location
Door edges	None		
Frame reveal	Intumescent Seals Ltd, Therm-A-Flex	34 x 1 thick	Surface mounted, butted up to the exposed edge, partially interrupted at hinge positions
Around hinges	Above strip extending 4mm past hinges	-	
Under hinge flap	None	-	-
Around latch	None	-	-
Under latch keep	Above intumescent strip fully interrupted	-	-
Smoke seal	None	-	-
Around panel perimeter	Top panel - Sealmaster Limited Masterseal mastic Bottom panel - Sealmaster Limited Masterseal mastic	- -	Bead of sealant around beading/panel junction only Around panel perimeter

2.6 Closer Forces

Measured in accordance with FTSG Resolution No. 63

	Opening Force (Nm)	Closing Force (Nm)
Leaf A	35	26
Leaf B	45	24
Leaf C	41	30

3. Test Results

When tested in accordance with BS476: Part 22: 1987, the requirements of the standard were satisfied for the following periods:

	Door A)	Door B	Door C
Integrity	31 (thirty one) minutes	28 (twenty eight) minutes	32 (thirty two) minutes
Insulation	31 (thirty one) minutes	28 (twenty eight) minutes	32 (thirty two) minutes

4. Exclusions

The results only relate to the behaviour 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.

The results of this test were obtained using the door to frame gaps recorded in Figure 8. The fire resistance performance of doors of this design may change if substantially different gaps are employed.

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. TTL 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.

J J VIBERT
Laboratory Manager

C P A HOUCHEN
Head of Testing

Date of issue: 13/11/95

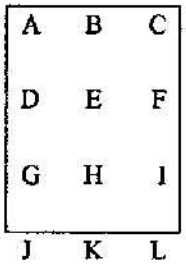
5. Observations

Time	Comments
00.00	Test started
03.55	Cracking noise from all doorsets.
05.41	Door B, the hanging edge is bowing in towards the furnace. The bottom closing corner has distorted in towards the furnace by approximately 8mm and the top closing edge by approximately 4mm.
06.40	Door B, top panel, top right hand corner, smoke issuing.
07.04	Door C, the bottom closing corner has distorted in towards the furnace by approximately 10mm.
07.48	Door A, the upper hinge position is continuing to discolour and scorch.
09.43	Doors A and B, top panels, beginning to distort.
10.90	Door A, discolouration and scorch marks around the middle hinge position.
15.00	Door B, smoke issuing from the two upper corners of the upper panel with discolouration in this area.
17.05	Door B, the bottom closing corner has distorted in towards the furnace by approximately 12mm and the top closing corner by approximately 8mm.
17.53	Door C, the top closing corner has distorted in towards the furnace by approximately 10mm, bottom corner by 13-14mm.
18.46	Door A, the top closing corner has distorted in towards the furnace by approximately 8mm, bottom corner by approximately 10mm.
19.05	Door A, the lower panel appears to be delaminating as the surface is bowing and cupping away from the furnace.
19.47	Door A, both panels appear to be delaminating and distorting away from the furnace.
22.00	View from the rear of the furnace, door B, sections of the "Fireface" have fallen away from the plywood core.

27.27	Door B, top panel, top left hand corner, glowing is visible.
27.50	Door B, top panel, bottom right hand corner, intermittent flaming.
28.06	Door B, top panel, top left hand corner, continuous flaming constituting **INTEGRITY FAILURE.**
28.35	Door B, top panel, bottom corners, continuous flaming constituting further **INTEGRITY FAILURE.**
28.59	Door A, upper hinge position, a glow is visible.
29.45	Door C, top panel, left hand edge, centre, glow visible and panel is delaminating.
30.00	Doors A and C satisfactory.
30.30	Door A, a cotton pad integrity test was performed at the upper hinge position, no failure.
31.02	Door A, top panel top edge, continuous flaming constituting **INTEGRITY FAILURE.**
32.00	Door C, bottom panel, top edge, continuous flaming constituting **INTEGRITY FAILURE.**
32.38	Door C, top panel, continuous flaming from the top left hand corner, constituting further **INTEGRITY FAILURE.**
	Test terminated.

6. Door Distortion Data

The following tables show the distortion of the doors in mm.
A positive measurement indicates distortion towards the fire.
A negative measurement indicates distortion away from the fire.
J, K and L give vertical movement of the door, a negative reading indicates that the door has dropped.



Door A (hung on left and opening towards the fire)

Time	A	B	C	D	E	F	G	H	I	J	K	L
10	-0.5	-1	1.5	-1.5	-1.5	0	1	2	4.5	0	-0.5	-1
20	1	0.5	4.5	-3	-3	0	2.5	4	8	-3	-2	-2

Doorset B (hung on left and opening towards the fire)

Time	A	B	C	D	E	F	G	H	I	J	K	L
10	0	1	2	-0.5	-1.5	0	2.5	3	6.5	-0.5	-1	-1
20	2.5	2.5	4.5	-2	-3.5	-0.5	6	6	11	-1	-2	-2.5

Doorset C (hung on left and opening towards the fire)

Time	A	B	C	D	E	F	G	H	I	J	K	L
10	0.5	1.5	3.5	-0.5	-1.5	-0.5	1.5	3.5	7.5	0	-0.5	-0.5
20	3	4.5	8.5	0	-4	-0.5	3.5	4	10	-0.5	-1	-1.5

7. Test Procedure

7.1 Where areas of the test specification are ambiguous or open to interpretation the Fire Test Study Group Resolutions have been followed (where appropriate). These Resolutions provide basis of common agreements between the fire test laboratories which are members of this Group.

7.2 The ambient temperature of the test area at commencement of test was 16°C.

7.3 After the first 5 minutes of the test, the furnace pressure was maintained at 0 ± 2 Pa with respect to atmosphere, at a point 1m from the notional floor level.

7.4 The furnace was controlled to follow the temperature/time relationship specified in BS476: Part 20: 1987 as closely as possible, using the average of six thermocouples suitably distributed within the furnace. The temperatures recorded are shown graphically in Figure 1.

7.5 The temperature of the unexposed face was monitored by means of four thermocouples fixed to the surface of each doorleaf, and two thermocouples attached to each frame, one at midheight on each jamb. The thermocouple positions are shown in Figure 8. The average temperature of each door leaf and maximum temperature of each doorset are shown graphically in Figure 2.

FIGURE 1 FURNACE TEMPERATURE CURVES

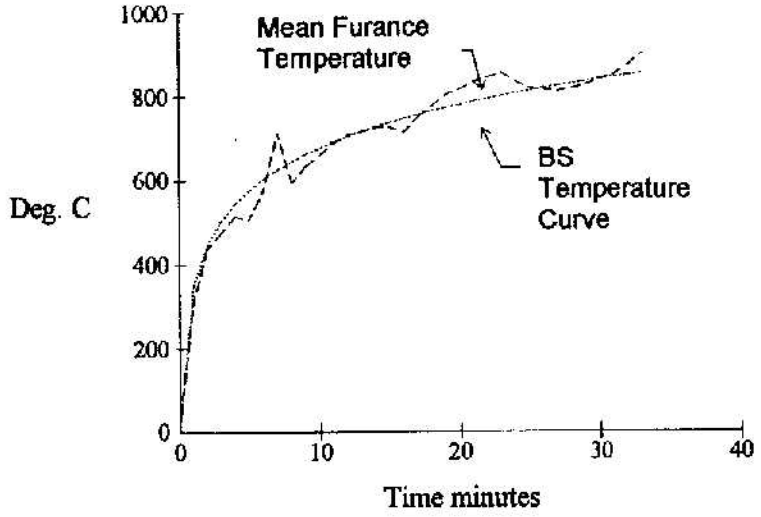
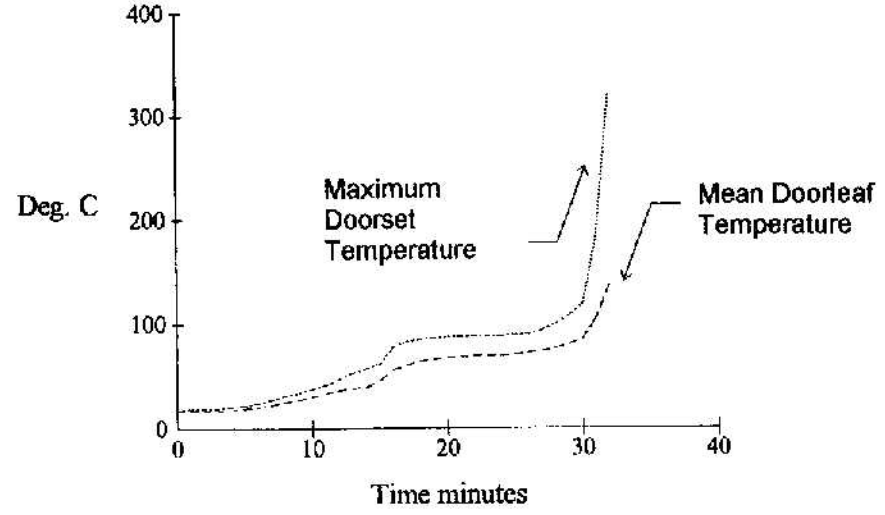


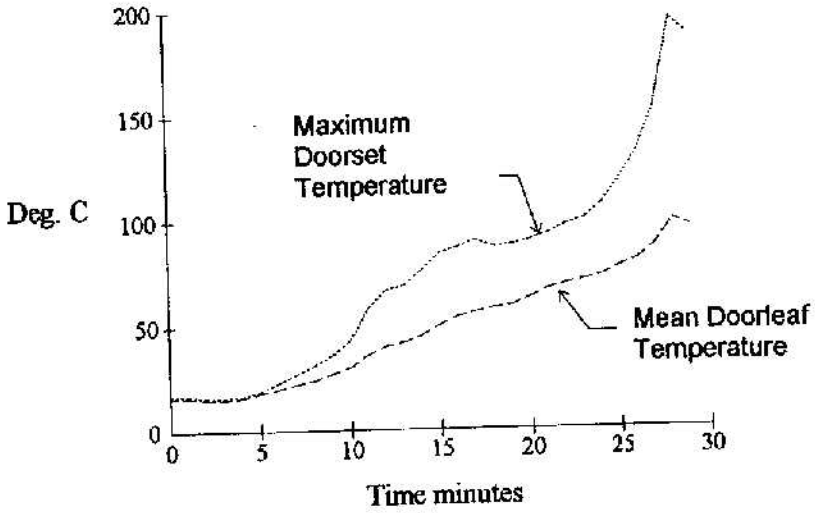
FIGURE 2 UNEXPOSED FACE TEMPERATURE CURVES

DOORSET A



UNEXPOSED FACE TEMPERATURE CURVES

DOORSET B



DOORSET C

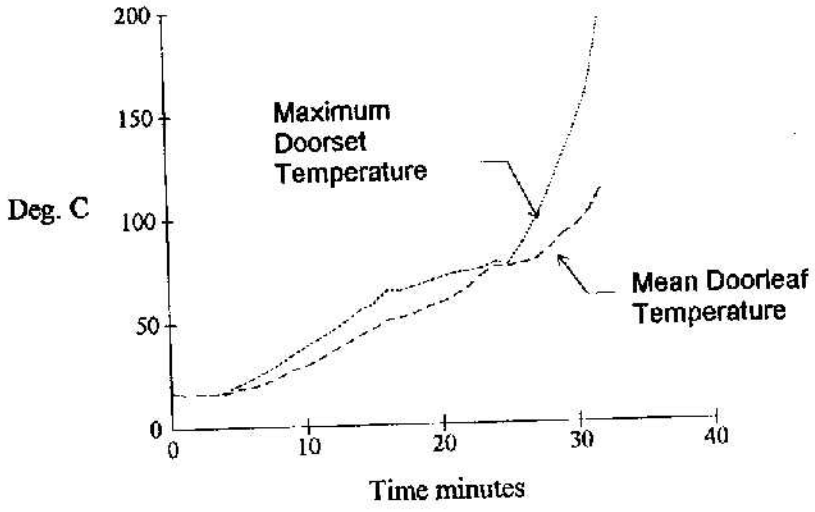
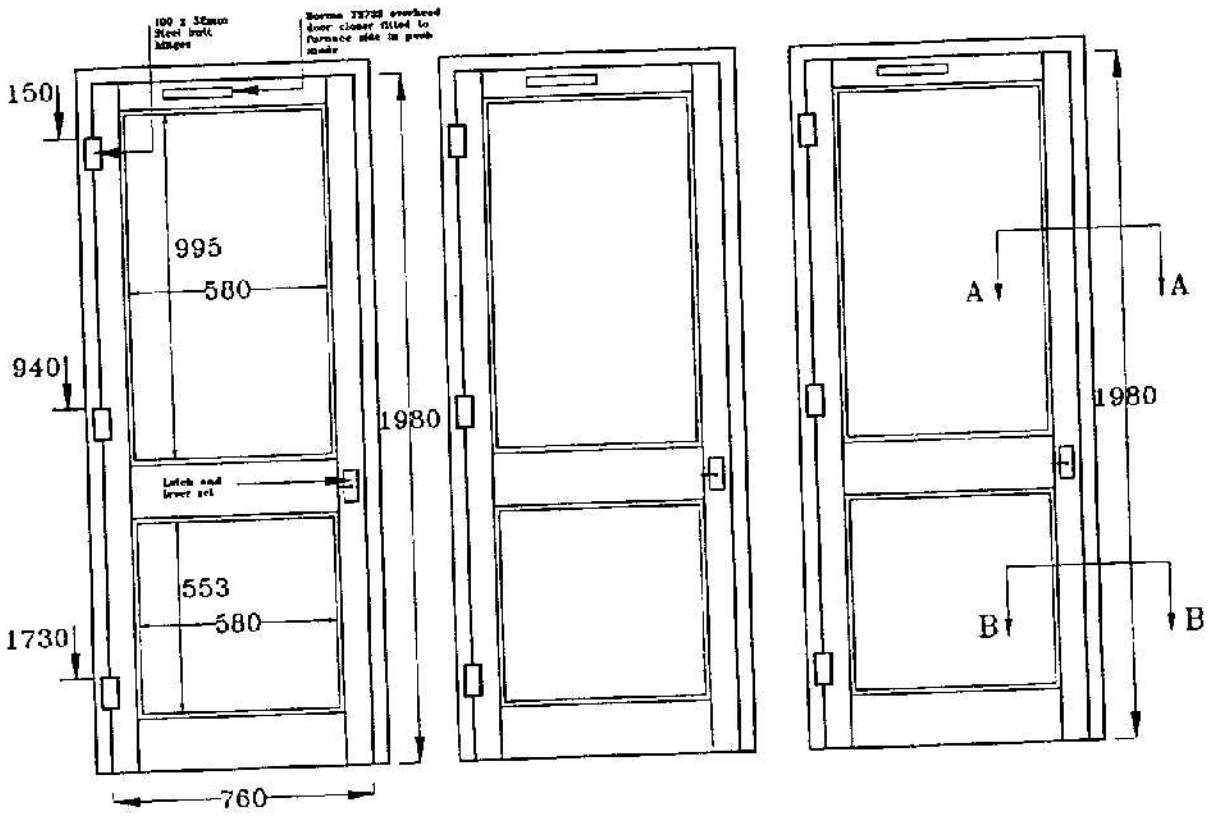


FIGURE 3



DOOR A DOOR B DOOR C

FIGURE 4

DOOR A - SECTION A-A & B-B

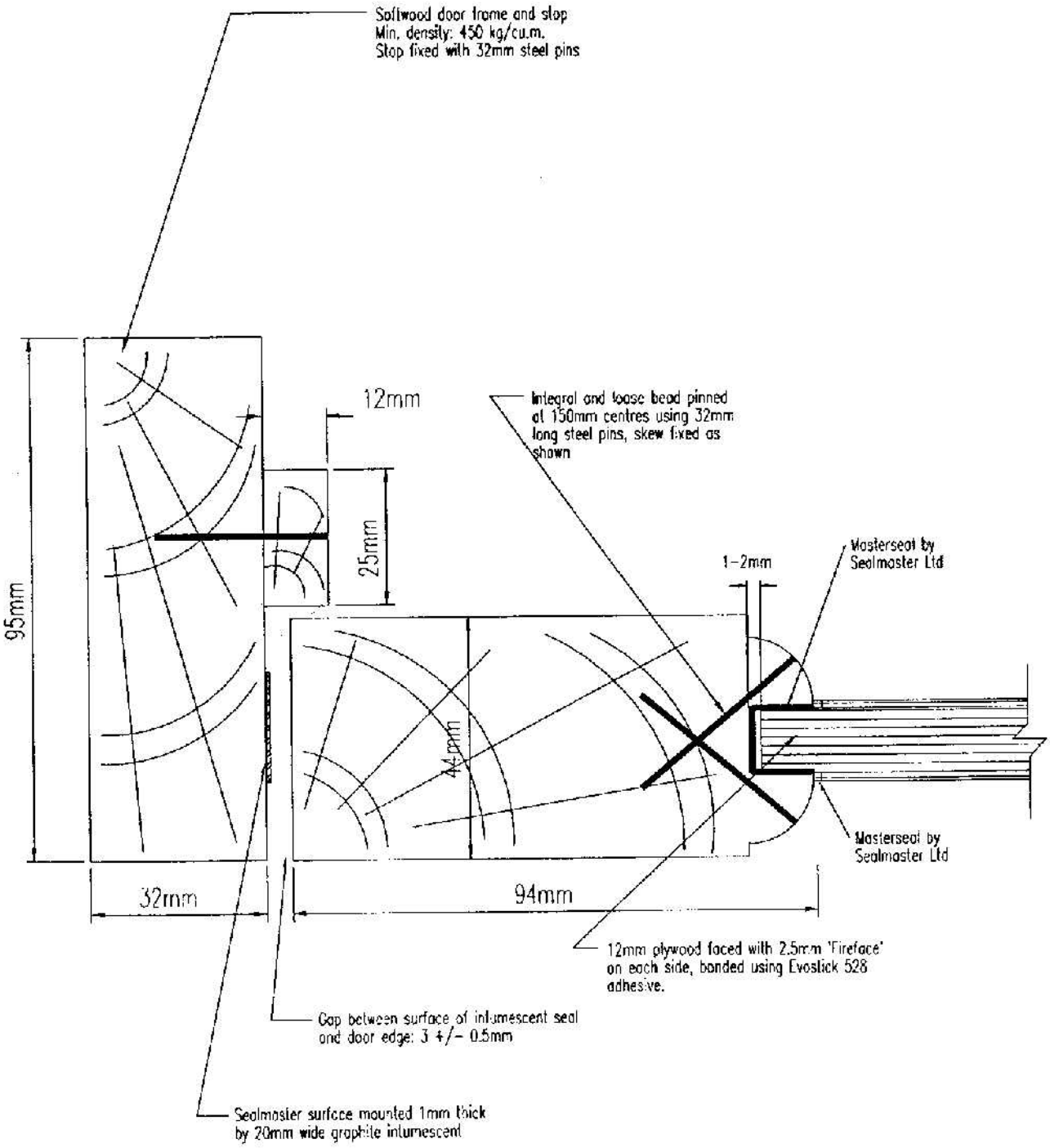


FIGURE 5

DOOR B - SECTION A-A & B-B

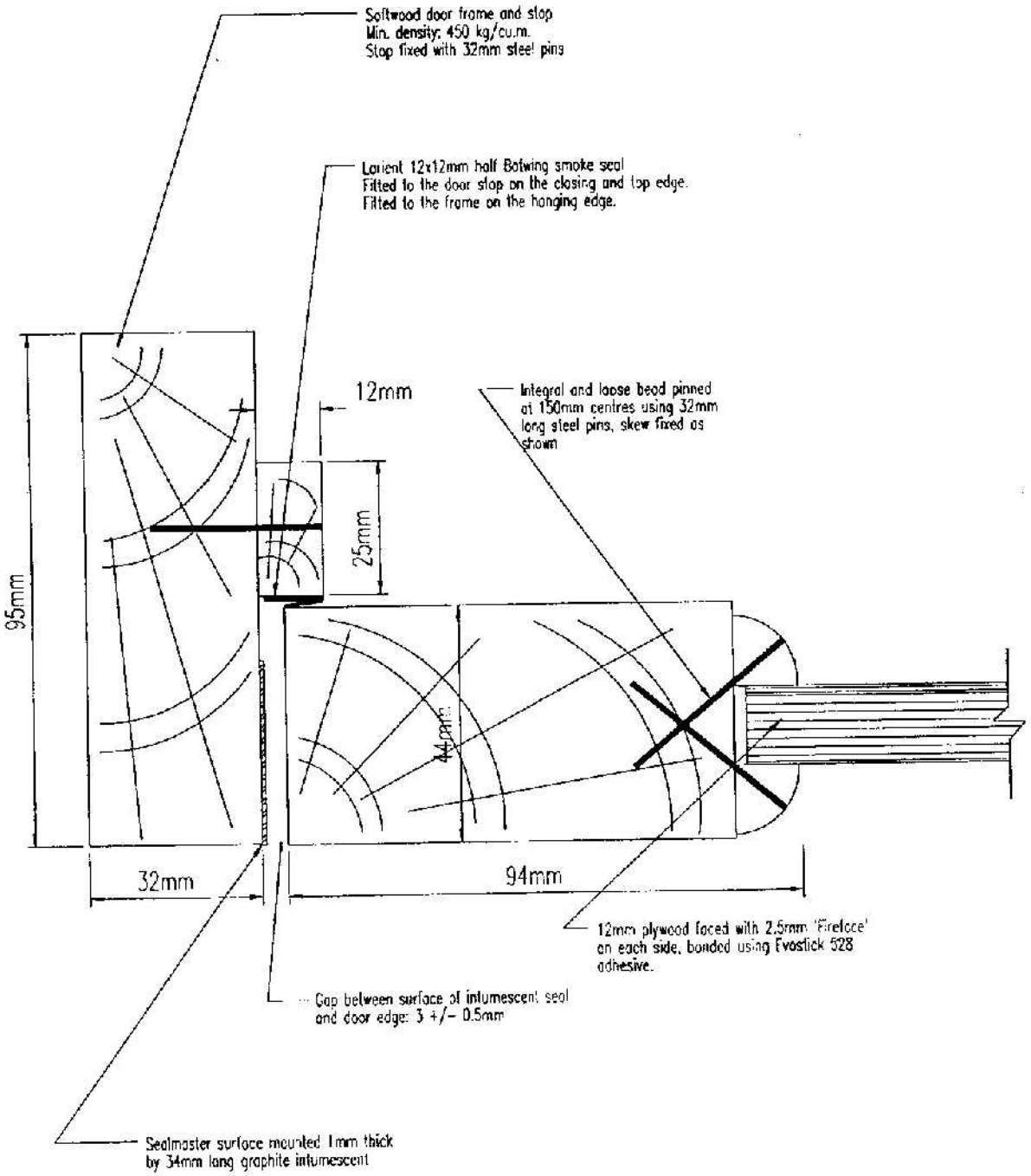


FIGURE 6

DOOR C - SECTION A-A

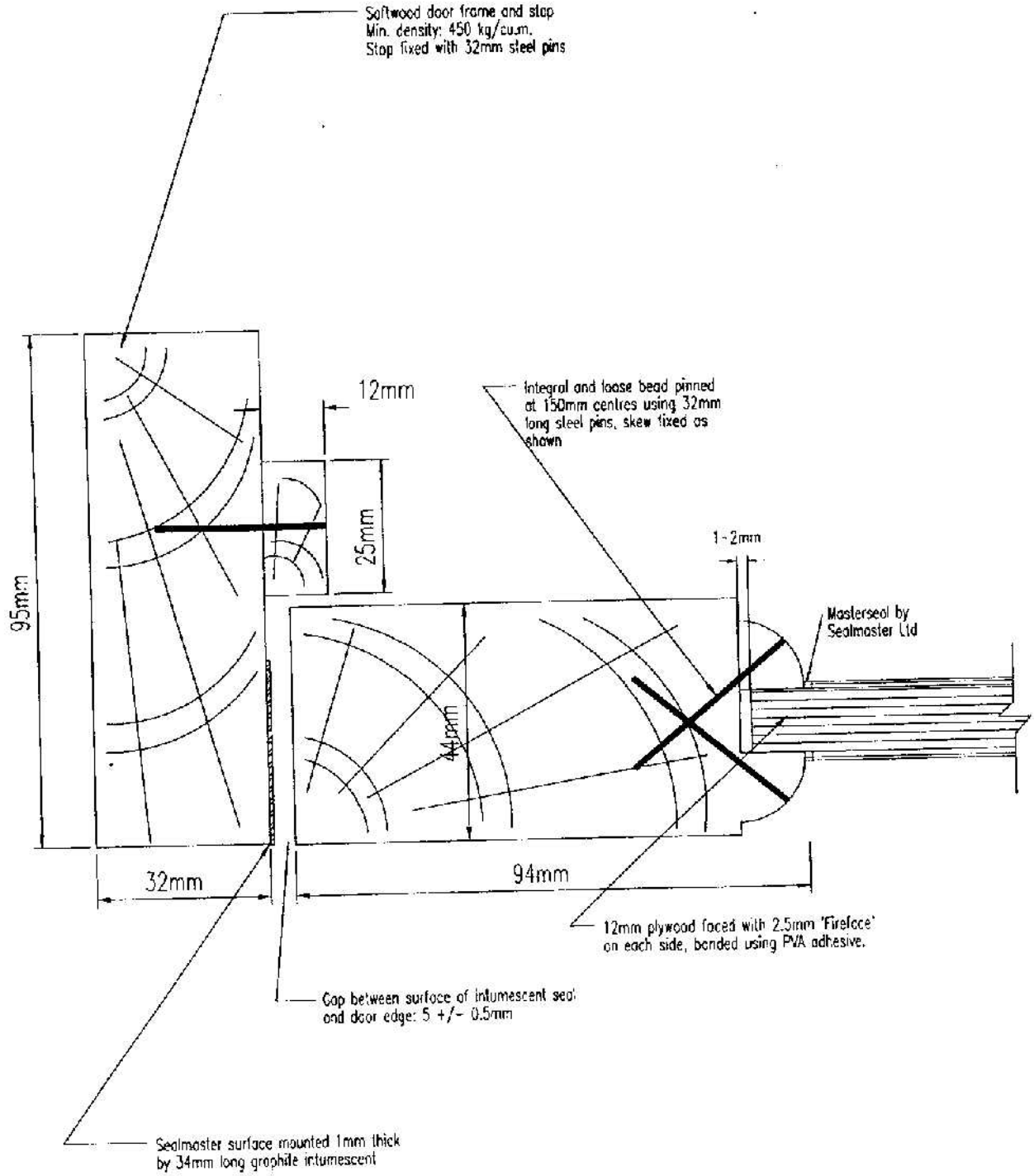


FIGURE 7

DOOR C - SECTION B-B

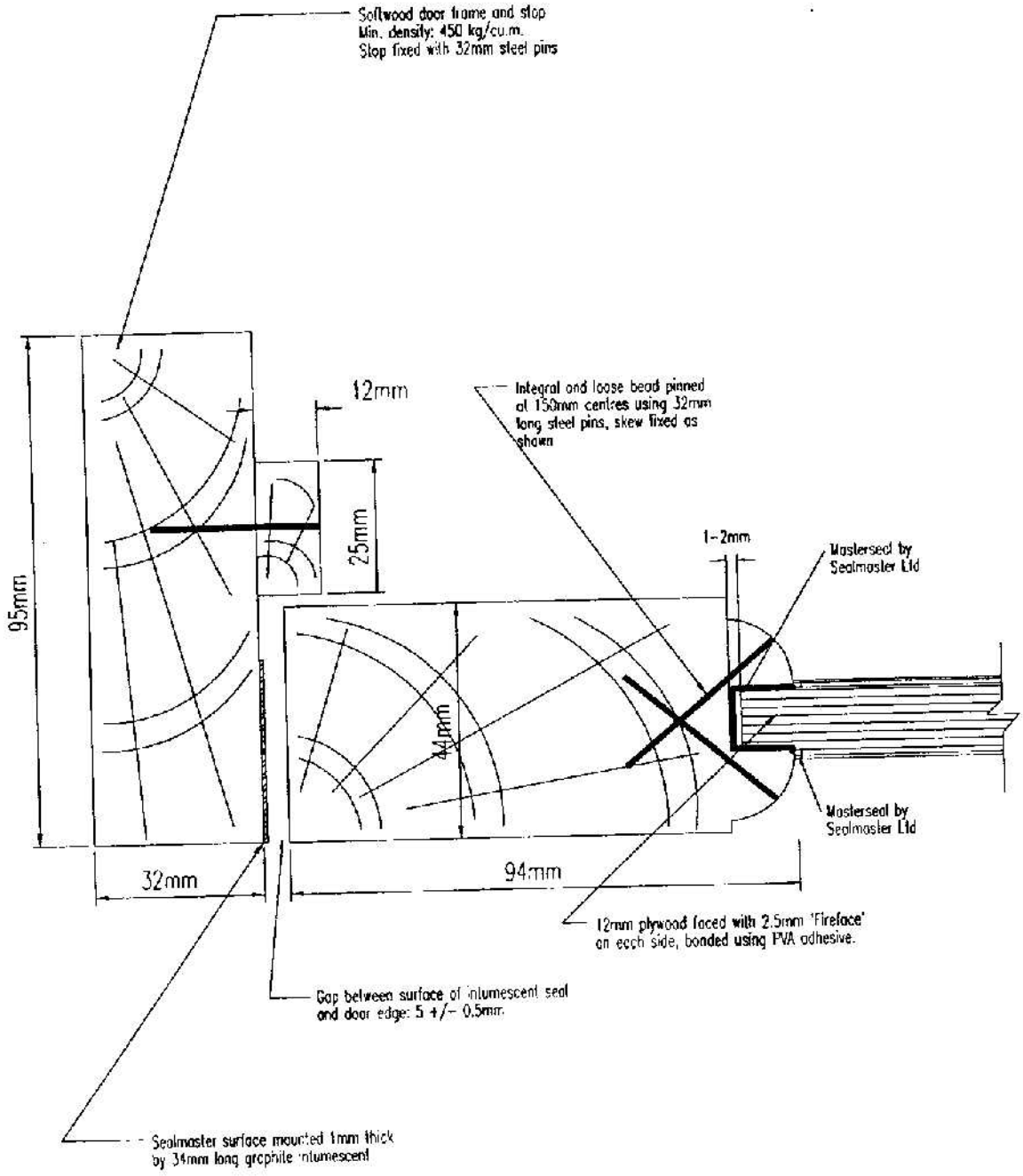
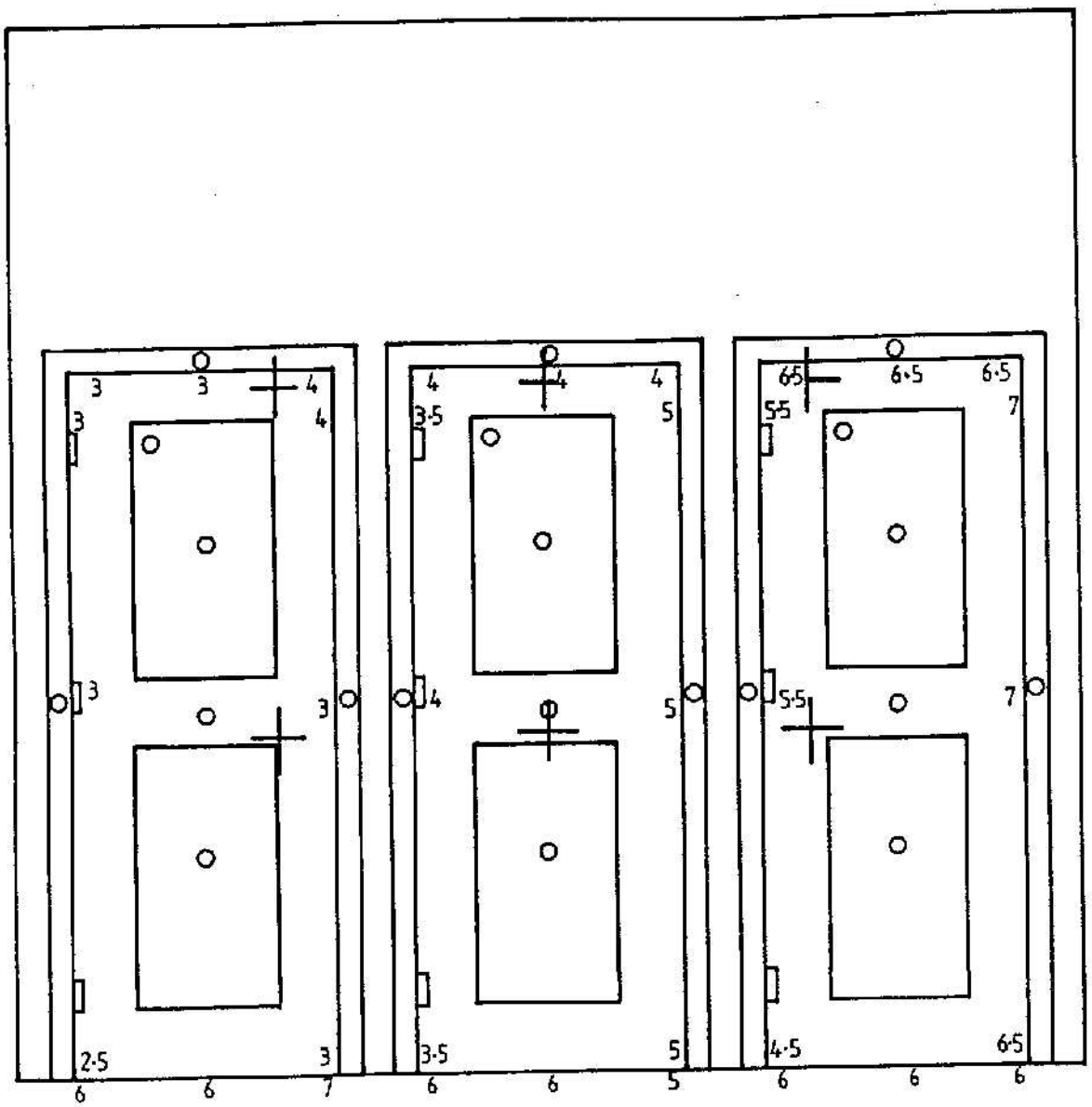


FIGURE 8



POSITION OF THERMOCOUPLES
and
DOOR GAPS (in mm)