

C A M B R I D G E
FIRE RESEARCH

FIRE TEST REPORT NUMBER CFR0610171

FIRE TEST GENERALLY IN ACCORDANCE WITH BS 476: PART 22: 1987

TEST SPONSOR: FIREWISE SUPPLIES LIMITED, Unit 5 The Old Brewery,
Brewery Road, Pampisford, Cambridge, CB22 3EW.

SUMMARY: A single acting, single leaf timber doorset was tested for 81 minutes generally in accordance with the test conditions laid out in BS 476: Part 22: 1987 to determine fire resistance.

The specimen satisfied the performance requirements specified in BS 476: Part 22: 1987 for the following period:

INTEGRITY: 76 minutes and 2 seconds

DATE OF TEST: 17th October 2006.

The test was witnessed by:

Mr P Grimwood	Cambridge Fire Research Limited.
Mr B Richardson	Cambridge Fire Research Limited.

PURPOSE OF THE TEST

To determine the fire resistance of a single acting, single leaf doorset, with leaf size 1830mm(h) x 818mm(w) x 54mm(thk), when tested generally in accordance with BS 476: Part 22: 1987.

SPECIMEN CONSTRUCTION

The specimen comprised a Halspan[®] 54 three-layer particleboard core fire blank set within a hardwood frame.

Door frame

	Species/type	Dimensions (mm)	Density (Kg/m ³)
Head & jambs	Sapele	95 x 45	650*
Head to jamb jointing detail	10mm rebate with 2 off 2 ½"xNo10 steel screws + PVA glue	-	-
Stops	Sapele affixed using 1"xNo.8 steel screws at 150 centres	13 x 40	650*
Threshold	Incombustible	150 x 30	-
Frame to supporting construction fixing detail	3 off steel angle brackets per jamb	100 mm high affixed 100 down, 100 up and central	-
Frame to supporting construction fire stopping detail	Evo-Stik Intucrylic Intumescent mastic to both faces	-	-

Leaf

	Species/type	Dimensions (mm)	Density (Kg/m ³)
Core	Halspan [®] 54	1830 x 818 x 54	630** @10% m/c
Facings	-	-	-
Lippings (all edges)	Sapele	10	650*
Adhesive (lippings)	Urea Formaldehyde		

*Nominal density

**Manufacturer's stated density.

Ironmongery

	Make/type	Size (mm)	Location
Hinges	3off Steel ball race butts	100 x 30 x 2.5	150 , 835 and 1520mm below leaf head
Latch/lock	Generic mortise latch/lock	Case: 150 x 90 x 14	1096 below leaf head to latch bolt c/l
		Forend: 230 x 25 x 2.75	
Handles	Generic aluminium	20 x 135 hook type	To suit latch spindle
Closer	Generic Size 3	Footprint - 245 x 40	Exposed face, to hanging stile

Intumescent detail

		Make/type	Size (mm)	Location
Door/frame gap	Head	Intumescent Seals Therm-A-Seal	2off 15x4	Frame reveal, 10mm apart and central to leaf thickness
	Jambs	Intumescent Seals Therm-A-Seal	2off 15x4	Frame reveal, 10mm apart and central to leaf thickness. 1 strip interrupted by hinges and keep
Latch/lock		Intumescent Seals Therm-A-Strip	Case: 1	To case faces
			Keep: 175x20x1	Under keep
Closer		Intumescent Seals Therm-A-Strip	Body: 245x40x1	Under closer body
			Arm: 60x17x1	Under bracket
Hinges		Intumescent Seals Therm-A-Strip	1	Under blades

The blockwork surround was built into a 2.22 metre (height) x 1.5 metre (width) steel frame.

Photographs of the tested construction before, during and after the test are shown in Figures 6 to 20

TEST CONDITIONS

Furnace pressure was maintained for the duration of the test at a nominal + 5.9 Pascals measured at the pressure sensing head which equates to a pressure of + 8.93 Pascals at the leaf head, corresponding to a leaf height of 2.05 metres. Figure 4 shows the furnace instantaneous and desired pressures ~ time curve.

Furnace temperature was controlled so as to nominally follow the time ~ temperature curve defined in BS 476: Part 20: 1987.

Figure 5 shows the “Standard” and actual furnace average time ~ temperature curves.

The specimen was orientated such that the leaf opened towards the heating conditions of the test.

Ambient temperature at the start of the test was 16.5 °C. Ambient temperature increased by 1.7 °C during the test.

INSTRUMENTATION AND MEASURING EQUIPMENT

Gap gauges (25 mm diameter and 6 mm diameter) were available to measure the diameter of any holes that developed and cotton pads for measuring permeability.

Ambient temperature (CH19) was monitored throughout the test.

A roving thermocouple (CH18) was available for measurement of any specific hotspots. Surface temperature monitoring thermocouples were affixed to the unexposed face of the leaf at the following positions:

Thermocouple channel 10:	central to the upper half of the leaf.
Thermocouple channel 12:	central to the lower half of the leaf.

These individual leaf temperatures are shown in Table 4.

Taut stainless steel wires were anchored to the surrounding blockwork horizontally across the unexposed face of the specimen such that any deflection experienced by the specimen could be measured. One wire was positioned 25 mm vertically below the head of the leaf, the second at mid-height and the third 25 mm vertically above the threshold.

Figure 1 shows the positions at which the deflections were measured and Table 1 is the recorded data at those positions.

The unexposed face of the leaf was marked at the hanging and closing stiles. Corresponding marks were made on the jambs as shown in Figure 2.

Measurements of leaf drop were recorded during the test and the recorded data are shown in Table 2.

ADDITIONAL MEASUREMENTS

The gap between the exposed leaf edge and the frame was measured prior to the start of the test. Figure 3 shows the position at which the measurements made and Table 3 shows the recorded data.

TEST OBSERVATIONS (E = Exposed face: U = Unexposed face)		
Time (min:sec)	Face	Observation
00:00		Start of the test.
00:45	U	Smoke/steam issues at mid-height of the closing stile.
02:20	U	Smoke/steam issues at the top hinge position and at the head/hanging stile corner.
03:00	U	Smoke/steam issues at the centre hinge position and at the closing stile adjacent to the latch.
10:00	U	Smoke/steam issues at both top corners. Staining is apparent at the head/closing stile corner and moisture is apparent where smoke/steam issues.
13:00	U	"Creaking" emanates from the specimen.
15:00	U	Smoke/steam issuing from the specimen has decreased in density.
26:00	U	Smoke/steam issuing at the top corners has increased in density. Staining has developed at the top corners.
28:00	U	Smoke/steam issues in the region of the latch rose.
31:00	U	Staining is apparent between the latch and lock roses.
34:00	U	Smoke/steam issuing in the region of the latch and lock roses has increased in density. Staining is apparent at the closing stile adjacent to the latch.
40:00	U	Smoke/steam issues at the top hinge position, both top corners, at the head, at the closing stile adjacent to the latch and at both roses.
48:00	U	Erosion of the bottom lipping nominally 100 mm from the closing stile is apparent.
52:00	U	Smoke/steam issues at the bottom hinge position. Staining is apparent at this position. Erosion of the bottom lipping develops. The intumescent seal is partially visible at the bottom of the closing jamb.
54:00	U	Staining in the region of the roses has developed. Smoke/steam issues at the centre hinge position.
59:00	U	Smoke/steam issuing at the centre hinge position has increased in density and also issues at the closing stile nominally 300 mm above the threshold.



61:00	U	A dull glow is apparent at the closing stile nominally 50 mm above the threshold.
63:40	U	A dull glow is apparent at the head/closing stile corner.
64:00	U	A cotton pad is applied at the head/closing stile corner.
64:14	U	The cotton pad is removed (no failure).
65:00	U	Glowing at the threshold adjacent to the hanging stile is apparent.
66:00	U	Glowing at the head/closing stile corner has developed.
67:00	U	Activated intumescent is apparent at the head. Glowing is apparent at the closing stile adjacent to the latch.
68:22	U	A cotton pad is applied at the bottom of the closing stile.
68:36	U	The cotton pad is removed (no failure).
69:00	U	Activated intumescent masks the head/closing stile corner where glowing has developed further.
71:50	U	A cotton pad is applied in the region of the head/closing stile corner.
72:04	U	The cotton pad is removed (no failure).
73:00	U	A cotton pad is applied at the bottom of the closing stile.
73:14	U	The cotton pad is removed (no failure).
74:10	U	Flame flashes occur at the closing stile adjacent to the latch.
74:15	U	A cotton pad is applied at the position of the flame flashes.
74:25	U	The cotton pad is removed (no failure).
75:00	U	A cotton pad is applied at the position of the flame flashes.
75:14	U	The cotton pad is removed (no failure).
75:52	U	Flaming commences at the closing stile adjacent to the latch.
76:02	U	INTEGRITY FAILURE is deemed to have occurred due to sustained flaming at the position noted at 75 minutes and 52 seconds. The failure position is sealed.
76:20	U	Flaming commences at the closing stile nominally 300 mm above the threshold.
76:30	U	Further integrity failure is deemed to have occurred due to sustained flaming at the position noted at 76 minutes and 20 seconds. The failure position is sealed.
77:00	U	Fissures are apparent at the top and centre hinge positions.
77:44	U	A cotton pad is applied at the top hinge position.
77:58	U	The cotton pad is removed (no failure). Flaming commences in the region of the lock rose.
78:08	U	Further integrity failure is deemed to have occurred due to sustained flaming at the position noted at 77 minutes and 58 seconds. The failure position is sealed. Glowing at the head/hanging stile corner is apparent.
79:08	U	Flaming commences at the closing stile nominally 400 mm above the threshold.
79:18	U	Further integrity failure is deemed to have occurred due to

		sustained flaming at the position noted at 79 minutes and 8 seconds. The failure position is sealed.
79:45	U	Glowing is apparent at the bottom hinge position.
80:22	U	Flaming commences at the bottom hinge position.
80:32	U	Further integrity failure is deemed to have occurred due to sustained flaming at the position noted at 80 minutes and 22 seconds. The failure position is sealed.
81:00		The test is terminated.

LIMITATIONS

1. The results relate only to the behaviour of the specimen of the element of construction under the particular conditions of test. They are not intended to be sole criteria for assessing the potential fire performance of the element in use, nor do they reflect the actual behaviour in fires.
2. The test results relate only to the specimen tested. Appendix A of BS476: Part 20: 1987 provides guidance information on the application of fire resistance tests and the interpretation of test data. Application of the results to specimens of different dimensions or supported other than by masonry / blockwork wall or incorporating different components should be subject of a design appraisal.
3. The doorset assembly was asymmetrical and was tested such that the door leaf opened towards the heating conditions of the test. The test results may not be appropriate to situations where the door leaf opens away from the heating conditions.

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Report prepared by:



B Richardson
Chief Technical Officer

Report checked by:



P Grimwood
Technical Manager

Report issued:

5th July 2007.

Figure 1

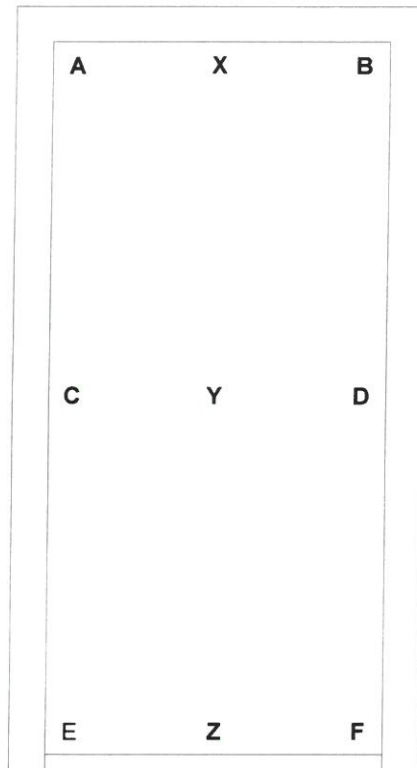


Table 1

Time (minutes)	Point of Measure								
	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	X (mm)	Y (mm)	Z (mm)
0	0	0	0	0	0	0	0	0	0
10	1	1	0	0	0	3	0	-2	1
20	3	5	0	0	1	5	0	-2	1
30	6	10	0	-3	2	6	5	-4	1
40	6	11	0	-3	3	7	3	-5	1
50	9	14	-1	-5	4	11	3	-10	0
60	14	16	-2	-6	8	17	3	-23	0
	Deflection (mm)								
	Positive values indicate deflection towards the heating conditions of the test.								

Figure 2

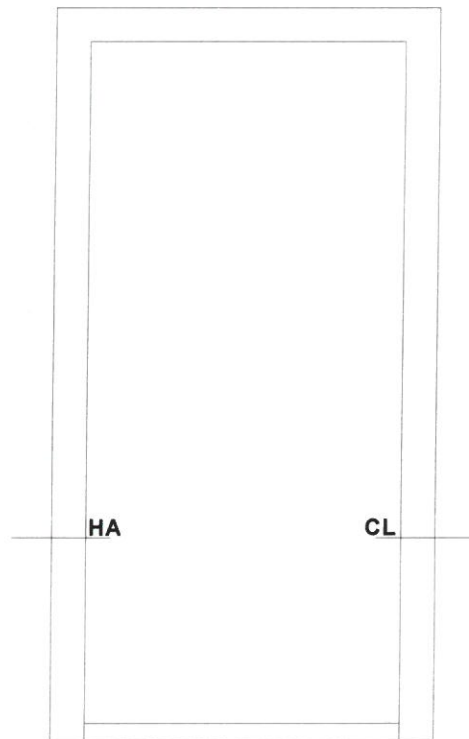


Table 2

Time (minutes)	Point of Measure	
	Hanging stile	Closing stile
0	0	0
10	0	1
20	2	3
30	3	4
40	3	4
50	3	4
60	3	4
	Leaf Drop (mm)	

Figure 3

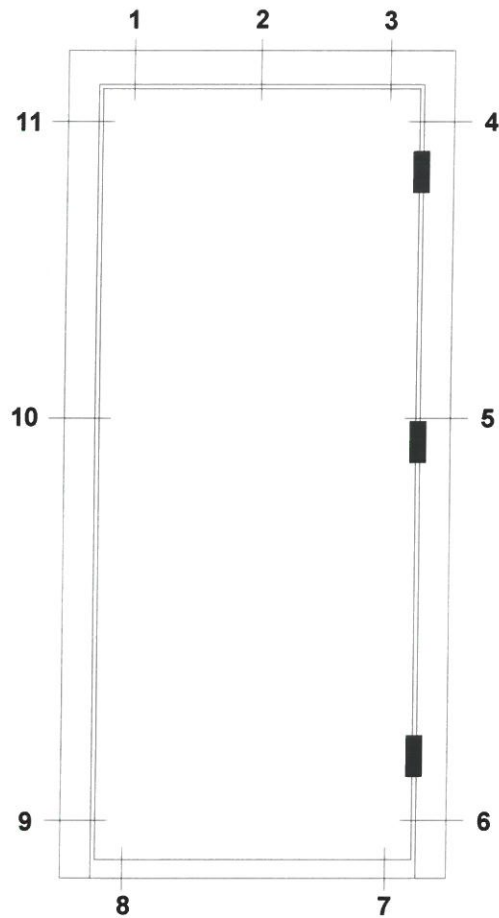


Table 3

Points of exposed leaf edge / frame gap prior to the test.			
Position No.	Gap (mm)	Position No.	Gap (mm)
1	3	7	2
2	3	8	2.5
3	2.75	9	3
4	3	10	3
5	3	11	2.75
6	2		

Figure 4

Actual and Desired Furnace Pressures ~ Time

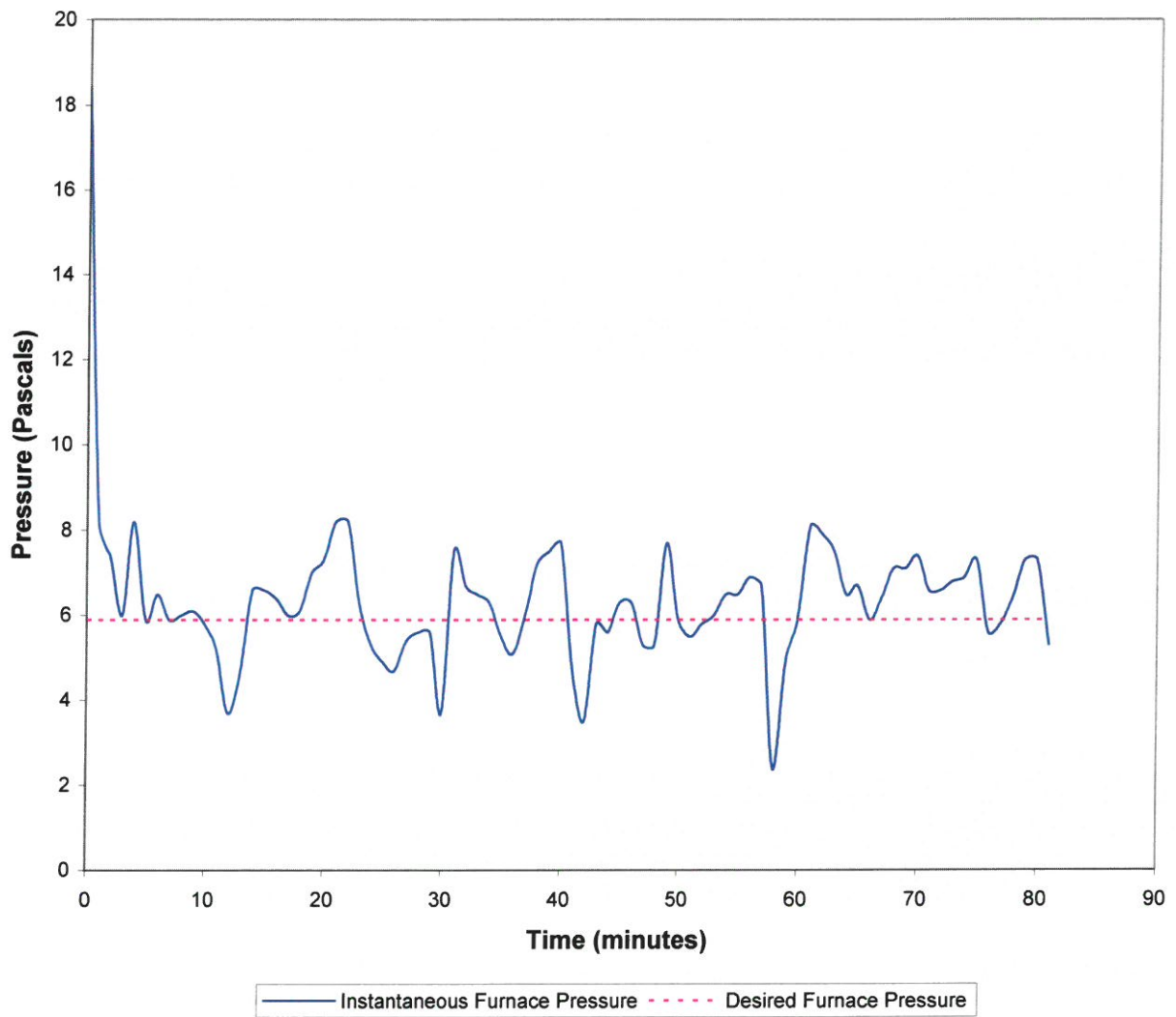


Figure 5

"Standard" and Actual Average Furnace Temperatures ~ Time

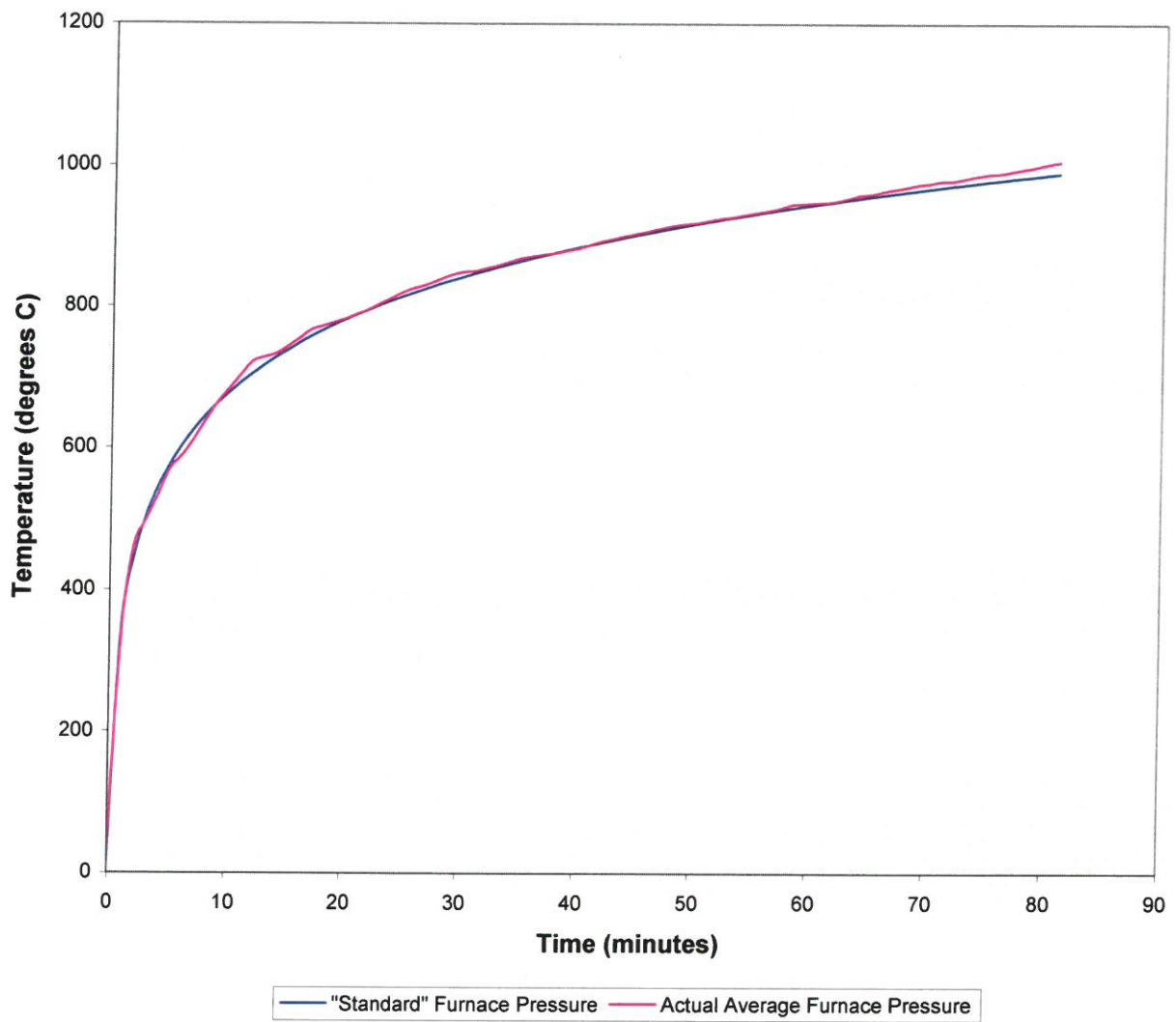


Table 4		
	Individual Leaf Temperatures	
Time	T/C CH10	T/C CH12
(minutes)	(deg. C)	(deg. C)
0	17.5	19
1	17.4	18.8
2	17.5	18.6
3	17.4	18.5
4	17.5	18.5
5	17.5	18.5
6	17.5	18.5
7	17.6	18.3
8	17.7	18.3
9	17.8	18.3
10	17.7	18.3
11	17.9	18.3
12	18	18.5
13	18.2	18.3
14	18.6	18.7
15	19.4	19.4
16	20.3	19.8
17	21.8	21
18	23.2	22.2
19	24.7	23.5
20	26.2	24.6
21	27.9	26.2
22	29.6	27.8
23	31.3	29.3
24	32.8	30.5
25	34.2	31.9
26	35.5	33
27	36.9	34.2
28	38.1	35.4
29	39.2	36.4
30	40.4	37.6
31	41.6	38.8
32	42.7	39.8
33	43.7	40.9
34	44.8	41.6
35	45.7	42.6
36	46.7	43.5
37	47.8	44.3
38	48.8	45

Table 4 (cont')		
Individual Leaf Temperatures		
Time (minutes)	T/C CH10 (deg. C)	T/C CH12 (deg. C)
39	49.7	46.1
40	50.6	47
41	51.8	48.4
42	52.8	49.4
43	53.7	50.4
44	54.9	51.8
45	55.8	53
46	57	54.3
47	58	55.8
48	59.1	56.8
49	60.2	58.1
50	61.4	59.7
51	62.6	60.9
52	63.8	62.2
53	64.9	63.4
54	66.1	65
55	67.2	66.3
56	68.1	67.5
57	69.1	68.9
58	70.2	70
59	71.3	71.3
60	72.3	72.6
61	73.2	73.6
62	74.3	74.9
63	75.1	75.8
64	76.2	76.9
65	77	77.9
66	78	78.9
67	78.7	79.7
68	79.4	80.3
69	80.2	81.4
70	81	82.2
71	81.6	83.1
72	82.3	83.8
73	83.2	84.7
74	83.9	85.8
75	84.7	86.3
76	85.7	87.3



Table 4 (cont')		
Individual Leaf Temperatures		
Time (minutes)	T/C CH10 (deg. C)	T/C CH12 (deg. C)
77	86.2	88
78	87.3	88.9
79	88.2	89.7
80	89.1	90.6
81	89.8	91.3

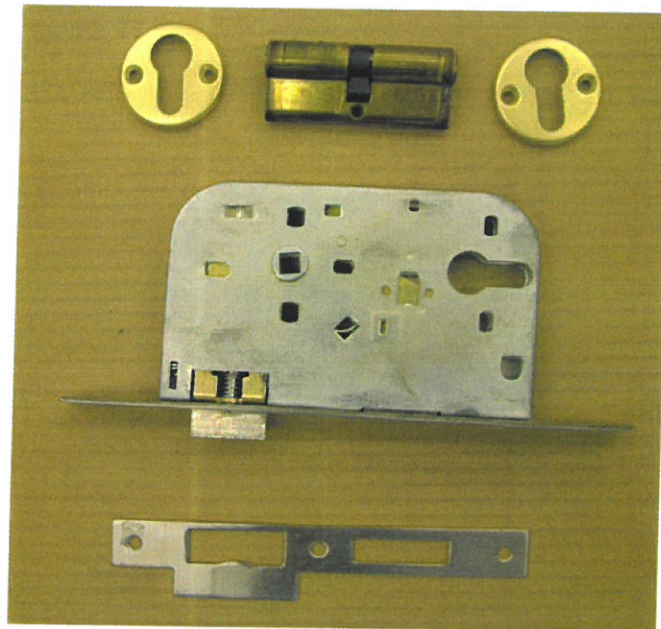


Figure 6

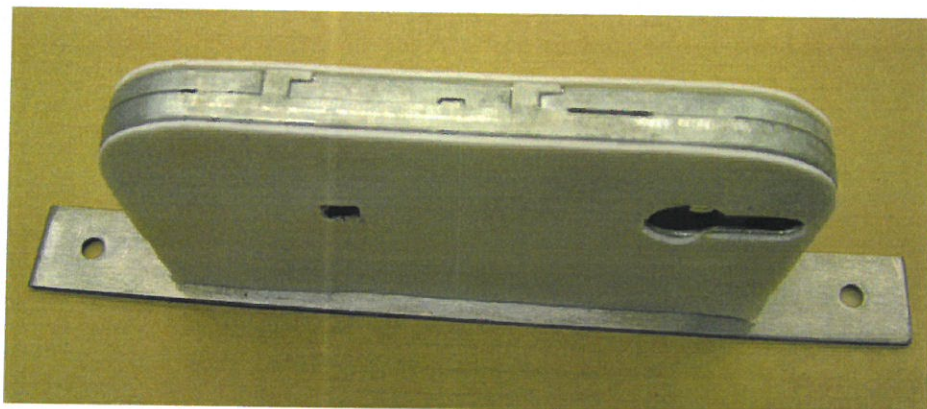


Figure 7

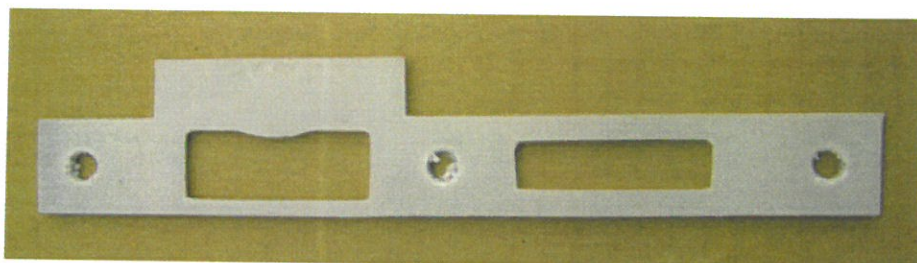


Figure 8



Figure 9



Figure 10



Figure 11



Figure 12



Figure 13



Figure 14

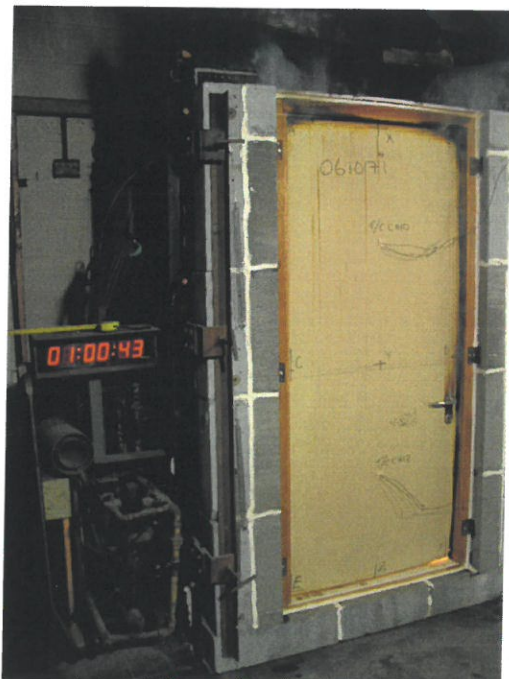


Figure 15

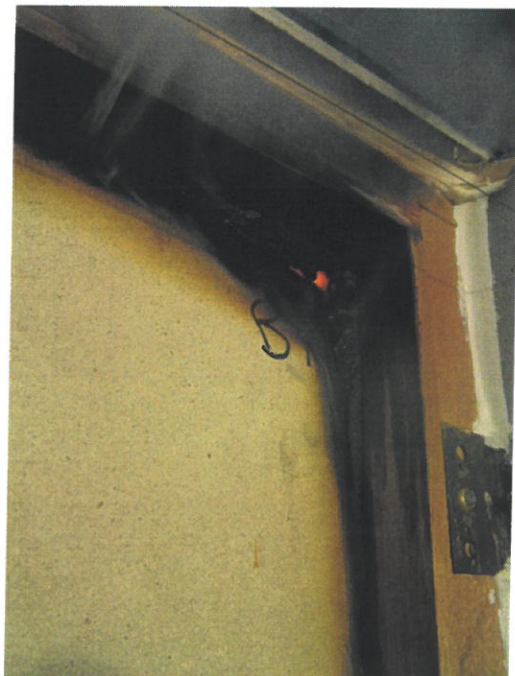


Figure 16