



CONFIDENTIAL

FIRE TEST SECTION

REPORT NO FR1632

**REPORT OF A FIRE RESISTANCE TEST
PERFORMED ON
TWO SINGLE LEAF, SINGLE ACTING
GLAZED DOORSETS**

**FOR: INTUMESCENT SEALS LIMITED
UNIT 3
THE OLD BREWERY
PAMPISFORD
CAMBRIDGE
CB2 4EW**

DATE OF TEST: 14th July 1992

PROJECT NO : TFETF 20349

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SUMMARY

STANDARD: BS476 : PART 22 : 1987

A fire resistance test was performed on two single leaf, single acting glazed doorsets of different designs, left leaf designated A and right leaf designated B.

Both doorleaves were of flush leaf construction measuring 2040mm high x 900mm wide x 54mm thick and contained a glazed aperture of sight size 595mm high x 545mm wide.

Doorleaf A was a Shadmaster 60 design, manufactured in accordance with Product Specification 808/H5, consisting of a laminated softwood core, overlaid on both sides with a chipboard facing. Hardwood lipping was used on all external edges. An aperture was created centrally in the top half of the leaf lined with hardwood beading to accept 6mm thick Georgian wired polished plate glass.

Doorleaf B was a Noberne 60 design, manufactured in accordance with Product Specification 803/C4, consisting of a flaxboard core with softwood framing, overlaid on both sides with a layer of non-combustible board and faced with chipboard. Hardwood lipping was applied to the vertical edges only. An aperture was created centrally in the top half of the leaf lined with hardwood beading to accept 6mm thick Georgian wired polished plate glass.

Both leaves were hung in hardwood frames on three, steel, lift off type hinges per leaf and fitted with latch sets which were disengaged for the test, with overhead closers on the exposed faces. Intumescent seals were incorporated in both doorsets. The glazing sealing system incorporated in both doorsets was Intumescent Seals Limited 'THERM-A-GLAZE 60'.

The doorsets achieved the following fire resistance performance ratings:

	Doorset A	Doorset B
Integrity:	71 minutes	70 minutes
Insulation:	71* minutes	70* minutes

*In accordance with the note to clause 7.6.1.1 of BS 476 : Part 22 : 1987, the glazing has not been evaluated for insulation.

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1. INTRODUCTION

- 1.1 This test was performed at the request of the sponsor, to determine the fire resistance performance of two single leaf doorsets, when tested in accordance with the conditions specified in BS 476 : Part 22 : 1987. The doorsets were mounted in a timber stud/plasterboard clad partition forming one side of the test furnace.
- 1.2 The doorsets were hung to open towards the furnace, as this was considered the weaker direction on exposure to fire, based on previous experience with specimens of this type.
- 1.3 The procedures adopted during the test followed the resolutions of the Fire Test Study Group, where appropriate. These resolutions provide the basis of common agreements between the consultant fire test laboratories in the UK, on areas of the test specification which may be ambiguous or open to interpretation.

2. CONSTRUCTION

2.1 General

The specimens were manufactured and supplied for test by F R Shadbolt & Sons and Noberne Doors Limited. All intumescent material was supplied by Intumescent Seals Limited. TRADA Technology Limited (TTL) manufactured a timber stud/plasterboard clad partition and installed the specimens into the partition.

The specimens were two unlatched, single leaf, single acting doorsets. The left hand specimen designated A and the right hand specimen designated B.

2.2 Doorleaves

Doorleaf A was 2040mm high x 900mm wide x 54mm thick. The leaf was designated as a Shadmaster 60, fire resisting doorleaf, manufactured in accordance with TRADA Product Specification 808/H5. An aperture was cut out of the upper half of the leaf positioned centrally 200mm below the head of the leaf. The aperture was fitted with 6mm thick Georgian wired polished plate glass, incorporating Intumescent Seals Limited 'THERM-A-GLAZE 60' system. Utile (measured density 616 kg/m³) 30mm x 24mm bolection mouldings were used to retain the glazing and sealing system in position, screw fixed at nominally 145mm centres for the horizontal beadings and nominally 157mm centres for the vertical beadings. All beading used had received no form of preservative or fire retardent treatment. All screws were fixed at an angle of 29.5° from the vertical. The sight size of the glass was 595mm high x 545mm wide.

Doorleaf B was 2040mm high x 900mm wide x 54mm thick. The leaf was designated as a Noberne Series 1 fire resisting doorleaf, manufactured in accordance with TRADA Product Specification 803/C4. A glazing aperture was cut out, as in doorleaf A and fitted with an identical glazing system, with the exception that the aperture was lined with 16mm thick dark red meranti between the non-combustible layers and the bolection mouldings were made from 27mm x 25mm dark red meranti (measured density 722 kg/m³). These were fixed at nominally 210mm centres for the horizontal beadings and nominally 157mm centres for the vertical beadings. All beading used had received no form of preservative or fire retardent treatment. All screws were fixed at an angle of 17.5° from the vertical. The sight size of the glass was 595mm high x 545mm wide.

2.3 Doorframe

Doorleaf A was hung in a 90mm x 45mm Utile doorframe with a 25mm x 19mm deep planted stop, whilst doorleaf B was hung in a 94mm x 57mm with 19mm deep rebate dark red meranti doorframe.

2.4 Ironmongery

Doorset A

The leaf was hung on 3 no. 100mm x 30mm Royde and Tucker type 101, steel, lift off hinges with a steel mortice latch. The glazing beads were fixed using 63.5mm, No 8 zinc plated steel screws, with surface cups.

Doorset B

The leaf was hung on 3 no. 100 x 30mm, ASSA 3228 zinc plated steel, lift off hinges with an aluminium cylinder latch. The glazing beads were fixed using 50.8mm, No 8 brass plated steel screws with countersunk cups.

2.5 Intumescent Materials

All intumescent materials used were manufactured by Intumescent Seals Limited.

Doorset A had 1 no. 10mm x 4.8mm 'THERM-A-STOP' intumescent/brush seal strip, and 1 no. 10mm x 4mm 'THERM-A-SEAL' intumescent strip running parallel up both jambs and across the head of the doorframe reveal which was partially interrupted at the ironmongery positions. The 'THERM-A-STOP' seal was positioned towards the stop side of the doorframe.

Doorset B had 1 no. 10mm x 3mm 'THERM-A-SMOKE' brush seal, fitted around the inner face of the door stop. 1 no. strip of 25mm x 2mm 'THERM-A-FLEX' was concealed behind the lipping on the vertical edges of the leaf and 1 no. 20mm x 4mm strip of 'THERM-A-SEAL' intumescent strip was fitted centrally in the frame head reveal.

The 'THERM-A-GLAZE 60' system incorporated in both doorsets, comprised a 54mm x 2mm 'THERM-A-LINE' intumescent strip, lining the glazing aperture and 2 no. 25mm x 4mm 'THERM-A-BEAD' intumescent strips, placed between the rear face of the beading and the glass.

A non-combustible threshold was fitted to the doorsets. Details of the construction are shown in Figures 3-5.

3. TEST PROCEDURE

3.1 Before the test the satisfactory operation of the doorsets were checked and the gaps between the doors and frames recorded. The moisture contents of component parts of the specimens were measured, with a Protimeter and were found to be as follows:

	Doorset A	Doorset B
a) faces	14-17%	10-11%
b) door frame	10-11%	11-12%

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- 3.2 The moments required to open and close the doors against the forces of the closers were measured. Measurement was carried out in accordance with BS 6459 : Part 1 : 1984. The left door required 28 Nm to open and 5 Nm to resist closing. The right door required 80 Nm to open and 5 Nm to resist closing.
- 3.3 When testing doorsets in accordance with BS 476 : Part 22 : 1987, it is necessary to determine the level of insulation they provide since this dictates the exact test procedure. There are three categories of fire resisting doorsets as follows:
- 3.3.1 Fully insulated doorsets are those designed to provide insulation for the expected duration of the test.
- 3.3.2 Partially insulated doorsets are those designed to provide insulation for a period shorter than the expected duration of the test and include insulated doorsets incorporating non-insulating features, such as conventional glazing, where such areas form less than 20% of the surface area of the specimen.
- 3.3.3 Uninsulated doorsets are those which provide little or no insulation including otherwise insulating doorsets fitted with non-insulating features where such features form more than 20% of the area of the specimen.
- The doorsets in this test are therefore designated as being partially insulated.
- 3.4 Thermocouples were fitted in accordance with BS 476 : Part 22 : 1987. Six suitably distributed thermocouples monitored the furnace temperature and six disc type surface thermocouples were fixed to the unexposed face of each door to monitor the insulation performance. A further three surface thermocouples were attached to each doorframe, one at midheight on each jamb and one centrally above the leaf on the frame head. The door gaps and thermocouple positions are shown in Figure 6 and the unexposed face thermocouple readings are shown graphically in Figure 7.
- 3.5 The furnace was operated to follow as closely as possible the temperature/time relationship specified in BS 476 : Part 20 : 1987 and the temperatures recorded are shown graphically in Figure 8.
- 3.6 The furnace pressure was measured 1m from the notional floor level and was continuously controlled as closely as possible after the first five minutes, to provide a 0 (± 2 pascals) pressure differential for the duration of the test, to give a neutral pressure axis at 1m above notional floor level.
- 3.7 At the conclusion of the test, the furnace was shut down and the specimens hosed with water.
- 3.8 Observations were made during the test and these are recorded in Section 4. The comments refer to the unexposed side of the specimens unless otherwise stated.
- 3.9 The distortion of the leaves was monitored and is recorded in Figures 1 and 2.
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4. OBSERVATIONS

Time	Comments
00.00	Test started
01.33	Doorsets A and B, glass beginning to crack.
04.07	Doorsets A and B, glass continuing to crack, mainly around the perimeter edges.
05.30	Doorset B, smoke beginning to issue from the top of the opening edge.
06.30	Doorset A, still fairly flush against the stop. Doorset B, slight distortion of the opening edge, fairly flush against the stop at the top and bottom corners, middle moved approximately 6mm towards the furnace.
09.00	Doorset B, smoke still issuing from towards the top of the hanging edge and central position of the head. Doorset A, almost no smoke issuing from the perimeter of the leaf.
12.26	Doorset B, distortion towards the furnace on the opening edge by approximately 7 - 8mm at the latch position, approximately 2mm at the bottom and approximately 5mm at top. Smoke also issuing from the top third of the opening edge. Doorset A, almost no smoke issuing at all.
13.28	Doorset B, pops, bangs and wisps of smoke from the foot of the leaf.
18.00	Doorset A and B, the intumescent seal around the unexposed face of both glazed apertures beginning to activate and bubble out between the bead and the glass. Doorset B, smoke issuing from the right vertical edge of the glazing more so than anywhere else and from the top opening corner of the door leaf.
21.33	Doorsets A and B, smoke increasing from the perimeters of both glazed apertures. Smoke is slightly heavier from doorset B.
27.00	Doorset B, copious smoke issuing from the top opening corner. An attempt was made to close the leaf by engaging the latch but the unexposed face handle came away without engaging the latch. Smoke increasing from around the perimeters of both glazed apertures.

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- 33.35 Doorsets A and B, both panes of glass are distorting towards the furnace slightly, with copious smoke issuing from the perimeters of both panes. Doorset B, copious smoke issuing from the latch position and upper half of the opening edge.
- 48.00 Doorsets A and B, smoke still issuing from the perimeters of both glazed apertures. Smoke also issuing from all top corners of both doorsets.
- 55.25 Doorsets A and B, glass panes in both leaves beginning to distort further towards the furnace now with no signs of any glows on the beads, smoke has also decreased slightly.
- 58.00 Doorset B, beginning to get smoke issuing from the hanging edge approximately 800mm from the head with wisps of smoke also from both top corners. Doorset A, smoke issuing from both top corners.
- 60.00 Both leaves still satisfactory.
- 65.00 Doorset B, there is a glow in the bottom opening corner, still within the frame rebate. Doorset A, top corners beginning to distort towards the furnace.
- 67.00 Doorsets A and B, glass beginning to take on an 'S' bend formation with the top moving away, and the middle moving towards the furnace.
- 67.00 Doorset B, intermittent flaming from the top opening corner which extinguished itself. There is however, still a glow at this position.
- 70.03 Doorset B, continuous flaming from a central position on the top glazing bead constituting integrity failure.
- 71.30 Doorset A, continuous flaming from the top opening corner constituting integrity failure.
- 71.48 Doorset A, flaming has spread across the head, still no failure from the glazing yet.
- 73.34 Doorset A, continuous flaming from the top glazing bead constituting further integrity failure. Doorset B, simultaneously continuous flaming from the bottom hinge position.

5. COMMENTARY

Doorset A failed under the integrity criterion at 71 minutes, due to continuous flaming initiating from the top opening corner. Insulation failure was deemed to have occurred simultaneously.

Doorset B failed under the integrity criterion at 70 minutes, due to continuous flaming initiating from the upper section of beading surrounding the glazed aperture. Insulation failure was deemed to have occurred simultaneously.

6. CONCLUSION

When tested in accordance with the provisions of BS 476 : Part 22 : 1987, the doorsets described in the construction section of this report achieved the following fire resistance performance ratings:

	Doorset A	Doorset B
Integrity	71 minutes	70 minutes
Insulation	71* minutes	70* minutes

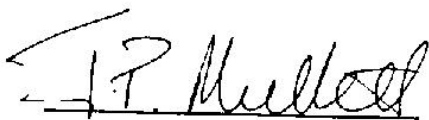
*In accordance with the note to clause 7.6.1.1 of BS 476 : Part 22 : 1987, the glazing has not been evaluated for insulation.

7. INTERPRETATION

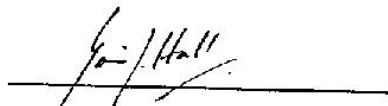
The results of this test only relate to the behaviour of the specimen of the element of construction under the particular conditions of test. They are not intended to be the sole criteria for assessing the potential fire performance of the element in use, nor do they reflect the actual behaviour in fires.

The results of this test were obtained using door to frame gaps as recorded in Figure 1632-6. The fire resistance performance of doors of this design may change if substantially different gaps are employed.

The results from this test were obtained with the doorset opening towards the furnace. The performance of the specimen was such that we are of the opinion that it was tested from the weaker direction of exposure to fire. The results are therefore applicable to both directions of exposure



J P MULLETT
Officer Responsible for Test



Issued under the Authority of
Dr G S Hall

21 August 1992

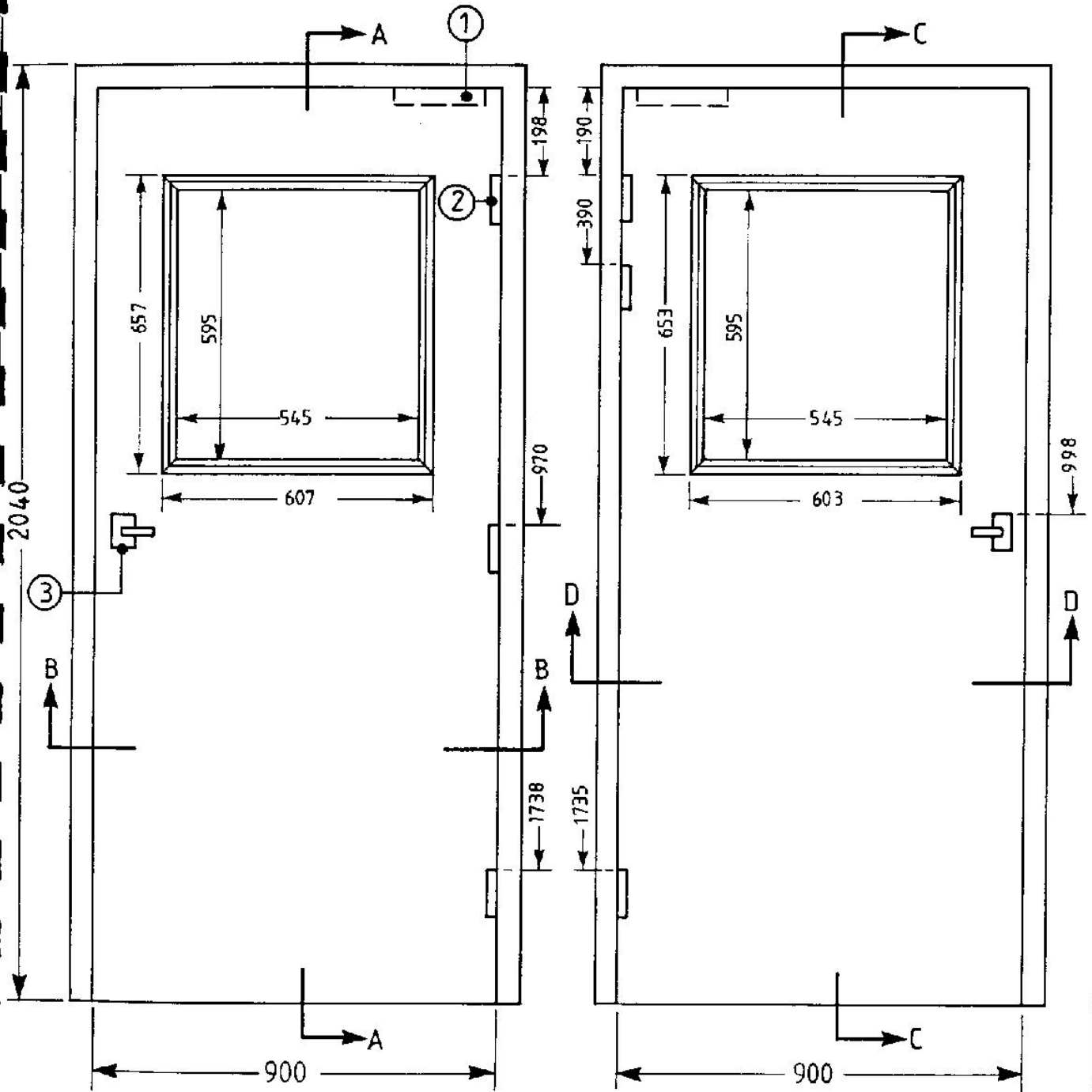
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KEY TO FIGURES 3-5

All dimensions on Figures in millimetres. Do not scale.

1. Overhead closer
2. Hinge
3. Latch
4. 90 x 45 doorframe plus 19 deep planted stop
5. 10 x 4.3 intumescent/brush seal strip
6. 10 x 4 intumescent strip
7. 10 thick hardwood lipping
8. 10 thick chipboard
9. 34 x 6 laminated softwood core
10. 54 x 2 intumescent strip lining
11. 30 x 24 hardwood bolection moulding
12. 25 x 4 intumescent strip
13. 6 thick Georgian wired polished plate glass
14. 94 x 57 doorframe rebated 19 deep
15. 20 x 4 intumescent seal
16. 10 x 3 brush seal
17. 63 x 36 softwood internal framing
18. 4 thick chipboard
19. 4.5 thick masterclad
20. 38 thick flaxboard
21. 27 x 24 hardwood bolection moulding
22. 25 x 2 intumescent strip
23. 63.5 long screws with surface cups
24. 50.8 long screws with countersunk cups
25. 16 thick hardwood lining



ELEVATION AND IRONMONGERY

All dimensions in mm

FIG. 1632-3

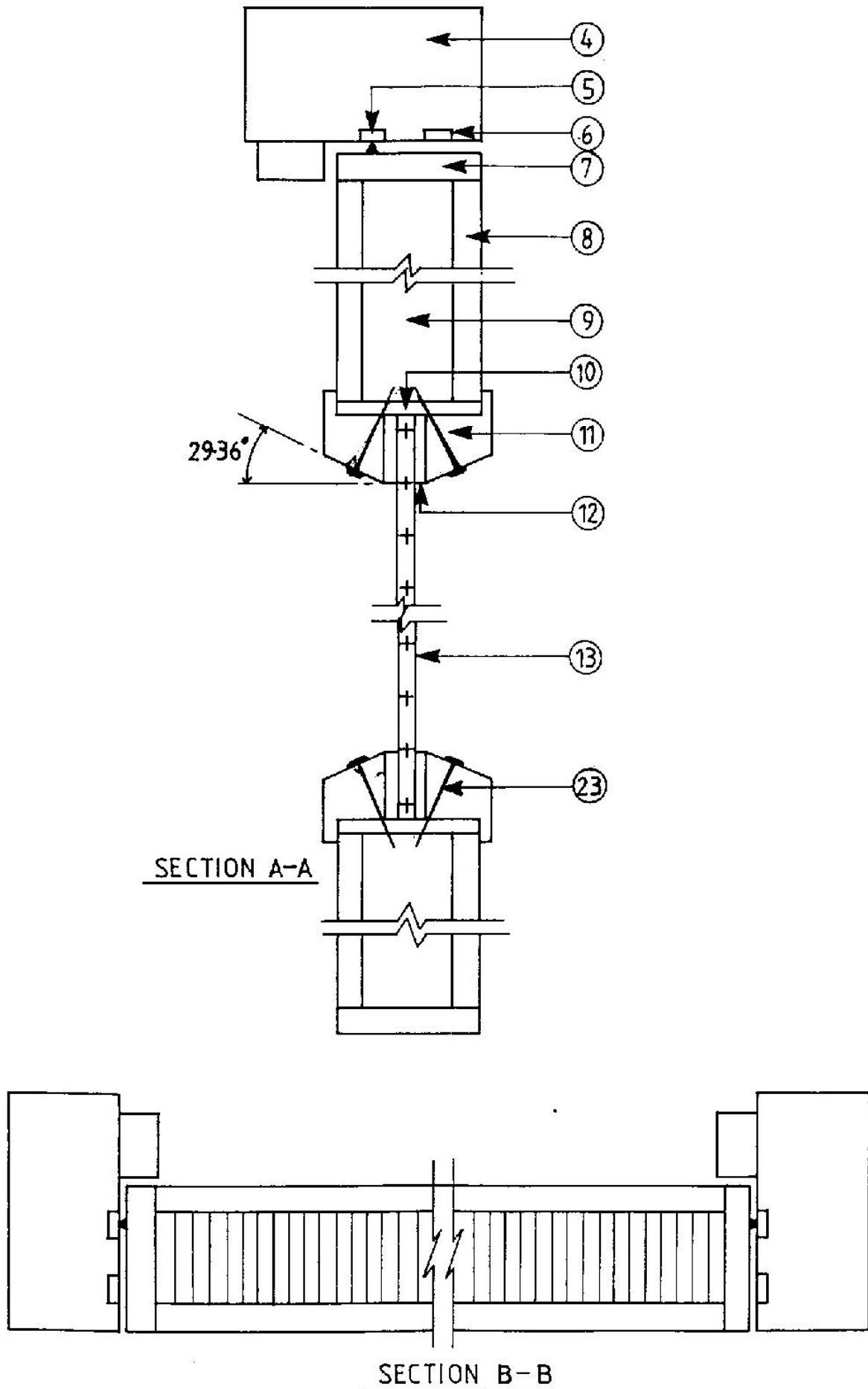


FIG 1632-4

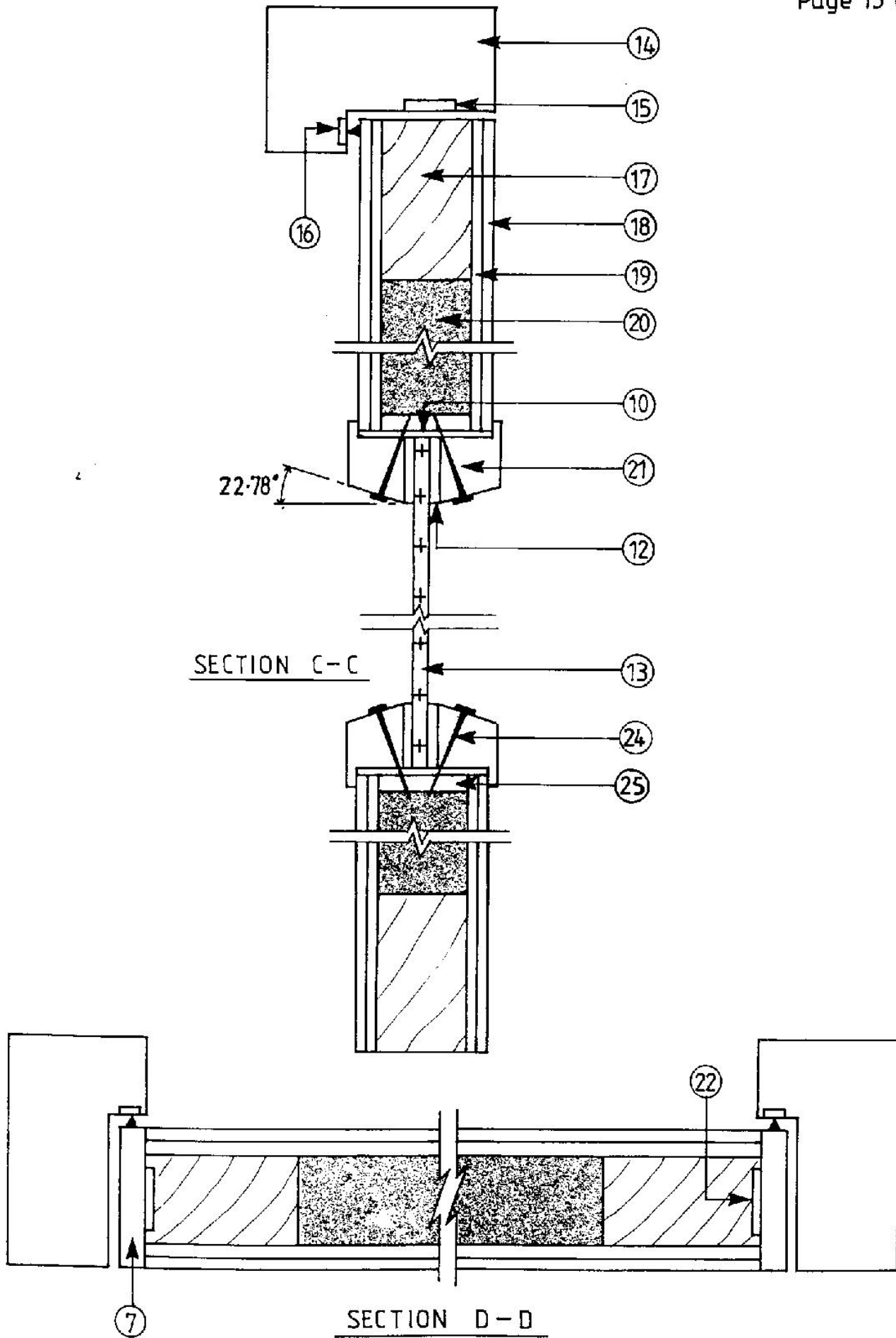


FIG. 1632-5