

BRE Global Assessment Report

An assessment of the fire performance of single-acting, single- and double-leaf hinged steel doorsets, with and without vision panels against BS 476: Part 22: 1987

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1 Introduction

Fire resistance tests in accordance with BS 476: Part 22: 1987 have been carried out on single-acting, single- and double-leaf hinged steel doorsets for Design and Supply Limited. This assessment report considers the fire performance of doorsets incorporating variations to the tested designs.

2 Scope

This assessment report considers the fire resistance of single-acting, single- and double-leaf hinged steel doorsets, with and without glazing, against the integrity criteria of BS 476: Part 22: 1987, for fire exposures of up to 240 minutes from either side.

3 Supporting data

This assessment is based on supporting test data which is more than five years old. This supporting data has therefore been reviewed against current test procedures.

3.1 Aycliffe Fire Testing Facility test report AFTF/321163

A fire resistance test in accordance with BS 476: Part 22: 1987 was carried out on a single-acting, double-leaf hinged steel doorset, overall dimensions 2300mm wide x 2400mm high, on 11 June 2003 for a duration of 247 minutes.

The doorset comprised door leaves, overall dimensions 1105.5mm wide x 2353mm high x 45mm thick, consisting of 1.6mm-thick steel facings and a core of 45mm-thick Rockwool RWA45 stone mineral wool. The facings were folded along their vertical edges so that they interlocked with one another. Each leaf included three vertical steel stiffeners, each comprising two sections, the first, a top-hat section, 15mm x 41.5mm x 100mm x 41.5mm x 15mm x 1.2mm thick, slid into the second which was 145mm wide x 1.2mm thick with a 19mm return along each edge. The two outer stiffeners were positioned so that their centrelines were 293mm from each edge of the leaf, and the third was positioned equidistant between these.

The door frame was fabricated from 1.6mm-thick steel and had overall dimensions 102mm deep x 63mm wide with a 48mm-deep x 25mm-wide rebate.

The doorset was fitted with a Nemef 6109 sash lock and each leaf was hung on two pairs of stainless steel ball-bearing hinges. The passive leaf was also fitted with a Zero Seals Z001 aluminium concealed bolt.

For the purposes of the test the passive leaf was locked using the flush bolts and the active leaf latched.

In the orientation tested, door leaves opening away from the furnace, the doorset achieved the following performance:



Integrity:	247 minutes
Insulation (frame):	13 minutes
Insulation (leaf):	17 minutes

3.2 Aycliffe Fire Testing Facility test report AFTF/352763/A

A fire resistance test in accordance with BS 476: Part 22: 1987 was carried out on a single-acting, single-leaf hinged steel doorset, overall dimensions 1000mm wide x 2400mm high, on 27 June 2003 for a duration of 375 minutes.

The doorset comprised a door leaf, overall dimensions 1105.5mm wide x 2353mm high x 45mm thick, consisting of 1.6mm-thick steel facings and a core of 45mm-thick Rockwool RWA45 stone mineral wool. The facings were folded along their vertical edges so that they interlocked with one another. The leaf incorporated a LoPro steel-framed vision panel, 250mm wide x 950mm high, fitted with a single pane of 5mm-thick Firelite glass and also included two vertical steel stiffeners. These each comprised two sections, the first, a top-hat section, 15mm x 41.5mm x 100mm x 41.5mm x 15mm x 1.2mm thick, slid into the second which was 145mm wide x 1.2mm thick with a 19mm return along each edge. The stiffeners were positioned so that their centrelines were 293mm from each edge of the leaf.

The door frame was fabricated from 1.6mm-thick steel and had overall dimensions 102mm deep x 63mm wide with a 48mm-deep x 25mm-wide rebate.

The doorset was fitted with a Nemef 6109 sash lock and the leaf was hung on one-and-a-half pairs of stainless steel ball-bearing hinges.

For the purposes of the test the leaf was latched.

In the orientation tested, door leaf opening away from the furnace, the doorset achieved the following performance:

Integrity:	375 minutes
Insulation:	13 minutes

3.3 Aycliffe Fire Testing Facility test report AFTF/352763/B

A fire resistance test in accordance with BS 476: Part 22: 1987 was carried out on a single-acting, single-leaf hinged steel doorset, overall dimensions 1000mm wide x 2400mm high, on 27 June 2003 for a duration of 375 minutes.

The doorset comprised a door leaf, overall dimensions 1105.5mm wide x 2353mm high x 45mm thick, consisting of 1.6mm-thick steel facings and a core of 45mm-thick Rockwool RWA45 stone mineral wool. The facings were folded along their vertical edges so that they interlocked with one another. The leaf also included two vertical steel stiffeners, each comprising two sections, the first, a top-hat section, 15mm x 41.5mm x 100mm x 41.5mm x 15mm x 1.2mm thick slid into the second which was 145mm wide x 1.2mm thick with a 19mm return along each edge. The stiffeners were positioned so that their centrelines were 293mm from each edge of the leaf.

The door frame was fabricated from 1.6mm-thick steel and had overall dimensions 102mm deep x 63mm wide with a 48mm-deep x 25mm-wide rebate.

The doorset was fitted with a Nemef 6109 sash lock and the leaf was hung on one-and-a-half pairs of stainless steel ball-bearing hinges.

For the purposes of the test the leaf was latched.



In the orientation tested, door leaf opening away from the furnace, the doorset achieved the following performance:

Integrity:	375 minutes
Insulation (frame):	8 minutes
Insulation (leaf):	20 minutes

3.4 CTiCM report no. 04-V-225

A fire resistance test in accordance with EN 1634-1 was carried out on a door with two glazed leaves with a fixed glazed side panel and glazed overpanel on 23 July 2005. The test duration was 125 minutes.

The frame of the assembly was made of RP Technik Hermetic 50 CS series steel profiles welded together to form five fixed apertures and a further one for the door. In the rebate of the frames around the opening for the door, an RP Technik RP-IM 500 intumescent seal, 16mm wide x 4mm thick, was fitted. The frame was fastened to the supporting test frame using screws and plugs, 8mm diameter x 120mm long, at nominal 500mm centres. Peripheral sealing was by stone wool insulation, 30mm thick.

The frame of the door leaves was made of RP Technik Hermetic 50 CS series steel profiles, welded together. The profiles located around the perimeter on the closing side were provided with RP Technik RP-IM 500 intumescent seals. The leaves were fitted with three galvanised steel hinges and the active leaf incorporated a two-point latch operated by steel lever handles. The passive leaf was fitted with manually-operated shoot bolts at the top and bottom. Each leaf was also fitted with a Geze TS 5000 E-IS door closer.

The side panel, overpanel and door leaves were all glazed with 13mm-thick Intervet Interflam EW 120/13-2 glass. The maximum size of glass used in the door was 1200mm wide x 2200mm high. The glazing was held in position by RP Technik RP 400 230 steel profile beading, 20mm x 23mm, with a RP Technik RP-IM 50 hermetic seal, 15mm x 5mm, placed between both sides of the pane of glass and the beading. On the active leaf this seal was made airtight by the installation of a Promaseal silicone seal. The glazing beads were clipped onto the beading screws, which were arranged on the support profiles at nominal 250mm centres. The glazing was supported from below by means of two Promatect-H shims, 7mm x 13mm x 80mm. The edge cover for the glass was 13mm.

In the orientation tested, with the doorset opening away from the furnace and the glazing beads on the exposed face, the specimen achieved the following fire performance:

Integrity:	
Gap gauge:	123 minutes
Sustained flaming:	52 minutes

4 Description of proposed doorsets

The doorsets covered by this assessment have the same construction as those tested, but with the following modifications and variations:

- a) Larger doorsets.



- b) Doorsets incorporating alternative glass in vision panels.
- c) Doorsets incorporating larger vision panels.
- d) Doorsets incorporating two vision panels.
- e) Doorsets with a deeper two-part frame.
- f) Double-leaf doorsets with a door leaf lip on one leaf only.
- g) Single-leaf doorsets with a modified latch-side jamb.
- h) Doorsets with door leaves having 2mm-thick facings.
- i) Doorsets fitted with continuous hinges.
- j) Doorsets mounted in drywall partition systems.
- k) Doorsets mounted in composite wall panel systems.

In all other respects, the doorsets are as tested.

5 Assessment

5.1 Comparison of test standards

The test detailed in CTiCM report no. 04-V-225 was carried out in accordance with EN 1634-1. The furnace heating curve of this standard and BS 476: Part 22 are the same but while the furnace temperature is measured using bare-wire thermocouples in the BS, plate thermometers are used in the EN. The latter detect the rising temperature in the furnace more slowly and this tends to lead to a more severe fire exposure. The furnace pressure is also higher at the top of the doorset when testing to the EN due to the neutral pressure plane being 500mm above sill level rather than the 1000mm specified in the BS. The EN is therefore also slightly more severe in this respect.

Therefore, we believe that had the test been carried out in accordance with BS 476: Part 22 the doorset would have achieved at least the same fire resistance.

5.2 Larger doorsets

The two single-leaf doorsets and the double-leaf doorset that were tested had the same leaf dimensions and construction except that one of the single-leaf doorsets incorporated a vision panel, and the leaves of the double-leaf doorset were hung on four hinges instead of three and they incorporated an additional stiffener. In all cases the doorsets maintained their integrity throughout the heating period (375 minutes in the case of the single-leaf doorsets and 247 minutes in the case of the double-leaf doorset). However, as deflection measurements were not made throughout the tests, the increase in leaf width and height has been limited to 15% and the increase in area to 20%. This is felt to be a conservative approach, particularly as the tests ran on for in excess of the required 240 minutes with no indication that a failure of integrity was imminent. Therefore, for both single- and double-leaf doorsets, the maximum leaf width and height are limited to 1271mm and 2706mm respectively, and the maximum area to 3.12m².



5.3 Doorsets fitted with vision panels glazed with Intervet Interflam EW 120/13-2 glass

Design and Supply have not tested a doorset fitted with vision panels glazed with 13mm-thick Intervet Interflam EW 120/13-2 glass. However, a test has been carried out on a double-leaf hinged doorset glazed with this glass. The doorset in this test satisfied the integrity criteria of EN 1634-1 for 52 minutes, failure occurring when there was sustained flaming from the door closer. As this failure was not related to the installation of the glass in the door leaf it can be ignored for the purposes of this assessment. A further failure did occur at 123 minutes when the top part of one of the panes of glass pulled out of the frame allowing a gap exceeding 150mm long x 6mm wide to develop. We therefore consider doorsets incorporating vision panels glazed with Intervet Interflam EW 120/13-2 glass to be suitable for applications where a fire resistance of up to 120 minutes is required with respect to the integrity criteria.

Although the framing system used was different, it is our opinion that the framing system used by Design and Supply will provide an equivalent level of restraint to the glass perimeter. Furthermore, the maximum vision panel size covered by this assessment is much smaller than that tested (see section 5.3). The glass must be supported by Promatect-H setting blocks and it must be sealed against the frame on both sides around its perimeter using RP Technik RP-IM 50 hermetic seals, nominally 15mm wide x 5mm thick, and sealed with a bead of Promaseal silicone sealant. The edge cover for the glass must also be 13mm.

5.4 Vision panel dimensions

The doorset tested in AFTF/352763/B was fitted with a vision panel having a clear view of 250mm wide x 950mm high. The vision panel was fitted with a single pane of 5mm-thick Firelite glass and maintained its integrity throughout the 375 minutes heating period. On the basis of the performance of the vision panel in this test, the size can be increased by a maximum of 20% in width, height and area, for installation in both single- and double-leaf doorsets. This results in a maximum clear view width of 300mm and a maximum clear view height of 1140mm, with a maximum clear view area of 0.29m².

The minimum distance between the edge of the vision panel and the edge of the leaf should always be at least 150mm and the vision panel should not be located such that the door leaf stiffeners are interrupted.

These sizes also apply to doors glazed with 13mm-thick Intervet Interflam EW 120/13-2 glass (see section 5.2).

5.5 Doorsets fitted with two vision panels

The doorsets tested in AFTF/352763/A and /B were the same, except that the former incorporated a vision panel with a clear view 250mm wide x 950mm high. The deflection of the two doorsets was similar and they each maintained their integrity for the 375 minutes heating period. This shows that the inclusion of the vision panel did not significantly affect to overall fire performance of the doorset. Therefore, we believe that a second vision panel can be included in the door leaf provided that the total area of both vision panels together does not exceed the tested clear view area, 0.24m², and the distance between vision panels and the vision panels and the leaf edge is not less than 150mm. The vision panels should also be located such that the door leaf stiffeners are not interrupted. This applies to doorsets glazed with 5mm-thick Firelite glass and 13mm-thick Intervet Interflam EW 120/13-2 glass.

5.6 Doorsets fitted with a deeper two-part frame

The frame of the tested doorsets was fabricated from 1.6mm-thick steel and had overall dimensions 102mm deep x 63mm wide with a 48mm-deep x 25mm-wide rebate. The proposed two-part frame, which is shown in figure 1, comprises an inner section fabricated from 3mm-thick steel and an outer section fabricated from 1.5mm-thick steel, the two being welded together. The overall dimensions of the frame are typically 140mm deep x 75mm wide with a 48mm-deep x 25mm-wide rebate. As the rebate dimensions are unchanged and the frame has a more robust construction, we would expect it to perform as well as the tested frame in a fire resistance test.



5.7 Removal of door leaf lip on double-leaf doorsets

The double-leaf doorset tested in AFTF/321163 incorporated lips at the meeting stiles on both the passive and active leaves; the lip on the passive leaf was on the exposed side of the doorset and that on the active leaf was on the unexposed side. It is proposed that one of these lips is removed. From the observations made during the test there is no indication of any gap development at the meeting stiles due to the bowing of the leaves. In addition, the photographs of the specimen taken after the test show that the lips on both the exposed and unexposed face were still covering the gap at the meeting stiles. Therefore, in our opinion removal of one of the lips would not lead to a failure of integrity at this location.

5.8 Single-leaf doorsets with a modified latch-side jamb

The proposal is to modify the latch-side jamb, as shown in figure 2, to allow the face of the doorset to be flush when in the closed position. The rebate in the frame is 12mm wide and the lip overlaps the frame by approximately 9.5mm. This change should not affect the fire resistance of the doorset as the rebate for the door leaf and the door stop size are not affected, and the lip on the leading edge of the leaf overlaps the frame by the same amount as that tested. There is, therefore, no greater likelihood of gaps opening up between the leaf and frame.

5.9 Doorsets with door leaves incorporating 2mm-thick facings

The door leaves of the doorsets tested in the reports detailed in section 3 of this assessment each had facings that were 1.6mm thick. It is proposed that 2mm-thick facings are offered as an alternative. This will make the leaf construction more robust, but could conceivably increase the door leaf deflection. However, as the tested doorsets all achieved in excess of 240 minutes integrity with no indication that failure was imminent due to the bowing of the leaf, it is our opinion that this change will not affect the fire resistance of the doorsets.

5.10 Doorsets fitted with a continuous hinge

The three tested doorsets were hung on either one-and-a-half or two pairs of stainless steel, ball-bearing hinges. It is proposed as an alternative that the leaves may be fitted with a continuous stainless steel or mild steel hinge. This change should, if anything, improve the performance of the doorset as the leaf will be held tight to the frame along the entire length of the hinge edge.

5.11 Mounting of doorsets in flexible supporting constructions

5.11.1 General

All three doorsets were tested opening away from the furnace, which is regarded as being the most onerous orientation. The performance of a doorset may vary, depending on the type of supporting construction. In addition, the performance of the supporting construction can be adversely affected by the deformation of the doorset. The doorsets were tested within a brick wall. A rigid supporting construction of this type will tend to restrain any bowing of the steel door frame, whereas a flexible supporting construction, such as a drywall partition, will tend to bow in sympathy with it, thus allowing the door frame bowing to follow that of the door leaf. This will probably reduce the tendency for any gaps to form between the door leaf and the door frame.

5.11.2 Installation in drywall partition systems

Where the doorset is installed in a drywall partition system, the edges of the opening within the partition should be lined with sections of steel stud. The vertical stud sections should run the full height of the partition and the horizontal section at the head of the aperture should be fixed to them at each end. Studs within the partition should only be interrupted if absolutely necessary, and where this is the case they should be securely fixed to the stud section at the head of the door leaf aperture. The aperture should then be lined with the same type, thickness and number of layers of board as were used to clad



the partition. Therefore, as long as the supporting construction has a fire resistance equal to or in excess of the proposed doorset, we are of the opinion that the door frame and wall system will perform adequately together provided that the doorset is secured with adequate steel fixings at maximum 300mm centres.

5.11.3 Installation in composite wall panel systems with a stone mineral wool core

Where the doorset is installed in a composite panel system, the edges of the opening within the wall for the doorset are sealed with a sub-frame fabricated from 2mm-thick steel (see figure 3). This will strengthen the wall in the area of the doorset. The frame is also in two parts, but the size of the rebate and the size of the stop are the same as that tested and the two parts are securely fixed together using steel rivets at 450mm centres. The frame is fixed to the panel system at the locations shown using steel rivets at 450mm maximum centres. On this basis, we would not expect any gaps to develop between the frame and the panel or the frame and the door leaf. This installation method is not considered suitable for applications where the composite wall panels have a foam core.

6 Conclusion

Therefore it is our opinion that single-acting, single- and double-leaf hinged steel doorsets, with and without vision panels, as described in section 4 of this report, are suitable for applications where a fire resistance of up to 240 minutes with respect to the integrity criteria of BS 476: Part 22: 1987 is required, for fire exposure from either side.

7 Figures

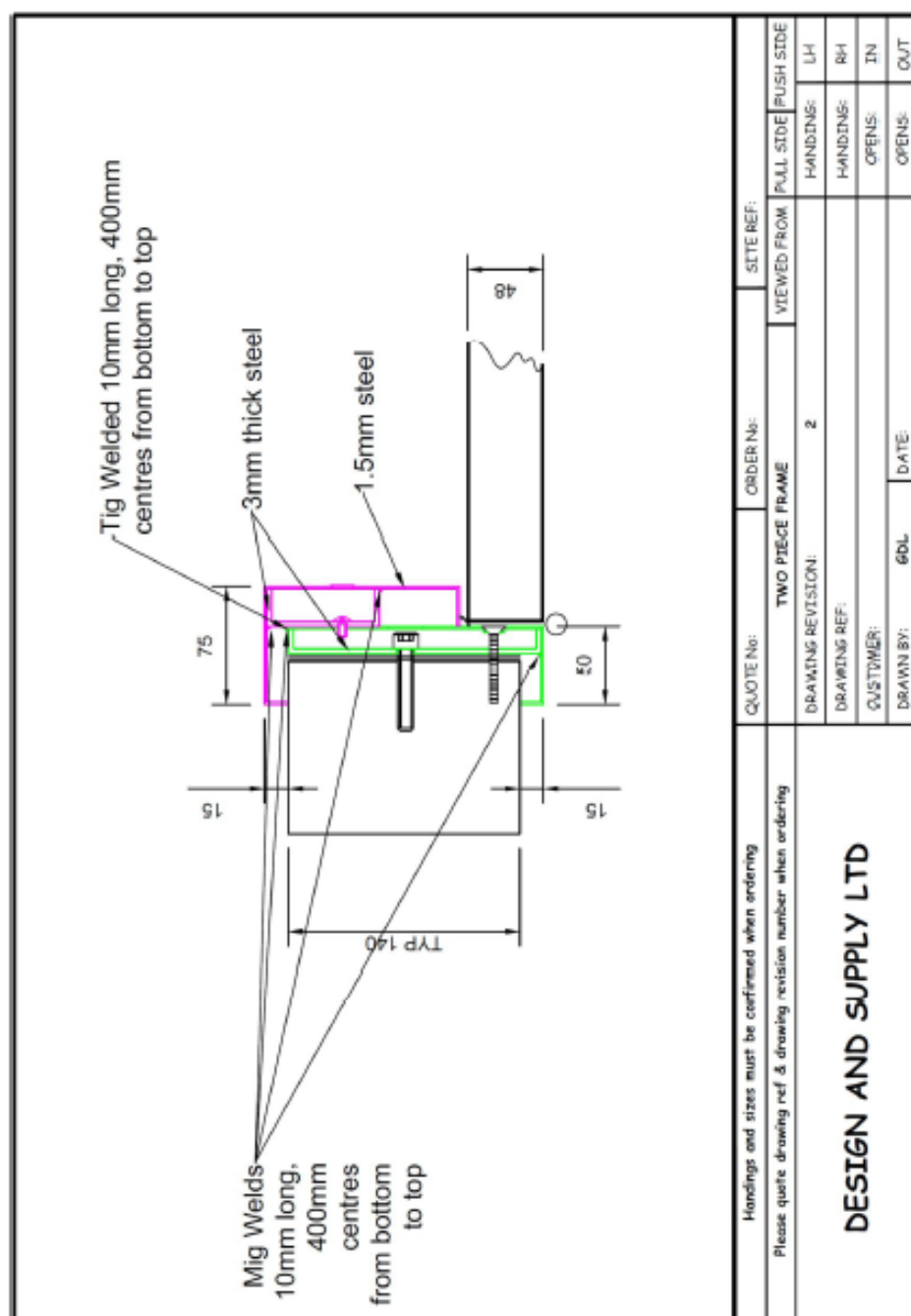


Figure 1

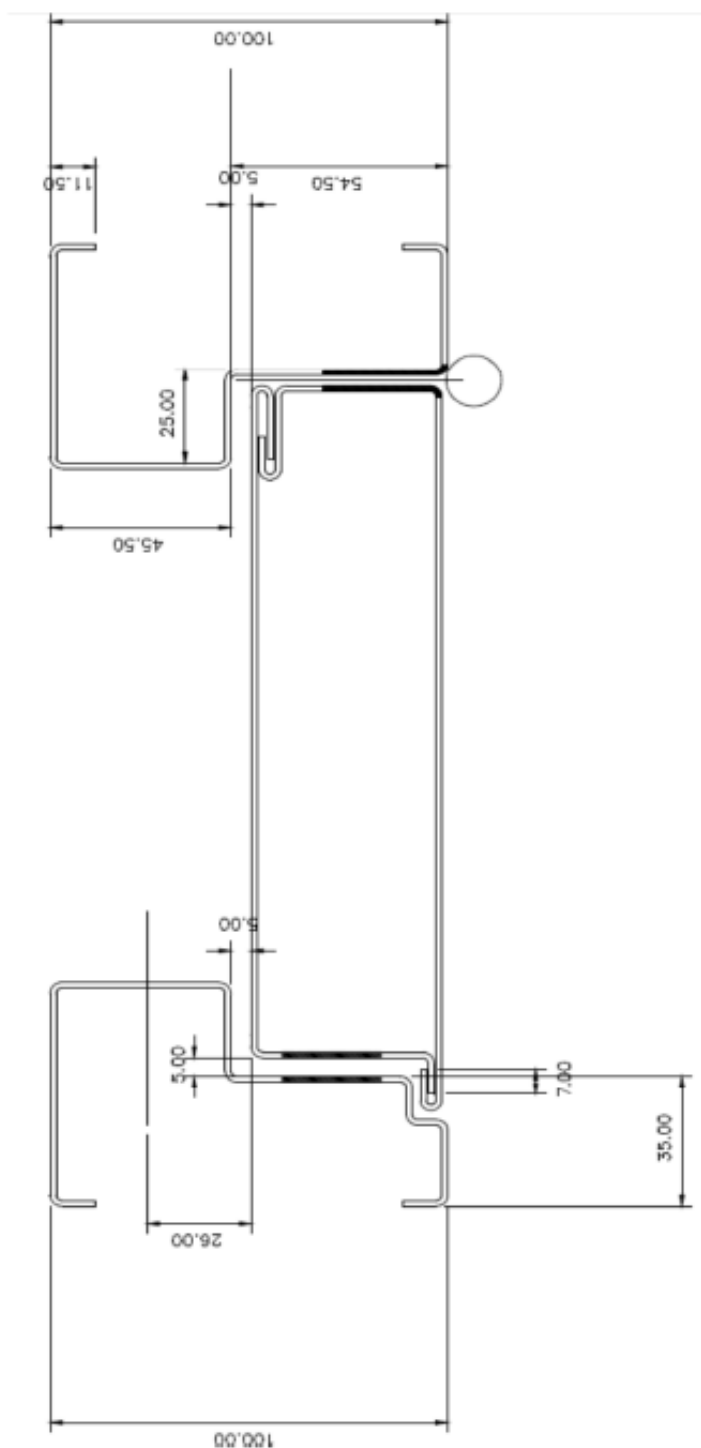


Figure 2

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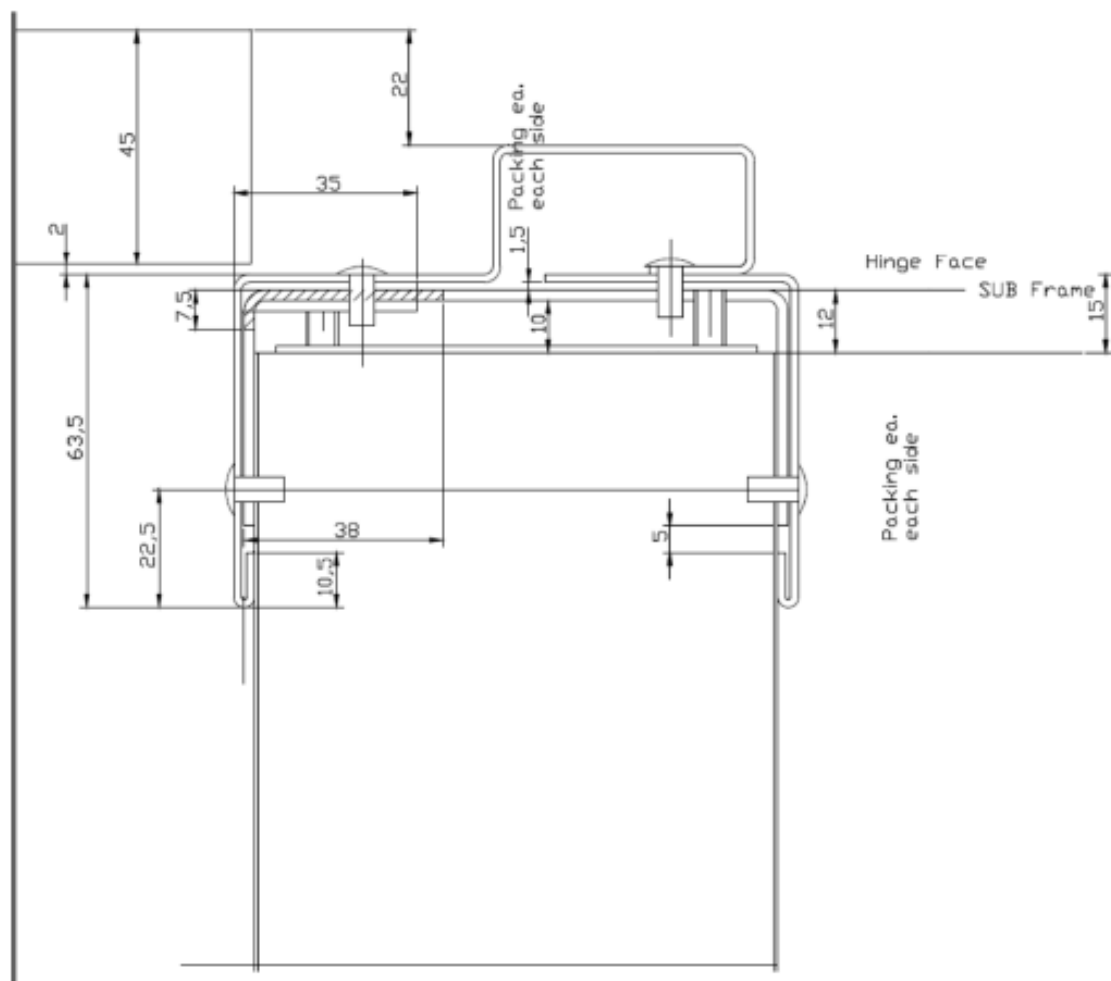


Figure 3



8 Validity of the assessment

8.1 Declaration by applicant

We the undersigned confirm that we have read and complied with the obligations placed on us by the PFPF Guide to Undertaking Assessments in Lieu of Fire Tests.

We confirm that the component or element of structure, which is the subject of this assessment, has not to our knowledge been subjected to a fire test to the Standard against which this assessment is being made.

We agree to withdraw this assessment from circulation should the component or element of structure be the subject of a fire test to the Standard against which this assessment is being made.

We are not aware of any information that could adversely affect the conclusions of this assessment.

If we subsequently become aware of any such information we agree to cease using the assessment and ask BRE Global to withdraw the assessment.

Signed:

For and on behalf of:

8.2 BRE Global declaration

This assessment is issued on the basis of test data and information to hand at the time of issue. If contradictory evidence becomes available to BRE Global the assessment will be unconditionally withdrawn and the applicant will be notified in writing. Similarly the assessment is invalidated if the assessed construction is subsequently tested since actual test data is deemed to take precedence over an expressed opinion. The assessment is valid for a period of five years after which it should be returned for review to consider any additional data which has become available or any changes in the fire test procedures. Any changes in the specification of the product will invalidate this assessment.

This assessment has been carried out in accordance with Fire Test Study Group Resolution No. 82. It relates to the fire performance of the product and does not cover aspects of quality, durability, maintenance nor service requirements. This assessment relates only to the specimen(s) assessed and does not by itself imply that the product is approved under any Loss Prevention Certification Board approval or certification scheme or any other endorsements, approval or certification scheme.

Next review date: 12 June 2023