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Title:

The Fire Resistance
Performance of Rolling
Shutter Doors with Clear
Opening Sizes up to 7m x 7m

**WF Assessment Report
No:**

180990 Issue 2

Prepared for:

DP Doors & Shutters Ltd

23b Orgreave Crescent
Dore House Industrial Estate
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Date:

19th June 2009

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Executive Summary

| | |
|-------------------------------|---|
| Objective | This report presents an appraisal of the fire resistance performance of steel rolling shutters, similar in construction to a previously tested assembly, but of increased size and including alternative components. |
| Report Sponsor | DP Doors & Shutters Ltd |
| Address | 23b Orgreave Crescent Dore House Industrial Estate Sheffield S13 9NQ |
| Summary of Conclusions | Should the recommendations given in this report be followed, it can be concluded that the DP rolling shutters, when fitted to openings as detailed in this report to the maximum sizes and specifications as given in Tables 1 to 6, would be expected to provide a fire resistance of 60, 120 or 240 minutes integrity when mounted on walls or fire-protected structural steel members if tested in accordance with BS 476: Part 22: 1987, Method 8, with fire attack from either face. |
| Valid until | 1 st March 2018 |

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Introduction

This report presents an appraisal of the fire resistance performance of steel rolling shutters, similar in construction to a previously tested assembly, but of increased size and including alternative components. The shutters are generally intended for the protection of a range of openings in masonry or concrete walls, or when fastened to fire-protected structural steel members, up to a maximum clear opening size of 7m x 7m.

This report considers the fire resistance performance of the proposed shutters for fire exposures of 60, 120 or 240 minutes with respect to BS 476: Part 22: 1987, Method 8, when mounted on masonry/concrete walls or when fastened to fire-protected structural steel members, with fire attack from either face.

FTSG

The data referred to in the supporting data section has been considered for the purpose of this appraisal which has been prepared in accordance with the Fire Test Study Group Resolution No. 82: 2001.

Assumptions

Supporting construction

It is assumed that the proposed doorsets will be fixed to appropriate masonry/concrete constructions that have a fire resistance of at least that specified for the doorset and are capable of providing adequate support to the doorsets for the required period.

Alternatively it is assumed that the proposed doorsets will be fixed to appropriate structural steel members that are clad with a proprietary fire protection system such that they have a fire resistance of at least that specified for the doorset and are capable of providing adequate support to the doorsets for the required period.

Shutter position

It is assumed that the shutters are in the completely closed position and where appropriate the barrel rests fully on the barrel support frames.

Steel grade

The minimum yield strength for the steel supporting components is assumed to be 275N/mm².

Fixings

Steel expansion bolt fixings are assumed to engage within the concrete or masonry structure for a depth of at least 100mm.

Floor support

It is assumed that the contribution to curtain support offered by the floor will be consistent throughout the range of opening sizes considered.

Radiation

Although the level of radiation from the rolling shutter was measured during the fire resistance test, the level of radiation from larger doorsets has not been considered as part of this assessment report.

Proposals

Shutters in walls It is proposed that the design of rolling shutter tested under reference WF No. 180669 may be modified to suit increased opening sizes and incorporate alternative components. The test has shown that the shutter, with the modifications described in this assessment report, is capable of satisfying the integrity performance criterion for fire resistance as given in Method 8 of BS 476: Part 22: 1987 for a period of 60, 120 or 240 minutes.

Variations The proposals are summarised as follows:

- The designs of shutter are intended for the protection of openings up to 7m x 7m in masonry/concrete walls, or when fastened to structural steel members, for periods of fire resistance of 1, 2 and 4 hours.
- The use of barrel support frames.
- Soffit fixing and reveal fixing of shutters.
- The use of alternative design and thickness of curtain laths.
- The use of a tubular motor.
- Alternative designs of bottom rail.

Basic test evidence

The test referenced WF No. 180669 and described briefly in the supporting data section of this report describes a full scale fire resistance test conducted on a DP rolling shutter doorset mounted on the fire face of a masonry wall. The test has demonstrated that the doorset is able to satisfy the integrity criteria of BS 476: Part 22 for 240 minutes.

The test referenced WF No. 305803 and described briefly in the supporting data section of this report describes an indicative fire resistance test conducted on a sample of DP rolling shutter doorset mounted on the fire face of a masonry wall and fitted with a tubular motor. No flaming from the motor emerged onto the non-fire face of the shutter for the duration of the 132 minute test.

Assessed Performance

Shutters without barrel support frames The strength, support and expansion for the proposed designs have been examined by calculation utilising data obtained from the shutter assembly tested under the reference WF No. 180669 have been found to be suitable for periods of fire resistance of up to 4 hours.

Tables 1 to 3 present summaries of the main component sizes required for specified clear openings for 1, 2 and 4 hours fire resistance respectively.

Shutters with barrel support frames

Due to the span of the barrel with respect to opening size, and the elevated temperatures expected during standardised fire test conditions, it is expected, based on the information obtained from the tested assembly, that the proposed barrels will not be capable of supporting any significant load under these conditions when used in a single clear span.

It is likely that the barrel will gradually deflect downwards as the temperature rises, forming a gradually increasing arc. Consequently, supporting frames are to be fixed in the central region of the shutter to provide additional support for the barrel at elevated temperatures.

It is anticipated that the barrel, when hot, will deflect downwards and will eventually come to rest on the supporting frames. The barrel at this time will be supported by the frames and will therefore be prevented from any further significant deflection. The supporting frames are designed to support the expected loading due to the curtain, barrel assembly, and self weight. (The barrel casing is largely independently fixed).

For the purpose of this report it is considered reasonable to expect one barrel support frame installed at the centre width of the shutter, together with a contribution from the endplates, to carry the anticipated loads for opening heights or widths up to 7m.

Typical details of the design of the barrel support frame are shown in Figure 1. It is assumed that the barrel support frames are constructed with minimum steel channel, 100mm web x 50mm flanges x 6mm thick, oriented such that one flange of the channel faces the barrel.

Tables 4 to 6 show summaries of the appropriate components for shutters with barrel support frames, for specified clear openings, for 1, 2 and 4 hours fire resistance respectively.

Expansion allowances

The expansion allowances provided for the most critical components have been compared with the minimum required based on the test information or BS 5950.

The calculation of the expansion allowance for the curtain is based on a temperature of approximately 550°C since at this temperature the residual strength of the steel is insufficient to cause disruption of the vertical guides.

The following allowances for expansion should be provided and are based on the levels used for the tested assembly for up to 2hours and 4 hours:

| Component | 1 hour mm/m | 2 hours mm/m | 4 hours mm/m |
|----------------------|----------------|-----------------|-----------------|
| Barrel/Axle Assembly | 12.5 | 13.8 | 15.3 |
| * Guides | 11.3 | 11.9 | 13.0 |
| Bottom Rail | 8.0 | 8.6 | 9.3 |
| Curtain | 7.7 | 7.7 | 7.7 |

* No allowance need be provided for mild steel components contained within the concrete/masonry structure.

Curtain

The tested doorset incorporated a rolling shutter curtain with steel laths of 0.7mm thickness for a fire exposure of 264 minutes. The alternative curtain laths are similar in construction and jointing detail to the laths as tested except that the thickness may be 0.9mm or 1.2mm. The curtain is fastened to the barrel with M10 steel studs and nuts at 800mm nominal centres. At the end of the heating period the laths were intact and remained interlocked.

Test experience has also demonstrated that curtain laths of a similar design to that tested are capable of withstanding standardised fire test conditions without adverse effect for 240 minutes for laths at least 0.9mm thick and at much larger clear opening sizes of shutter. However, the size of opening for each lath thickness must be limited to ensure the interlocking joint between laths remains intact and sufficient material remains for the required period.

The maximum clear opening size for the different curtain thicknesses are as follows:

| Lath thickness - mm | Fire resistance - minutes | |
|---------------------|---------------------------|---------|
| | 60 & 120 | 240 |
| 0.7 | 4m x 4m | 3m x 3m |
| 0.9 | 5m x 5m | 5m x 5m |
| 1.2 | 7m x 7m | 7m x 7m |

Curtain finish

The curtain laths, bottom rail and side guides may be finished with a powder coating (nominally 30µm thick) or a Plastisol finish. These are thin film paint finishes or coatings that char and peel away from the components rather than flame.

Bottom rail

The bottom rail on the tested doorset consisted of a 70mm high x 70mm wide rolled T-section bottom rail, 1.6mm thick. During the test the bottom rail bowed towards the furnace and slightly upwards but no gap of a size that would constitute integrity failure occurred in this region for the full duration of the test. An alternative bottom rail consists of a 70mm high x 70mm wide rolled T-section but 2.0mm thick. Test experience has shown that the bowing of thicker T-section type bottom rails is slightly greater than one constructed with thinner steel. However, the increase in thickness is small and therefore the bowing of the thicker T-section bottom rail is not expected to result in any gaps of a size that would constitute integrity failure at sill level.

Soffit fix and reveal fix

It is proposed that the rolling shutters may be fixed to the soffit of the supporting construction and within the reveal of the opening. The endplates and, where required, barrel support frames, will be fitted to the soffit using the same number and size of bolts as for the assessed face fixed shutters.

The report referenced WFRC No. C43588, referred to in a later section of this report, relates to tests conducted on loaded fixings in a soffit-mounted application. As such the use of the calculated fixings to support the shutter in either a wall or soffit mounted application is considered acceptable.

For reveal fixing, the shutter is confined within the constraints of the aperture. It is acceptable to fix shutters in this manner subject to the provision of the correct allowance for expansion for the supporting components. In particular and in the situation where the endplates are fixed to the inside of the wall, the barrel and axle assemblies must be allowed to expand unrestricted. In these situations the guides may be exposed or recessed within the structure. (See later section of this report for guide fixing).

Alternative guides

The tested side guides consisted of 3.0mm-thick steel channel that were 50mm deep x 30mm wide. The channel guides are welded to support angles, 6mm thick. The guide assemblies are fastened to the structure with M10 all-steel expanding anchors, or equivalent, at 750mm maximum centres through slotted holes.

The minimum engagement of the curtain within the guide should be 30mm to ensure the curtain remains within the guide as the curtain bows under heating. For wider shutters the depth of the guides may have to be increased to provide sufficient thermal expansion for the curtain.

Alternative guide arrangements are shown in Figure 2 and are considered to be minor variations of the tested components.

Where it is required for the guides to be fitted within the concrete/masonry structure it is not necessary to provide an allowance for expansion of the guides on the understanding that the guides are fully fixed and grouted with cement mortar.

End plate thickness

It is considered appropriate to increase the thickness of the end plates for all shutter designs to compensate for the increased size of shutters. Where opening heights or widths exceed 3500mm the endplate thickness will be increased from 6mm to 8mm and then to 10mm for opening heights or widths up to 7000mm.

Enclosure hoods

The calculations used in the preparation of this report have been based on temperature data obtained from the tested assembly that included an enclosure hood in order to maintain integrity in the barrel area. The proposed assemblies must therefore be fitted with steel hoods of nominal 1.2mm thickness to ensure integrity can be maintained.

In addition, and where opening widths exceed 4000mm, a hood support bracket is to be provided at approximately mid width. The hoods may be supplied in sections providing adjacent sections are jointed with a minimum 75mm overlap and fixed together using minimum 5mm diameter steel rivets or self-tapping screws. Barrel support frames may be used to provide support for the enclosure hood, where appropriate.

The top edge of the hood is fastened to the structure with M6 all-steel expanding anchors, or equivalent, at 900mm maximum centres. The ends of the hood are fastened to the end plates with M6 steel screws or bolts.

Industrial motor The calculations referred to in this report consider both mechanical (where appropriate) and motorised operations; therefore the appraisal is applicable to each type. Motor type and specification to be as specified by the manufacturer.

The motor may be fitted independently to the supporting structure or to an end plate using steel bolt fixings of at least M10 size and at least three in number. A motor enclosure hood, made of steel 1.2mm thick, may be fitted around the motor, if required. However, the openings between the motor hood and the barrel enclosure hood should be the minimum for the operation of the drive chain.

Where manual chain operation is required the enclosure hood may contain a small hole for the operating chain.

Tubular motor On the shutter that was tested in WF No. 305803 a steel cover plate was fitted around the end of the barrel that contained the tubular motor. The cover plate was constructed with 1.5mm-thick steel and, in conjunction with the end plate, formed an enclosure around the end of the barrel. These changes almost eliminated the gaps through which flaming could escape into the barrel enclosure. No flaming from the motor emerged onto the non-fire face of the shutter during the test that could have failed the integrity performance criteria of the test standard. Although test WF No. 305803 was stopped after 132 minutes, any combustible materials within the motor would have been long since consumed by the fire. Also the steel cover plate over the motor end of the barrel provides additional support to that end of the barrel. Therefore the fire resistance period for shutters fitted with a tubular motor may be extended to 240 minutes.

The calculations referred to in this report consider motorised operation of the shutter using a tubular motor or an industrial motor. The tubular motor that is fitted within the barrel is an Ellard 50Nm motor, as tested in WF No. 305803. Alternative sizes of Ellard tubular motor may be fitted provided that the combustible content of components within the motor does not exceed that of the tested motor.

Comments on calculations The calculations referred to in this report concern the expected stability of the critical components at elevated temperatures and when the shutter is in the closed position. Consequently the recommendations for the sizes of the critical components may not be appropriate to the shutters under normal temperatures where safety and other factors may be introduced.

The calculations are based upon measured temperatures of the critical components for the appropriate fire resistance test period and the steel strengths are taken from BS 5950 or as tested. The calculations provide a guide to the likely performance of the various components at elevated temperatures.

Grade of bolts The calculations referred to in this report are based on normal Grade 4.6 steel bolts and the limiting stress values for up to 4 hours fire test exposure are taken from the results of tests carried out on similar bolts under reference WFRC No. C43588.

Orientation This appraisal is based on the details recorded during a fire resistance test where the rolling shutter was exposed on the side likely to provide the least period of fire resistance. The appraisal therefore is appropriate to exposure from either side.

Steel supporting structure If the doorset is supported by structural steel members, then those members must be clad with a proprietary fire protection system such that they have a fire resistance, in terms of BS 476: Part 21: 1987, of at least that specified for the doorset and are capable of providing adequate support to the doorset for the required period.

The fixing of the doorset components to the steel members must not reduce the ability of the fire cladding system to protect the members. Fixings through protection systems such as boards and fibrous sprays should be fitted with steel sleeve spacers such that they do not compress or crush the protection. Where the structural steel members are protected with an intumescent coating additional fire protection must be added around the connecting shutter components to compensate for the area of coating that is trapped between the steel members and the shutter components and therefore cannot intumesce. Any gaps between the fire cladding system and the shutter components must be fitted with a fire rated seal system that has been shown by test to be suitable for the application and the fire resistance period required. The structural steel members may be contained within a partition system but must still be clad with a proprietary fire protection system.

The vertical structural steel members providing the support at the sides of the shutter must be continuous and secured to the structural floors slabs above and below the doorset. The horizontal steel member over the opening must be connected to the vertical structural steel members and must be deep enough to accept the fixings for the doorset. Alternatively, more than one horizontal steel member may be fitted.

Conclusions

The designs of rolling shutter door fitted to openings as detailed in this report to the maximum sizes and specifications as given in Tables 1 to 6 would be expected to provide a fire resistance of 60, 120 or 240 minutes integrity when mounted on walls or structural steel members if subjected to a fire test in accordance with BS 476: Part 22: 1987, Method 8, with fire attack from either face.

Validity

This assessment is issued on the basis of test data and information available at the time of issue. If contradictory evidence becomes available to Exova Warringtonfire the assessment will be unconditionally withdrawn and DP Doors & Shutters Ltd will be notified in writing. Similarly the assessment is invalidated if the assessed construction is subsequently tested because actual test data is deemed to take precedence over an expressed opinion. The assessment is valid for a period of five years i.e. until 1st March 2018, after which time it is recommended that it be returned for re-appraisal.

The appraisal is only valid provided that no other modifications are made to the tested construction other than those described in this report.

This report was reviewed and reissued on 14th February 2013. It has been confirmed by DP Doors & Shutters Ltd that there have been no changes to the material specifications and methods of construction of the shutter assemblies. The data used for the original appraisal has been updated. This has been re-examined and found to be satisfactory. Since issuing the original report there have been no relevant changes to the fire testing standard upon which the assessment was based, or testing experience, that could affect the opinion expressed. The procedures adopted for the original assessment have also been re-examined and are consistent with those currently in use.

Summary of Primary Supporting Data

WF No. 180669 This report describes a fire resistance test, in accordance with BS 476: Part 22: 1987, performed on a single specimen of an asymmetrical face fixed rolling shutter doorset for a heating period of 264 minutes. The rolling shutter assembly incorporated a galvanised mild steel curtain, 0.7mm thick, and was fixed to the face of a masonry wall to cover an aperture of dimensions 2400mm high by 2500mm wide, such that the barrel assembly, covered with a 1.2mm-thick galvanised steel casing, was exposed to the heating conditions of the test.

The specimen satisfied the integrity criteria of the standard for 264 minutes.

Test date : 25th February 2009

Test sponsor : DP Doors & Shutters Ltd.

Summary of Secondary Supporting Data

WF No. 305803 This report describes an indicative fire resistance test, utilising the heating and pressure conditions of BS 476: Part 20: 1987, performed on a single specimen of an asymmetrical face fixed rolling shutter doorset for a heating period of 132 minutes. The rolling shutter assembly incorporated a galvanised mild steel curtain, 0.7mm thick, and was fixed to the face of a masonry wall to cover an aperture of dimensions 1100mm high by 1060mm wide, such that the barrel assembly, covered with a 1.2mm-thick galvanised steel casing, was exposed to the heating conditions of the test.

The specimen satisfied the adopted integrity criteria of the standard for 132 minutes.

Test date : 7th April 2011

Test sponsor : DP Doors & Shutters Ltd.

WFRC No. C43588 Details of loadbearing capacity of fixings at high temperatures. Internal tests carried out for WFRC (not available for publication).

BS 5950-8 Structural use of steelwork in building, Part 8: Code of practice for fire resistant

design.

Declaration by DP Doors & Shutters Ltd

We the undersigned confirm that we have read and complied with the obligations placed on us by the UK Fire Test Study Group Resolution No. 82: 2001.

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 the 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 Exova Warringtonfire to withdraw the assessment.

Signed:

For and on behalf of:

Signatories

| |
|---|
|  |
| Responsible Officer R H Earle* - Certification Engineer |

| |
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|  |
| Approved D Hankinson* - Principal Certification Engineer |

* For and on behalf of Exova Warringtonfire.

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| Report Issued: 22 nd June 2009 |
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Issue 2 – Option of fitting a tubular motor added and report reviewed – 14th February 2013.

The assessment report is not valid unless it incorporates the declaration duly signed by the applicant.

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Performance Tables 1 to 6

Table 1: 1 Hour Fire Resistance

| | |
|------------------------------|--------------|
| Barrel Support Frames | Not Required |
|------------------------------|--------------|

Width m 2.5

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain |
|----------|-------------|----------|-------------|----------------|--------|--------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm |
| 4.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.7 |
| 4.5 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.9 |
| 5.0 | 101.6 | 3.6 | 30.0 | M10 | 3 | 0.9 |
| 6.6 | 127.0 | 3.2 | 30.0 | M10 | 3 | 1.2 |
| 7.0 | 139.7 | 5.0 | 30.0 | M10 | 3 | 1.2 |

Width m 3.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain |
|----------|-------------|----------|-------------|----------------|--------|--------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm |
| 3.6 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.7 |
| 4.0 | 101.6 | 3.6 | 30.0 | M10 | 3 | 0.7 |
| 5.0 | 127.0 | 3.2 | 30.0 | M10 | 3 | 0.9 |
| 7.0 | 139.7 | 5.0 | 30.0 | M10 | 3 | 1.2 |

Width m 4.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain |
|----------|-------------|----------|-------------|----------------|--------|--------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm |
| 3.4 | 127.0 | 3.2 | 30.0 | M10 | 3 | 0.7 |
| 4.0 | 139.7 | 5.0 | 30.0 | M10 | 3 | 0.7 |
| 5.0 | 139.7 | 5.0 | 30.0 | M10 | 3 | 0.9 |
| 7.0 | 168.3 | 6.3 | 35.0 | M10 | 3 | 1.2 |

Width m 5.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain |
|----------|-------------|----------|-------------|----------------|--------|--------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm |
| 2.8 | 139.7 | 5.0 | 30.0 | M10 | 3 | 0.9 |
| 5.0 | 168.3 | 6.3 | 35.0 | M10 | 3 | 0.9 |
| 6.8 | 193.7 | 6.3 | 40.0 | M10 | 3 | 1.2 |

Width m 6.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain |
|----------|-------------|----------|-------------|----------------|--------|--------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm |
| 2.6 | 168.3 | 6.3 | 35.0 | M10 | 3 | 1.2 |
| 4.0 | 193.7 | 6.3 | 40.0 | M10 | 3 | 1.2 |

Width m 7.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain |
|----------|-------------|----------|-------------|----------------|--------|--------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm |
| 2.3 | 193.7 | 6.3 | 40.0 | M10 | 3 | 1.2 |

Width and height refer to maximum clear opening dimensions.

Table 2: 2 Hours Fire Resistance

| | |
|------------------------------|--------------|
| Barrel Support Frames | Not Required |
|------------------------------|--------------|

Width m 2.5

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain |
|----------|-------------|----------|-------------|----------------|--------|--------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm |
| 4.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.7 |
| 3.7 | 101.6 | 3.6 | 30.0 | M10 | 3 | 0.9 |
| 5.0 | 127.0 | 3.2 | 30.0 | M10 | 3 | 0.9 |
| 7.0 | 139.7 | 5.0 | 30.0 | M10 | 3 | 1.2 |

Width m 3.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain |
|----------|-------------|----------|-------------|----------------|--------|--------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm |
| 2.2 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.7 |
| 2.9 | 101.6 | 3.6 | 30.0 | M10 | 3 | 0.7 |
| 4.0 | 127.0 | 3.2 | 30.0 | M10 | 3 | 0.7 |
| 5.0 | 139.7 | 5.0 | 30.0 | M10 | 3 | 0.9 |
| 6.0 | 139.7 | 5.0 | 30.0 | M10 | 3 | 1.2 |
| 7.0 | 168.3 | 6.3 | 35.0 | M10 | 3 | 1.2 |

Width m 4.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain |
|----------|-------------|----------|-------------|----------------|--------|--------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm |
| 2.0 | 127.0 | 3.2 | 30.0 | M10 | 3 | 0.7 |
| 4.0 | 139.7 | 5.0 | 30.0 | M10 | 3 | 0.7 |
| 5.0 | 168.3 | 6.3 | 35.0 | M10 | 3 | 0.9 |
| 5.9 | 168.3 | 6.3 | 35.0 | M10 | 3 | 1.2 |
| 7.0 | 193.7 | 6.3 | 40.0 | M12 | 3 | 1.2 |

Width m 5.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain |
|----------|-------------|----------|-------------|----------------|--------|--------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm |
| 4.0 | 168.3 | 6.3 | 35.0 | M10 | 3 | 0.9 |
| 5.0 | 193.7 | 6.3 | 40.0 | M10 | 3 | 0.9 |
| 4.5 | 193.7 | 6.3 | 40.0 | M10 | 3 | 1.2 |

Width m 6.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain |
|----------|-------------|----------|-------------|----------------|--------|--------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm |
| 2.4 | 193.7 | 6.3 | 40.0 | M10 | 3 | 1.2 |

Width and height refer to maximum clear opening dimensions.

Table 3: 4 Hours Fire Resistance

| | |
|------------------------------|--------------|
| Barrel Support Frames | Not Required |
|------------------------------|--------------|

Width m 2.5

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain |
|----------|-------------|----------|-------------|----------------|--------|--------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm |
| 2.4 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.7 |
| 3.0 | 101.6 | 3.6 | 30.0 | M10 | 3 | 0.7 |
| 4.1 | 127.0 | 3.2 | 30.0 | M10 | 3 | 0.9 |
| 5.0 | 139.7 | 5.0 | 30.0 | M10 | 3 | 0.9 |
| 6.5 | 139.7 | 5.0 | 30.0 | M12 | 3 | 1.2 |
| 7.0 | 168.3 | 6.3 | 35.0 | M12 | 3 | 1.2 |

Width m 3.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain |
|----------|-------------|----------|-------------|----------------|--------|--------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm |
| 3.0 | 127.0 | 3.2 | 30.0 | M10 | 3 | 0.7 |
| 5.0 | 139.7 | 5.0 | 30.0 | M10 | 3 | 0.9 |
| 7.0 | 168.3 | 6.3 | 35.0 | M14 | 3 | 1.2 |

Width m 4.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain |
|----------|-------------|----------|-------------|----------------|--------|--------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm |
| 2.1 | 139.7 | 5.0 | 30.0 | M10 | 3 | 0.9 |
| 5.0 | 168.3 | 6.3 | 35.0 | M12 | 3 | 0.9 |
| 5.6 | 193.7 | 6.3 | 40.0 | M14 | 3 | 1.2 |

Width m 5.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain |
|----------|-------------|----------|-------------|----------------|--------|--------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm |
| 2.3 | 168.3 | 6.3 | 35.0 | M12 | 3 | 0.9 |
| 3.8 | 193.7 | 6.3 | 40.0 | M12 | 3 | 0.9 |

Width and height refer to maximum clear opening dimensions.

Table 4: 1 Hour Fire Resistance

| | |
|------------------------------------|----------|
| Barrel Support Frames (BSF) | Required |
|------------------------------------|----------|

Width m 3.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain | Number of BSF |
|-------------|----------------|-------------|----------------|----------------|--------|-----------------|------------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm | |
| 4.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.7 | 1 |
| 5.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.9 | 1 |
| 7.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 1.2 | 1 |

Width m 4.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain | Number of BSF |
|-------------|----------------|-------------|----------------|----------------|--------|-----------------|------------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm | |
| 4.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.7 | 1 |
| 5.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.9 | 1 |
| 6.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 1.2 | 1 |
| 7.0 | 101.6 | 3.6 | 30.0 | M10 | 3 | 1.2 | 1 |

Width m 5.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain | Number of BSF |
|-------------|----------------|-------------|----------------|----------------|--------|----------|------------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thick mm | |
| 4.6 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.9 | 1 |
| 5.0 | 101.6 | 3.6 | 30.0 | M10 | 3 | 0.9 | 1 |
| 6.7 | 127.0 | 3.2 | 30.0 | M10 | 3 | 1.2 | 1 |
| 7.0 | 139.7 | 5.0 | 30.0 | M10 | 3 | 1.2 | 1 |

Width m 6.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain | Number of BSF |
|-------------|----------------|-------------|----------------|----------------|--------|----------|------------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thick mm | |
| 2.5 | 101.6 | 3.6 | 30.0 | M10 | 3 | 1.2 | 1 |
| 4.2 | 127.0 | 3.2 | 30.0 | M10 | 3 | 1.2 | 1 |
| 7.0 | 139.7 | 5.0 | 30.0 | M10 | 3 | 1.2 | 1 |

Width m 7.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain | Number of BSF |
|-------------|----------------|-------------|----------------|----------------|--------|----------|------------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thick mm | |
| 2.7 | 127.0 | 3.2 | 30.0 | M10 | 3 | 1.2 | 1 |
| 5.9 | 139.7 | 5.0 | 30.0 | M10 | 3 | 1.2 | 1 |
| 7.0 | 168.3 | 6.3 | 35.0 | M10 | 3 | 1.2 | 1 |

Width and height refer to maximum clear opening dimensions.

Table 4 assumes that each barrel support frame is fixed with a minimum of three M12 size steel bolts/anchors.

Table 5: 2 Hours Fire Resistance

| | |
|------------------------------------|----------|
| Barrel Support Frames (BSF) | Required |
|------------------------------------|----------|

Width m 3.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain | Number of BSF |
|-------------|----------------|-------------|----------------|----------------|--------|-----------------|------------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm | |
| 4.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.7 | 1 |
| 5.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.9 | 1 |
| 7.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 1.2 | 1 |

Width m 4.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain | Number of BSF |
|-------------|----------------|-------------|----------------|----------------|--------|-----------------|------------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm | |
| 4.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.7 | 1 |
| 5.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.9 | 1 |
| 5.1 | 101.6 | 3.6 | 30.0 | M10 | 3 | 1.2 | 1 |
| 7.0 | 127.0 | 3.2 | 30.0 | M10 | 3 | 1.2 | 1 |

Width m 5.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain | Number of BSF |
|-------------|----------------|-------------|----------------|----------------|--------|----------|------------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thick mm | |
| 3.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.9 | 1 |
| 3.8 | 101.6 | 3.6 | 30.0 | M10 | 3 | 0.9 | 1 |
| 5.0 | 127.0 | 3.2 | 30.0 | M10 | 3 | 0.9 | 1 |
| 7.0 | 139.7 | 5.0 | 35.0 | M10 | 3 | 1.2 | 1 |

Width m 6.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain | Number of BSF |
|-------------|----------------|-------------|----------------|----------------|--------|----------|------------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thick mm | |
| 2.8 | 127.0 | 3.2 | 30.0 | M10 | 3 | 1.2 | 1 |
| 6.1 | 139.7 | 5.0 | 35.0 | M10 | 3 | 1.2 | 1 |
| 7.0 | 168.3 | 6.3 | 40.0 | M10 | 3 | 1.2 | 1 |

Width m 7.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain | Number of BSF |
|-------------|----------------|-------------|----------------|----------------|--------|----------|------------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thick mm | |
| 4.0 | 139.7 | 5.0 | 35.0 | M10 | 3 | 1.2 | 1 |
| 7.0 | 168.3 | 6.3 | 40.0 | M10 | 3 | 1.2 | 1 |

Width and height refer to maximum clear opening dimensions.

Table 5 assumes that each barrel support frame is fixed with a minimum of three M12 size steel bolts/anchors.

Table 6: 4 Hours Fire Resistance

| | |
|------------------------------------|----------|
| Barrel Support Frames (BSF) | Required |
|------------------------------------|----------|

Width m 3.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain | Number of BSF |
|-------------|----------------|-------------|----------------|----------------|--------|-----------------|------------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm | |
| 3.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.7 | 1 |
| 5.0 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.9 | 1 |
| 5.8 | 101.6 | 3.0 | 30.0 | M10 | 3 | 1.2 | 1 |
| 7.0 | 101.6 | 3.6 | 30.0 | M10 | 3 | 1.2 | 1 |

Width m 4.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain | Number of BSF |
|-------------|----------------|-------------|----------------|----------------|--------|-----------------|------------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thickness mm | |
| 3.6 | 101.6 | 3.0 | 30.0 | M10 | 3 | 0.9 | 1 |
| 4.6 | 101.6 | 3.6 | 30.0 | M10 | 3 | 0.9 | 1 |
| 5.0 | 127.0 | 3.2 | 30.0 | M10 | 3 | 0.9 | 1 |
| 7.0 | 139.7 | 5.0 | 30.0 | M10 | 3 | 1.2 | 1 |

Width m 5.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain | Number of BSF |
|-------------|----------------|-------------|----------------|----------------|--------|----------|------------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thick mm | |
| 2.3 | 101.6 | 3.6 | 30.0 | M10 | 3 | 0.9 | 1 |
| 4.1 | 127.0 | 3.2 | 30.0 | M10 | 3 | 0.9 | 1 |
| 5.0 | 139.7 | 5.0 | 30.0 | M10 | 3 | 0.9 | 1 |
| 6.6 | 139.7 | 5.0 | 35.0 | M10 | 3 | 1.2 | 1 |
| 7.0 | 168.3 | 6.3 | 35.0 | M10 | 3 | 1.2 | 1 |

Width m 6.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain | Number of BSF |
|-------------|----------------|-------------|----------------|----------------|--------|----------|------------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thick mm | |
| 4.0 | 139.7 | 5.0 | 35.0 | M10 | 3 | 1.2 | 1 |
| 7.0 | 168.3 | 5.0 | 40.0 | M10 | 3 | 1.2 | 1 |

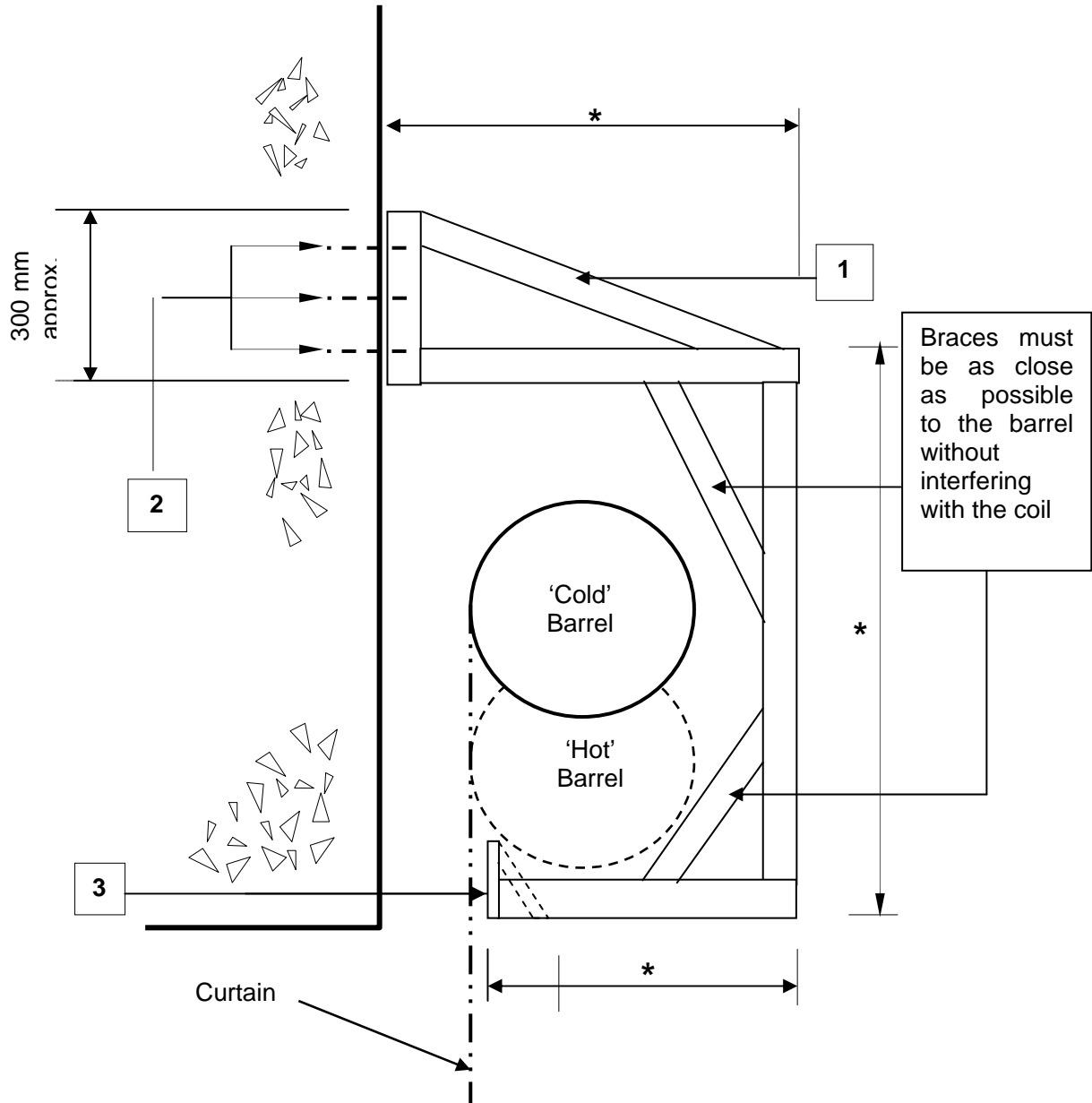
Width m 7.0

| Height m | Barrel | | Axle | Endplate Bolts | | Curtain | Number of BSF |
|-------------|----------------|-------------|----------------|----------------|--------|----------|------------------|
| | Diameter mm | Thick mm | Diameter mm | Size | Number | Thick mm | |
| 2.5 | 139.7 | 5.0 | 35.0 | M10 | 3 | 1.2 | 1 |
| 5.6 | 168.3 | 5.0 | 50.0 | M10 | 3 | 1.2 | 1 |
| 7.0 | 193.7 | 6.3 | 50.0 | M12 | 3 | 1.2 | 1 |

Width and height refer to maximum clear opening dimensions.

Table 6 assumes that each barrel support frame is fixed with a minimum of three M12 size steel bolts/anchors.

Figure 1 - Diagrammatic Representation of the Barrel Support Frame

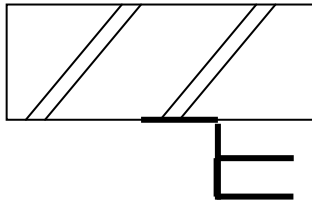


Key:

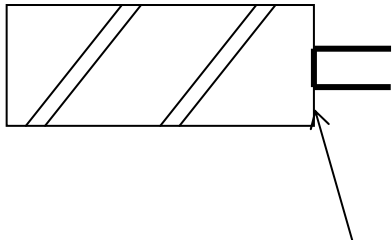
- * Dimensions to suit
- 1 All components steel channel minimum 100 mm by 50 mm by 6 mm
- 2 3 M12 size steel anchor bolts
- 3 6 mm thick steel nosing

Drawing not to scale
All joints fully welded

Figure 2 - Alternative Guide Details

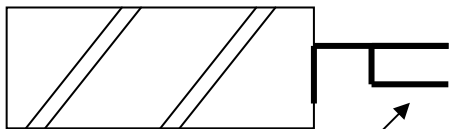


**Guide Rail Type 1
Face Fixed
(Similar to Tested)**



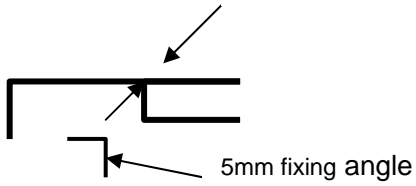
**Guide Rail Type 2
Fixed Within**

6mm flat may also be used



**Guide Rail Type 2A
Fixed Within**

Or



5mm fixing angle