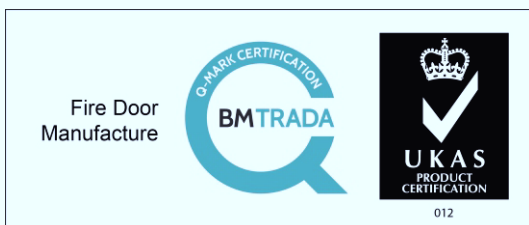
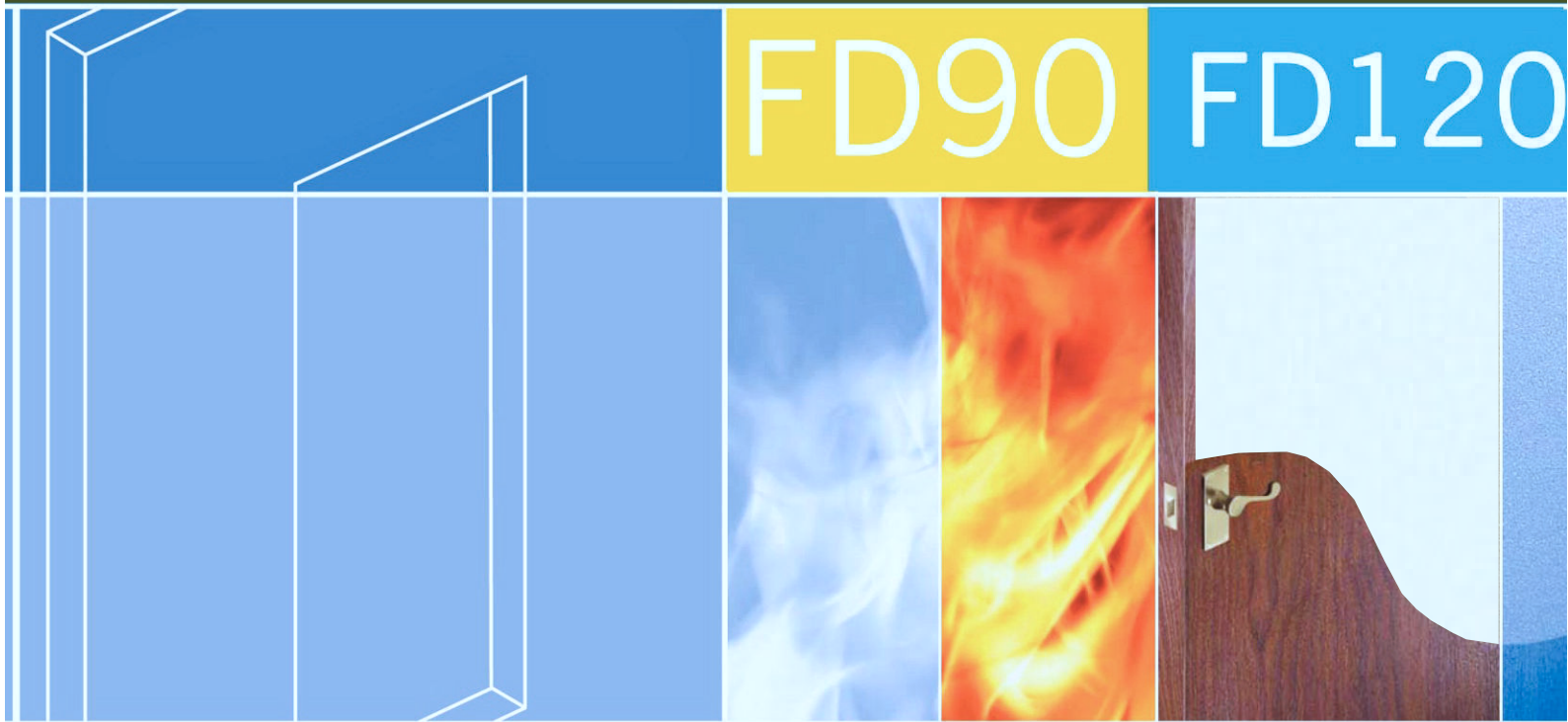




Technical Manual

FD90 & FD120

Fire Resistant Doorsets



WARM SPRINGS - TECHNICAL MANUAL

DOOR CORE PRODUCTS

About this Manual:

This Technical Manual has been prepared as part of Falcon Panel Products Ltd. commitment to users of Warm Springs Door Core products.

This Manual is intended for use as guidance and to assist in the identification of the standards and requirements applicable to the manufacture of doors and doorsets. Whereas reference is made to 'Building Regulations - England and Wales' this is for guidance only. Separate building regulations apply in Scotland, Northern Ireland and in the Irish Republic. Local bye laws may also apply. The users of Warm Springs Door Core products should determine applicable regulations by reference to the particular project specifications. This manual also suggests methods for the handling and use of Warm Springs Door Core products.

Queries relating to the use of Warm Springs door Core products should be referred to:

Head Office:

Falcon Panel Products Ltd.,
Clock House,
Station Approach,
Shepperton,
Middlesex TW17 8AN

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Fax: +44 (0) 1932 230268

Because of an ongoing commitment to develop Warm Springs Door Core products, the information contained in this manual may be amended without notice.

Please visit our web site at: www.falconpp.co.uk for updates recording the technical progress of Warm Springs Door Core products.

NOTE:

This manual is for guidance only. Falcon Panel Products Ltd. do not accept any liability in tort or otherwise resulting from any failure of Warm Springs Door Core based products to satisfy any project performance requirements or for any damage howsoever caused resulting from the use of Warm Springs Door Core products.



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— FALCON —
— PANEL PRODUCTS LTD —

Introducing Warm Springs Door Core products.

Warm Springs Door Core products includes for a low density fire resistant mineral 'Raw Core' material that can be cut to size and jointed if necessary by door manufactures as a base material for the manufacture of high performance fire doors.

The core material is banded by the doorset manufacturer on all edges using high density Warm Springs 'Tectonite' stiles and rails. The resultant blanks can then be faced and edge lipped to provide for wood appearance finishes.

The high density Warm Springs 'Tectonite' is also used as the base material for the manufacture of frames that can be faced to match door leaves for doorsets requiring a two hour fire performance.

Additionally Warm Springs Door Core products can be supplied as a door blank (in limited dimensions) with the Raw Core factory assembled within a Tectonite framing.

This manual covers the principles covered under the Exova BM Trada global assessment Chilt/A06218 Rev E, this assessment and subsequent manual is written with regards to the BS 476 pt 22 standard.

A separate American UL standard manual is available upon request. It is advised that these manuals are not read in conjunction with each other due to the conflicts within the separate standards.

Warm Springs has also been successfully tested to the BS EN 1634-1 standard for European coverage. Some of the test results obtained have been used to benefit the BS 476 pt 22 coverage.

General Specifications

Introduction to Warm Springs Door Core Products

- Warm Springs Door Core products are manufactured using a man-made vitreous fibre materials that are capable of providing for exceptional fire resistant properties. The products offered by Falcon Panel Products Ltd. are designed specifically for use in the manufacture of high performance fire resistant doors and doorsets.
- Falcon Panel Products Ltd. have an ongoing BS 476 Pt.22 related fire test programme designed both to satisfy auditing requirements of the 'Q' Mark certification scheme and to increase the scope of application for Warm Springs Door Core based fire rated doorsets. Testing has also been carried out in accordance with BS EN 1634-1 in anticipation of a requirement to satisfy this specification in due course. Due to the exceptional reliability and predictability of the Warm Springs Door Core product under fire test conditions, these materials have become a preferred base product for the fire testing 'by others' of door related components where high performance fire ratings are required for wood appearance doorsets. Extensive testing has also been carried out to provide users of Warm Springs Door Core products sound attenuating performance options.
- Warm Springs Door Core products can be worked using standard woodworking tools and machinery but the use of diamond tipped cutters is recommended particularly when machining 'Tectonite' stiles and rails and door frame components.
- For performances up to FD90, Warm Springs Door Core products based door leaves can be used with Nom. 640kg/m³ density hardwood or 'Tectonite' based frames. For FD120 performances frames must be manufactured using Warm Springs 'Tectonite' material.
- For door leaves, a nominal 51mm thickness door blank is created by the use of the Warm Springs low density Raw Core with 'Tectonite' stiles and rails. The door blank can then be faced with nominal 3~4mm thickness Medium Density Fibreboard (MDF), High Density Fibreboard (HDF), Plywood or Chipboard.
- Wood veneers, plastic laminates and other door facing materials can be applied direct to the sub face material with minimal preparation. Where painted, the use of paint grade veneers or painting foils is recommended but these are not essential. i.e. when suitably primed, paint can be applied directly to the board faces.
- Nom. 640Kgs/m³ average density hardwood lippings, not exceeding 4mm finished thickness, must be applied to two vertical edges with an option to apply lippings to all edges.
- Dedicated intumescent seals available from Falcon Panel Products Ltd must be added to the door leaf and / or the frame. The Fire Door Applications Data Section describes the 'Q' Mark approved seals for this purpose.
- When glazed, the glass used for fire doors must be of a type and specification determined by test as suitable for use with Warm Springs materials for fire door applications to the desired level of performance. The glass must be retained in a proven beading system complete with intumescent glazing mediums. The beading and intumescent glazing system must be of a design proven by test as suitable for use with the intended glass.
- Reference should be made to BS8214 : 2007 'Code of Practice' in respect of the handling and use of fire doors. Further reference should be made to the A.S.D.M.A. (Architectural & Specialists Door Manufacturers Association) 'Best Practice Guide for Timber Fire Doors' and the Guild of Architectural Ironmongers Code of Practice for the selection and use of hardware for fire doors.

General Specifications

Handling & Storage:

- When handling with forklift trucks or other mechanised handling equipment, care should be taken to observe the safety advice and weight restrictions relating to the equipment.
- When manually handling, operatives should wear suitable industrial quality gloves to avoid injury.
- Areas for storing Warm Spring Door Core products should be dry and adequately ventilated such that the materials are not subjected to excessive humidity and temperature.
- Warm Springs Door Core products should be stored flat in bundles of not more than 20 Raw Core boards. The lower bundle should be stored flat and level on a minimum of 4No. equi-spaced timber bearers with similar bearers used to separate each bundle. A maximum of 5No. bundles per stack is recommended with larger board sizes used for the lower bundles reducing to the smaller boards at the top of the stack.

Health & Safety:

- Warm Springs Door Core products must be handled and machined in a well ventilated work site that is equipped with efficient dust extraction facilities to minimise the creation of airborne dust.
- It is recommended that operative should wear long-sleeve, loose fitting clothes, gloves and eye protection. Care should be taken to ensure minimal skin contact, and to avoid breathing in dust.
- When worked, the board is likely to produce dust that can act as a skin or respiratory irritant. Adequate ventilation and efficient dust waste extraction should be provided for in the workplace.
NOTE: Refer to COSHH Regulations 2002 and Guidance Note EH40/2005.
- Ori-nasal masks to BS EN 149 : 1992 and eye shields to BS EN 166 ~ 168 are recommended for use by operatives involved in the handling and working of Warm Springs Door Core products.

Inhalation of Dust: Remove person to fresh air. Clean nasal passages.


Dust in eyes: Flush eyes with tepid, clean water for 15 minutes.

Affected by Dust: Remove person to fresh air. Drink copious volumes of water.

NOTE: If no recovery is made, seek immediate medical advice.

Fire & Explosion:

- Warm Springs Door Core products are non flammable and do not present any fire or explosion risks.

	WSCP Core	Tectonite	 DOOR CORE PRODUCTS
Type :	Man-made vitreous fibre materials specially developed as a high performance fire resistant door core.	Composite mineral board.	
Moisture Content:	6%	6%	
Screw holding :		Vertical edges of doors ≥ 2440N (475lbs). Horizontal edges of doors ≥ 1330N (300lbs). Door faces (Tectonite) ≥ 2440N (550lbs). <i>(Any suitable course threaded wood screw of the correct length and size).</i>	
Density :	WSCP Core = 288kg/m ³ +/-30kg/m ³	Tectonite = 1065kg/m ³ +/- 88kg/m ³	
Mass :	WSCP Core = Nom. 15kg/m ²	Tectonite = Nom. 55kg/m ²	
Uses :	Suitable as a highly effective door core for the manufacture of wood appearance FD90 to FD120 fire rated doorsets (BS476 Pt.22). Warm Springs Door blanks consisting of a WSCP core retained within a Tectonite framing for subsequent processing by the doorset manufacturer. The doorset manufacturer may apply MDF, HDF, Plywood or Chipboard sub facings and veneer, laminate or foil facings together with hardwood lippings.		
Sheet / Material sizes :	See Page 1.4 for stock sizes held in the United Kingdom. Stock sizes may vary - check web site for current details.		
Machining :	May be use with standard woodworking tools and machinery. Use of diamond tipped cutters recommended.		
Fire :	Tested to BS476 Pt.22 : 1987 Suitable for single & double leaf applications in single swing configurations. May be glazed. <i>See Section 4 Fire Door Applications.</i>		
Acoustic Performance :	Tested to the requirements of BS EN ISO 140-3 : 1995 with results expressed as a single weighted index in accordance with BS EN ISO 717-1 : 1997. <i>See Section 9 Acoustic Applications.</i>		

General Specifications

Falcon Panel Products Ltd. - UK Stocked materials:

Core

Component Ref:	Component Description	Height	Width	Thickness
WS48207842L	Warm Springs 'Raw Core'	2070	845	51

Stiles & Rails

Component Ref:	Component Description	Height	Width	Thickness
WS512643ST	Tectonite Stile	2642	43	51
WS512143ST	Tectonite Stile	2100	43	51
WS510910	Tectonite Rail	900	101	51
WS510951	Tectonite Rail	900	51	51

Frame Components

Component Ref:	Component Description	Height	Width	Thickness
WS422210FL	Tectonite Jamb / Head	2200	101	43
WS422610FL	Tectonite Jamb / Head	2642	101	43

*Dimensions given above are nominal and subject to tolerances of:
Height & Width = +/- 0.5mm Thickness = +/- 0.2mm*

Factory Banded Door Cores

Supplied factory assembled with the Raw Core retained in a Tectonite stile & rail framing for the application of sub facings, facings and lippings etc. 'by others'.

Component Ref:	Component Description	Height	Width	Thickness
WS472040BA	Banded Door Core	2040	920	51

*Dimensions given above are nominal and subject to tolerances of:
Height & Width = +/- 0.5mm Thickness = +/- 0.2mm*

Dedicated Intumescent Seals

Component Ref:	Component Description	Height	Width	Thickness
WSL2240NBR	WS TA Seal PVC Clad Intumescent Seal	2100	22	4
WSL2242NBR	WS TA Seal PVC Clad Intumescent Seal	2600	22	4
FL4710N	Thermafex Door Bottom Edge Seal	2100	47	1
FL4712N	Thermafex Door Bottom Edge Seal	2600	47	1
HRT105SPAD	Intumescent Hinge blade gasket 4No. per pack	-	-	-

Unless otherwise specified the colour of the PVC cladding for door leaf / frame intumescent seals will be Brown.

*The following alternative colour PVC cladding is available where specified:
Add Code suffix - /B = Black. Add Code suffix /W = White. Add Code suffix /R = Red*

Other door core products available from Falcon Panel Products Ltd.

Strebord® A world leading high quality graduated density solid chipboard material suitable for a wide range of applications including the manufacture of general purpose doors, fire performance doorsets up to FD90 (BS476 Pt.22), Strebord® offers excellent sound attenuating properties and is highly recommended for the manufacture of doorsets required for high use buildings that require rugged and dependable materials.

Falcon Tri-Sound® - A multi layer chipboard based core providing for excellent acoustic properties for use where sound attenuating performances in excess of Rw.40dB are required (BS EN ISO 140 - 3 / BS EN ISO 717-1). The Tri-Sound® core construction is also suitable for the construction of fire doors with performances up to FD30 (BS476 Pt.22) 1/2hr. Additionally a new FD60 core is now available, following similar production principles to the FD30 material the FD60 product completes the offering for all your fire and acoustic needs.

Falcon Superpan®:

44mm graduated density chipboard core construction with integral formed MDF facings providing for all of the benefits of Streboard® with improved surfaces for the application of decorative finishes. The product has a consistent 4mm MDF face which is ideal for receiving decorative features grooves and designs.

Falcon Stredor®:

Lighter weight solid timber door blanks with enviable fire scope and mechanical performance.

Falcon Blankfort®:

Engineered laminated softwood blank suitable for a wide range of performance applications, providing for optimum stability and structural integrity.

For further information regarding these exceptional high performance door core products please contact:

**Falcon Panel Products Ltd.,
Clock House,
Station Approach,
Shepperton,
Middlesex TW17 8AN**

**Tel: +44 (0) 1932 256580
Fax: +44 (0) 1932 230268**

Door Leaf Constructions

Door Leaf & Frame Construction:

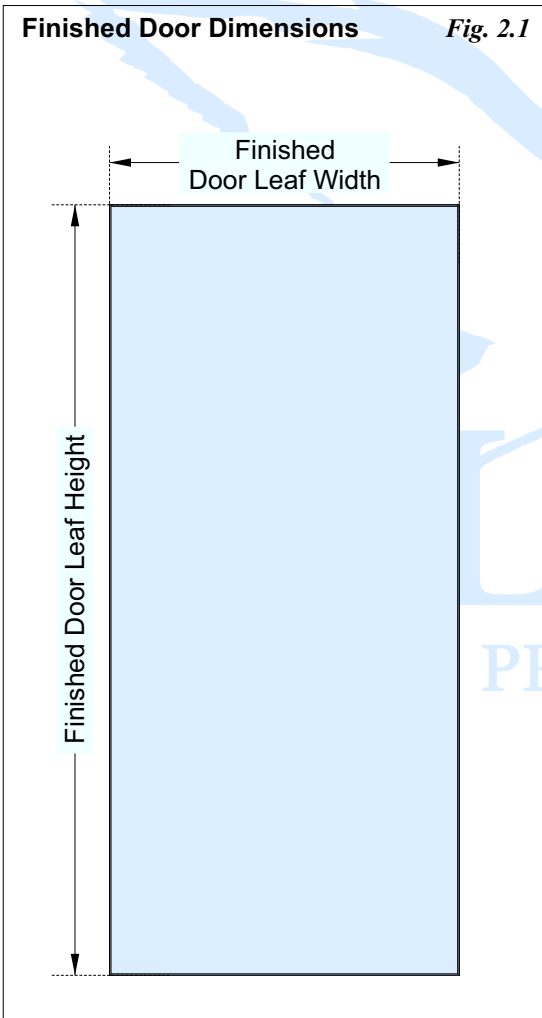
This section provides for general recommendations for the manufacture of FD90 (1½hr.) and FD120 (2hr.) fire rated door leaves using Warm Springs WSCP and Tectonite products.

This section is essentially for guidance only, manufacturing processes may vary to suit the particular requirements of individual manufacturers to suit their normal practices and machining capabilities.

Planning:

As with most manufacturing processes, the best results are achieved as a consequence of good planning in advance of the cutting of materials.

Calculating Door leaf Raw Core Dimensions: For FD90 and FD120 door leaves calculate WSCP Core dimension by first determining the required finished dimensions of the door leaf.



o The overall door leaf height and width includes lippings that are applied to two vertical edges and optionally to the top and bottom edges of the door.

NOTE 1: The finished thickness for hardwood lippings for FD90 and FD120 applications must not exceed 4mm. When calculating dimensions some manufacturers may prefer to make doors with over size lippings with these reduced during final sizing of the door leaf. The additional trimming allowance should be excluded in these component dimension calculations. i.e. work dimensions relate to the finished lipping thickness after trimming.

- o Deduct the finished lipping dimensions to determine the door blank height and width.
- o Deduct 2x Stile width = 2x43mm. = -86mm.
- o Deduct 1x Head rail width = 101mm = -101mm.
- o Deduct 1x Bottom rail width = 51mm = -51mm
- o These calculations will determine the required Raw Core height and width dimensions.

NOTE 2: Some manufacturers may prefer to make the door blank oversized and to trim the blank before applying lippings. This is a permitted practice provided that the finished Tectonite framing (stile & rail) dimensions are not trimmed by more than 16mm. (See page 2.2 - Fig. 2.2).

Example:

Required finished door leaf dimensions = 2040x926mm (assuming lipped on all edges with 3mm fin. lippings).

Height:	=2040mm
Less top & Bottom lippings	= -6mm
Less top rail	= -101mm
Less bottom rail	= -51mm
Raw Core Height	= 1882mm

Width:	= 926mm
Less vertical lippings	= -6mm
Less 2No. Stiles = 2x43mm	= -86mm
Raw Core Width	= 834mm

Door Leaf Construction

Door Leaf & Frame Construction - Core Assembly:

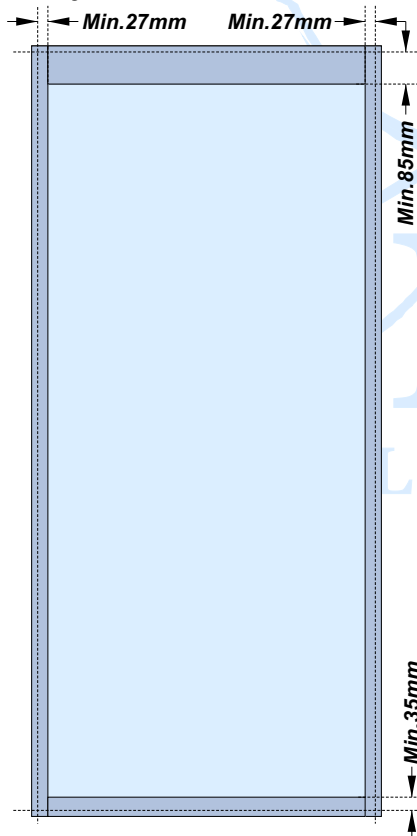
Having completed the calculations, the components can now be cut to size.

The Raw core is a low density, quite brittle material that must be handled and machined with care. To minimise wastage, the centre WSCP Core material can be made up to the required dimensions by using a number of square or rectangular pieces. For both FD90 and FD120 applications up to seven individual pieces can be used.

When assembling multiple piece cores, care must be taken in respect of the following:

- Avoid gaps between pieces.
- Ensure that dust is removed, particularly from the edges of the core material.
- All core pieces must be bonded together using a cross linked PVAc glue that is evenly and generously applied.
- Ensure that the glue has set before proceeding with further processing.

Warm Springs Component Assembly - Door Blank *Fig. 2.2*



The centre WSCP Core material can be made up to the required dimensions by using up to seven individual pieces that must be bonded together.

Stiles and rails can be made up using multi piece Tectonite components for FD90 applications. Single piece Tectonite stiles and rails must be used for FD120 applications.

Stiles and rails may be reduced by a maximum of 16mm to provide for the desired door blank size.

The Tectonite stiles and rails can now be cut to size. The top and bottom rails are cut to the WSCP Core width with the Tectonite stiles cut to the WSCP Core height plus head and bottom rail widths.

NOTE 1: For FD90 (1 $\frac{1}{2}$ hr.) applications multi piece stiles and rails may be used subject to the following:

- Pieces less than 400mm length must not be used.
- Ensure that dust is removed, particularly from the edges of the Tectonite.
- All core pieces must be bonded together using a cross linked PVAc glue that is evenly and generously applied.
- Ensure that the glue has set before proceeding with further processing.

NOTE 2: The use of multi piece stiles and rails is not approved for FD120 (2hr.) applications.

The Tectonite stiles and rails must be bonded to the WSCP Core material using a cross linked PVAc adhesive that is evenly and generously applied.

The Tectonite rails are cut to the WSCP Core width with Tectonite stiles extended over the rails.

The wider 101mm Tectonite rails are generally used at the head of the door with this higher density material providing for improved screw holding to receive overhead closer fixings. However, the wider rail can be used at the bottom of the door to suit alternative hardware, if required, without detriment to performances.

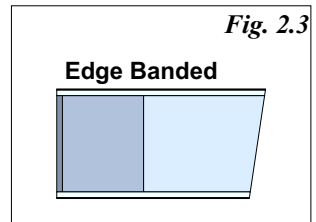
NOTE: The Tectonite stiles and rails may be reduced after assembly by a maximum of 16mm to provide for the required door blank size.

Door Leaf & Frame Construction - Facings & Lippings:

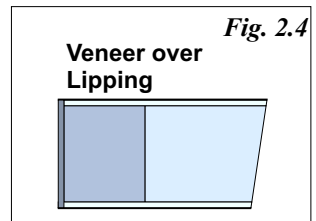
When the bonding has set the core assembly should be lightly sanded to remove surplus adhesive. Use of a (*calibrating*) drum sander is recommended for this process. Extreme care should be taken if sanding is carried out using a belt sander due to the difference in densities between the WSCP Core material and the Tectonite stiles and rails.

With the processing dust removed, the facings and lippings can be applied. The following options are available to manufacturers without detriment to performances:

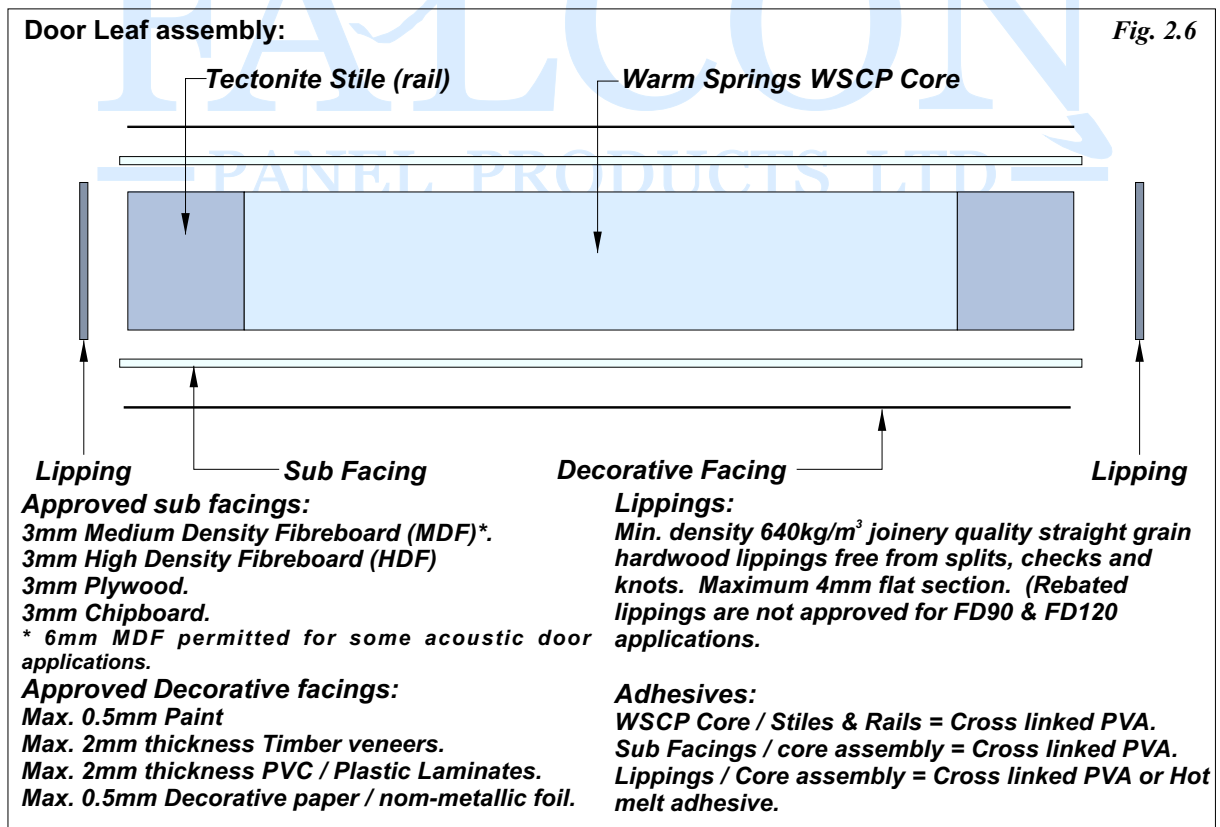
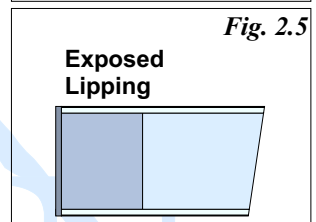
- **Edge banded detail:** The hardwood lippings are applied to the two vertical edges (*or all edges*) of the core assembly before the application of facing materials. This will result in any sub facing material being visible at the edge of the completed door. This permits a single pressing operation i.e. sub facings and decorative facings pressed onto the core assembly at the same time. Lippings are not visible on the face of the completed door.



- **Veneer over lip detail:** Apply sub facing material to the core assembly before lipping on vertical edges only or all edges with decorative facing materials (*veneers, laminates etc.*) applied after lipping and calibrating. This process requires double pressing, i.e. sub face to core then, after lipping and calibrating, facings to door.



- **Exposed lipping detail:** Lippings are applied following the pressing of sub facings and facings to the core assembly, this results in the edges of the lippings being visible on the face of the door. The sub facings and decorative facings being pressed onto the core assembly in one pressing process.



Door Leaf Construction

Door Leaf & Frame Construction - Facings & Lippings:

Adhesives:

For FD90 and FD120 applications the following adhesives must be used:

- Tectonite Stiles and rails to WSCP Core = Cross linked PVA.
- Stiles to Rails = Cross linked PVA.
- Sub facings to core assembly = Cross linked PVA.
- Facings (*veneers, laminates etc.*) to sub facings = Manufacturers choice or Cross linked PVA.
- Lippings to Tectonite stiles & rails = Cross linked PVA or Hotmelt adhesive.

NOTE 1: Care must be taken to avoid contamination of glue lines by removing residual dust after cutting or machining WSCP Core and Tectonite materials.

NOTE 2: Adhesives for all applications must be generously and evenly applied e.g. recommended adhesive spread rate sub facings to core assembly = 250 ~ 350g/m².

NOTE 3: Glue lines for multi piece WSCP Cores must be cured before further processing.

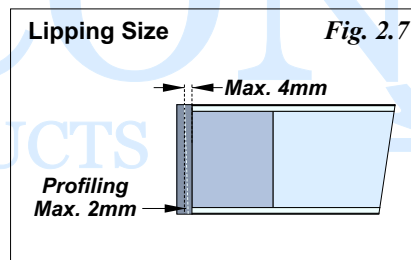
NOTE 4: Glue lines Tectonite to WSCP Core must be cured before further processing.

NOTE 5: For bonding sub facings onto the core assembly the adhesive must be applied directly to the facing material only and not to the mineral core. (Due to the porosity and absorption rate of the mineral core).

Lippings:

The lipping thickness must not exceed 4mm (*with a maximum 2mm profiling*) for the finished door leaf.

Some manufacturers may prefer to make doors with larger lippings with these to be reduced during final sizing processes. Where door leaf dimensions are adjusted in this manner the adjustments must be equal on all edges.



Sub Facings - Acoustic Applications:

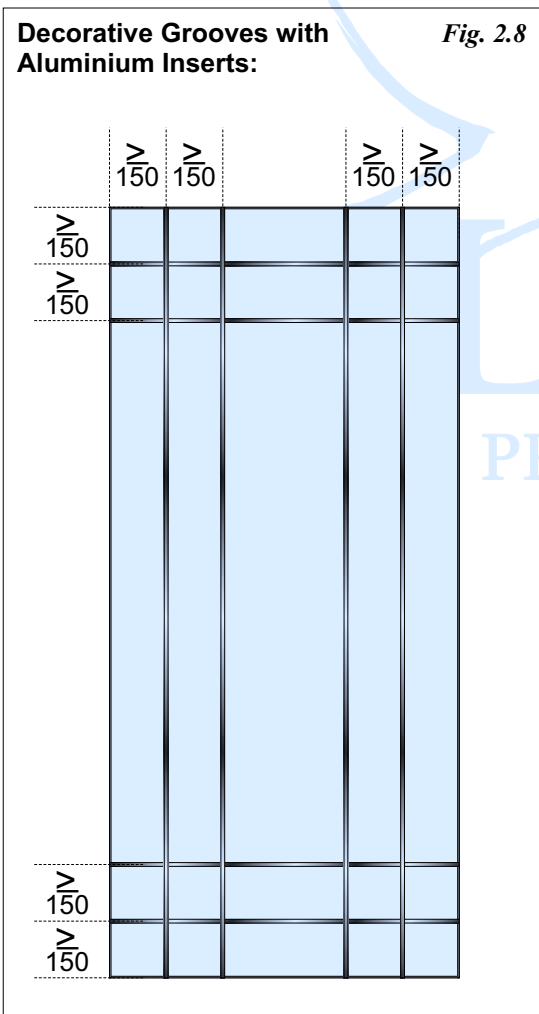
To provide for improved sound attenuating performances MDF (*Medium Density Fibreboard*) sub facings may be increased from 3mm to 6mm but with restrictions with regard to doorset configurations and dimensions for fire door applications. See *Section 4 - Fire Door Applications* and *Section 9 - Acoustic Doorsets*.

Door Leaf & Frame Construction - Facings & Lippings:

Decorative Grooves with Aluminium Inserts:

Door leaves using Warm Springs Door Core products for FD90 and FD120 applications may be grooved to provide for decorative designs to suit Designer requirements where the grooves are filled with an aluminium insert, subject to the following:

Max. groove size (mm)	10 wide x 4 deep	
Proximity to door edge (mm)	Horizontal Grooves	≥ 150 from top and bottom
	Vertical grooves	≥ 150 from door stiles
Orientation	Vertical or Horizontal.	
Configuration	Latched and unlatched, single acting, single leaf and double leaf doorsets.	



- The grooves must not coincide with any glazed apertures.
- A maximum of 4No. vertical and / or 4No. horizontal grooves are permitted, perpendicular and intersecting one another, provided all other details meet the specification given in the above table.
- Grooves may run to the leaf edges.
- For aluminium inserts requiring a groove depth in excess of 3mm, the facing material (*veneer / laminate etc.*) must be 2mm thickness to provide for a total 5mm sub facing + facing thickness (*i.e. 3mm sub facing + 2mm facing*) with all other details to remain as described in the above table. (See Fig. 2.6 Page 2.3)

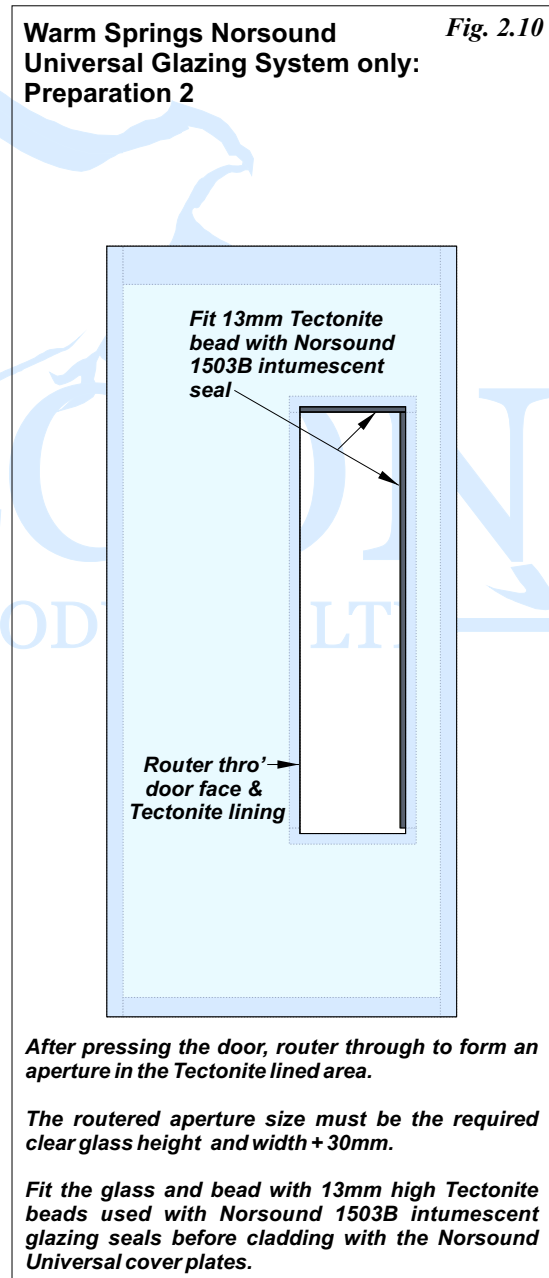
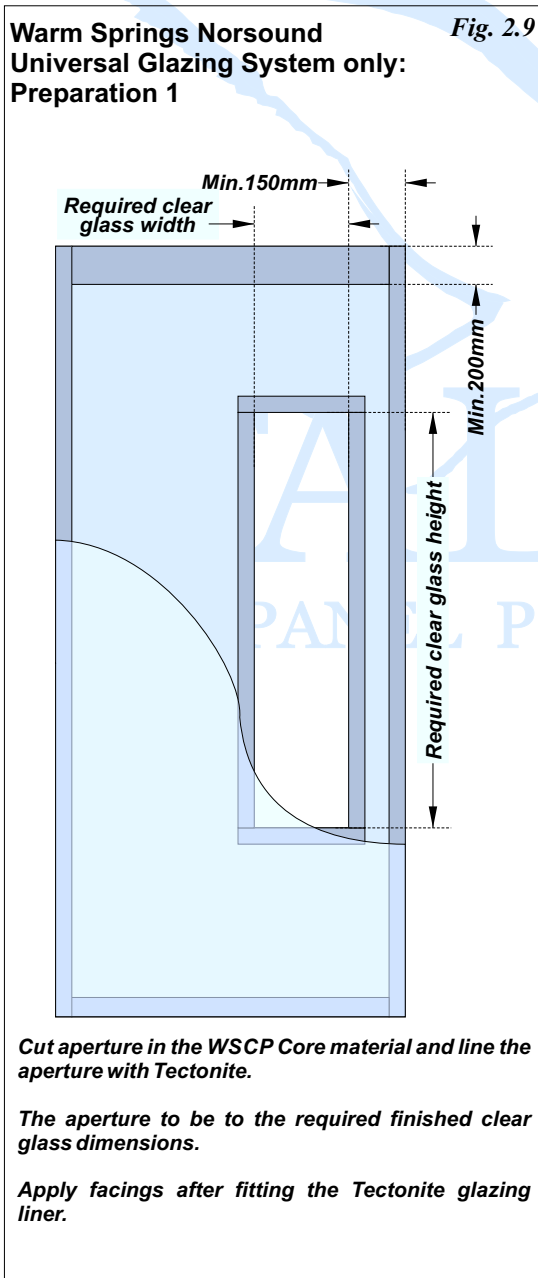
Door Leaf Construction

Door Leaf Preparation for Glazing - (Norsound Universal System only):

The Norsound Universal glazing system permits the use of larger glazed apertures and provides for an identical appearance beading system for fire rated doorsets for all performances up to FD120.

For FD90 and FD120 applications using Warm Springs material door leaf constructions it is necessary to pre plan glazing aperture size and location and to prepare the door core to receive the glazing system using an internal Tectonite aperture lining before pressing facings onto the door blank.

For further information: See Section 7 - Glass & Glazing.



Frame Constructions

Frame Materials & Specifications:

Details in this section show minimum dimensions for frames for use with fire rated doorsets.

FD90 (1½hr) Doorsets:

Frame material for FD90 doorsets may be hardwood of not less than 640kgs/m³ density @15% moisture content. OR, clad Tectonite.

The minimum quality standard for frames for fire doorset applications defined by reference to BS EN942 : 2007 Class J30. (*Equating to BS 1186 Pt.1 Class 2*).

NOTE: All timber used for fire rated doorset including frames, lippings & beading, must meet or exceed Class J30 as specified in BS EN 942 : 2007, any defects should be repaired and, as far as possible, orientated away from areas of intumescent seal activation.

Unless otherwise stated in project specifications: The moisture content of hardwood material used for frames should be 9 - 13% average. moisture content before the application of finishes, as required by reference to BS EN 942 : 2007 for internal joinery designed for use in heated buildings providing room temperatures of 12°C to 21°C.

Timber frame joints may be, mitred, butt or half lap joints. All jointing methods should be of a tight fit and assembled using mechanical fixing with appropriate size ring shank nails or screws. with mechanical assembly fixings (e.g. screwed).

NOTE: Joints may be glued and screwed.

A minimum 12mm deep door stop is required for single action doorsets. The door stop may be planted or moulded from the solid. When planted, the door stop may be to a 'T' section (*non vision*) profile with the 'T' extension adding to the minimum approved 12mm dimension. Door stops may be pin, glued and pinned or screwed to the frame lining. Optionally, planted door stop may be secured fixing through the back of the frame using suitable screw fixings that penetrate the stop to a depth of Nom. 8mm.

FD120 (2hr) Doorsets:

For FD120 doorsets the basic frame lining must be manufactured using a clad Tectonite core construction with a minimum frame lining finished section of 98x45mm.

Tectonite frame joints must be mortice and tenoned or butt jointed. Jointing methods must be of a tight fit and assembled using 3No. coarsely threaded wood type steel screws per joint. Pilot holes must be drilled to receive all fixing into Tectonite components.

NOTE: Joints may be glued and screwed.

Door stop for FD120 applications may be in hardwood, as described for FD90 applications or clad Tectonite.

Transom Rails - FD90 & FD120:

The transom rail must be of the same section and material as required for the frame jambs and head.

The transom rail must be mortice & tenon or butt jointed to the jambs (*with no gaps*), bonded with a cross linked PVA or urea / resorcinol formaldehyde adhesive and fixed with a minimum of 3No. steel fixings per joint penetrating to a minimum depth of 40mm.

Frame Extension Linings - FD90 & FD120:

The basic frame lining can be extended to suit required wall / partition thicknesses by the use of hardwood extension linings.

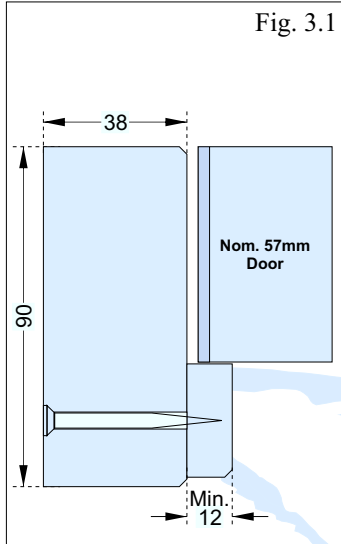
Architrave:

The use of architrave is recommended for fire doors. For FD90 and FD120 applications, these should be Min. 18mm thickness and conform with the material specifications described for FD90 frames.

For certain installations, doorsets may be installed without the use of architrave. (*See Section 14 - Fire Door Installation for further guidance*).

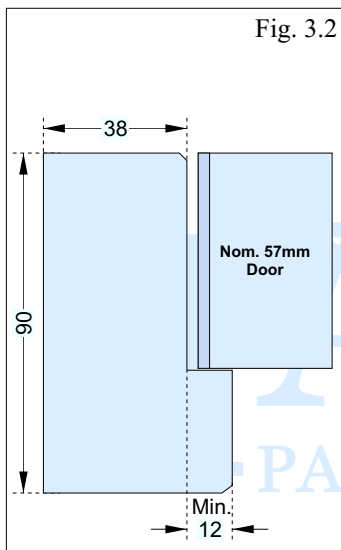
Doorframes

Minimum Recommended Frame Dimensions FD90 Doorsets.



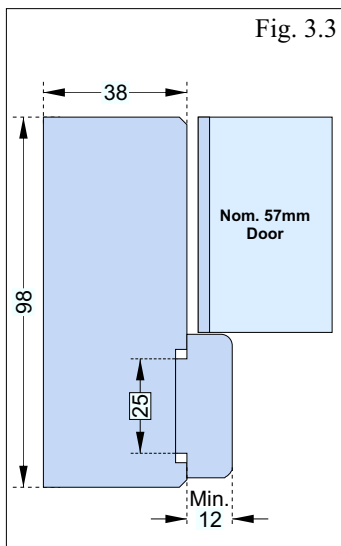
Recommended minimum frame dimensions for FD90 Single Action Doorsets - Planted Door Stop.

- Frame material to be hardwood of minimum 640kg/m³ density (@15% moisture content), complying with Class J30 BS EN 942 : 2007.
- Detail illustrates optional use of reverse screw fixing for the door stop to nominal depth of 8mm into the stop.



Recommended minimum frame dimensions for FD90 Single Action Doorsets - Moulded Door Stop.

- Frame material to be hardwood of minimum 640kg/m³ density (@15% moisture content), complying with Class J30 BS EN 942 : 2007.



Recommended minimum frame dimensions for FD90 Single Action Doorsets - 'T' Type Door Stop.

- Frame material to be hardwood of minimum 640kg/m³ density (@15% moisture content), complying with Class J30 BS EN 942 : 2007.

NOTE: The minimum frame section must be increased to accommodate 'T' detail doorstop.

Tectonite Frames - FD90 & FD120:

Tectonite based frames provide for and optional alternative to hardwood frames for FD90 applications.

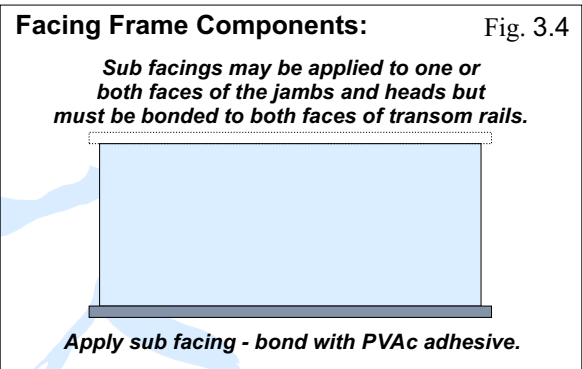
For FD120 applications the frames must be constructed using 'Tectonite' based Jamb heads, and where required, Transoms.

Tectonite required for the manufacture of door frames is supplied with in 101x43mm sections, the recommended processes for producing Jamb Head and Transom components are as follows:

1/ Ensure the removal of any dust that might otherwise contaminate glue lines.

- 2/ Apply sub facing / facing material to one face:
- 3mm Medium Density Fibreboard (MDF).
 - 3mm High Density Fibreboard (HDF)
 - 3mm Plywood.
 - 3mm Chipboard.
 - 3mm Constructional Veneer.

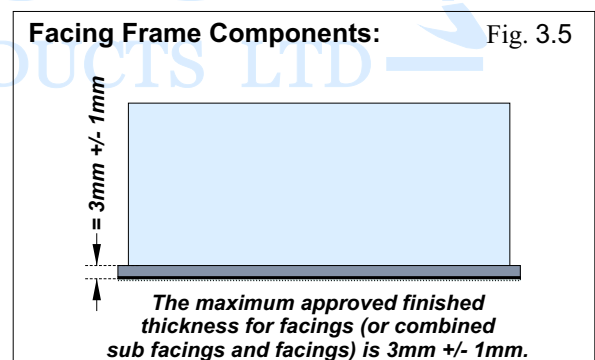
NOTE: For transom rails the sub facing / facing material is applied to both faces.



Option 1: If frames are to have veneered facings applied these can be pressed onto the core at the same time as the sub facings. In this event, lipping to be applied to the frame sections after facings have been applied will be visible.

Option 2: Apply lippings to the frame before applying final decorative facings. This will require double pressing of the frame components.

NOTE: The approved combined finished thickness for facings and sub facings is 3mm +/- 1mm.



3/ The following decorative facings / finishes can be applied to sub facings for frame components:

- Max. 0.5mm Paint
- Max. 2mm thickness Timber veneers.
- Max. 2mm thickness PVC / Plastic Laminates.
- Max. 0.5mm Decorative paper / non-metallic foil.

NOTE: It may be necessary to calibrate sub facings / facings such that the overall thickness of the combined sub facings / facings are not less than 2mm and not more than 4mm.

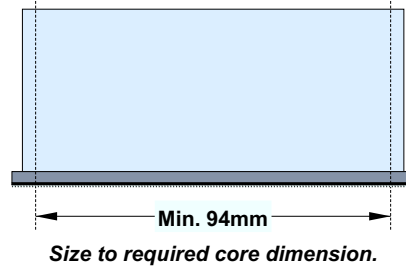
Doorframes

Tectonite Frames contd.:

4/ Option 1 - Trimming to core size: When the facings glue lines have cured, carefully size the assembly (*equally from both frame nose faces*) to the required finished dimensions less 6mm.

NOTE: The dimension for the frame core assembly before lipping should generally not be less than 94mm. However this may be reduced to Min. 72mm where the Bonded Hardwood frame extension method is used. See Fig. 3.21 page 3.8.

Sizing Frame Components: Fig. 3.6



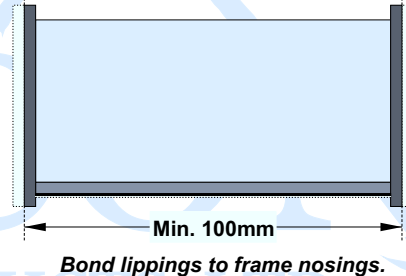
5/ Option 1 - Lippings: With the frame core assembly cleaned to remove any surplus dust, bond lippings to the core assembly faces using a PVAc adhesive.

NOTE 1: The finished thickness of the lippings must not exceed 3mm. The finished frame dimension with lippings applied must not be less than 94mm.

NOTE 2: Some manufacturers may prefer to apply thicker lippings and calibrate these as a finishing process.

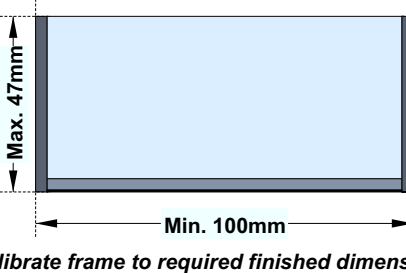
NOTE 3: The maximum 3mm thickness for the lippings applies to the door leaf side nose of the frame. Where frames are required to suit larger partition thicknesses, thicker lippings can be applied to the non door side face of the frame. See Pages 3.8 & 3.9.

Frame lippings: Fig. 3.7



6/ Option 1 - Final calibration: The final process for the base frame construction for the 'exposed lipping' Option 1 appearance is to carry out final machining and sanding to calibrate the base frame to the required dimensions.

Calibration: Fig. 3.8

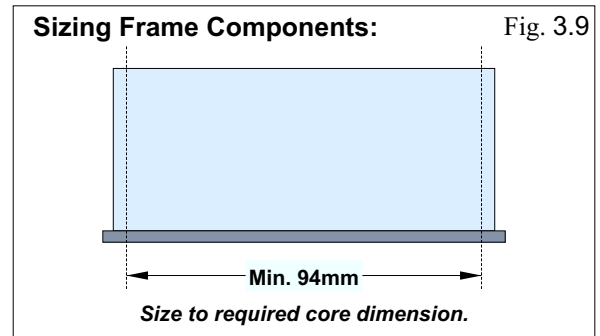


Tectonite Frames contd.:

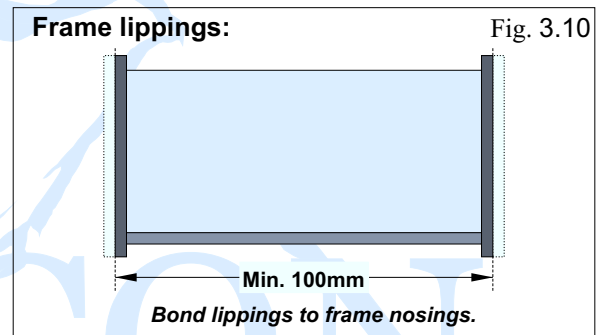
7/ Option 2 : For Option 2, (facings applied to the frame reveal following the application of lippings) the processes are slightly different.

a/ Apply sub facing (only) to the frame reveal.

NOTE: The dimension for the frame core assembly before lipping should generally not be less than 94mm. However this may be reduced to Min. 72mm where the Bonded Hardwood frame extension method is used. See Fig. 3.21 page 3.8.

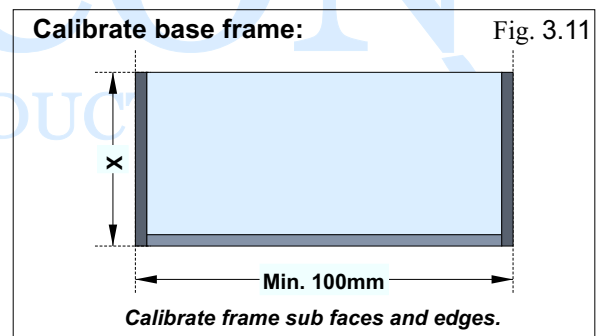


b/ Apply lippings.



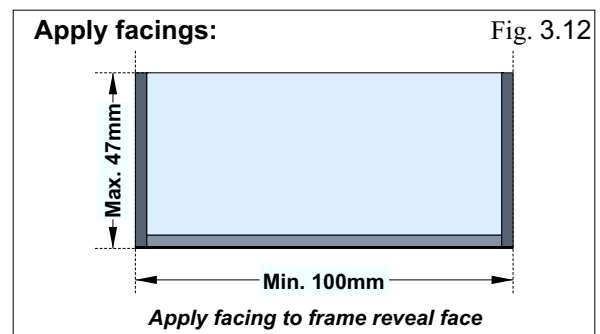
c/ Calibrate frame core assembly.

NOTE: Dim. 'X' = Finished frame dimension less thickness of finished facing material (after calibration & sanding)



d/ Apply facing material, trim and calibrate / sand to require finished frame section dimension.

NOTE: Facings for Option 2 frames will generally be thin materials e.g. wood veneers not exceeding 0.5mm thickness.



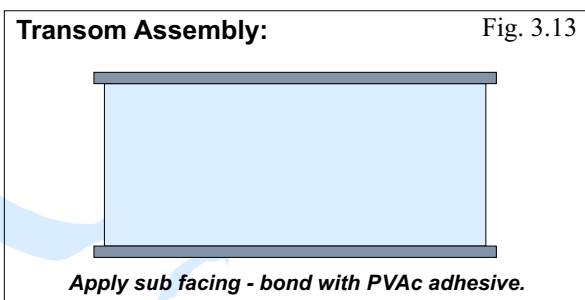
Doorframes

Tectonite Frames contd.:

8/ Transom Rails: The application of sub facings and / or facings to both sides of the frame is optional for the jambs and head and sub facings / facings will generally only be applied to the visible frame reveal. For transom rails the frame must be faced on both sides. However facing materials e.g. veneers, laminates etc. need only be applied to parts of the frame that will be visible when installed. i.e. sub facing materials only may be applied to the top of a transom rail.

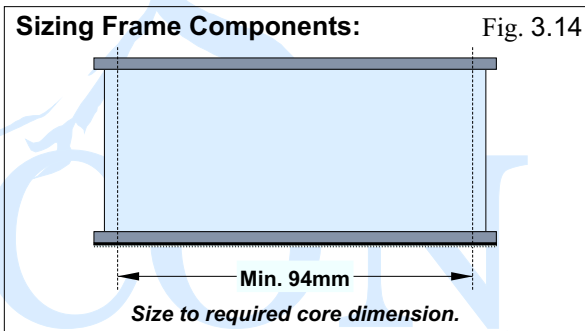
These details show recommended procedures for the manufacture of transom rails for use with Option 1 frame designs.

a/ Apply sub facings to both reveal faces of the frame core. For Option 1 frame designs, facing materials can also be applied to one or both faces of the transom rail.

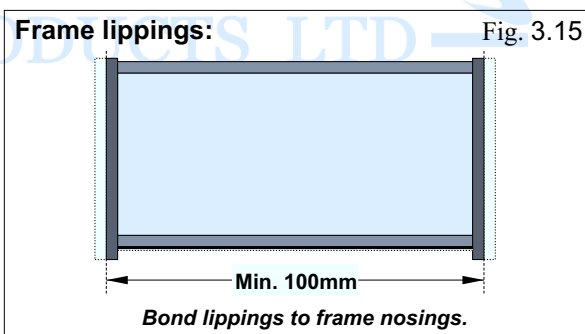


b/ Trim the transom rail to the required core dimension.

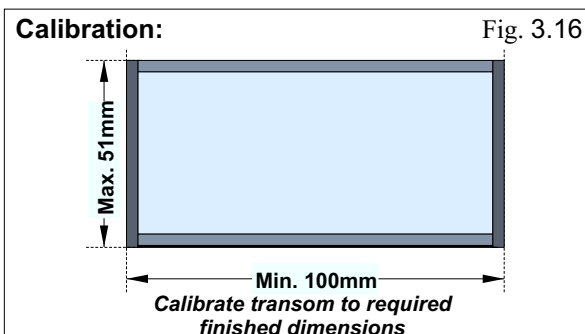
NOTE: The dimension for the frame core assembly before lipping should generally not be less than 94mm. However this may be reduced to Min. 72mm where the Bonded Hardwood frame extension method is used. See Fig. 3.21 page 3.8.



c/ Apply lippings.



d/ Final calibration to the required finished dimensions.

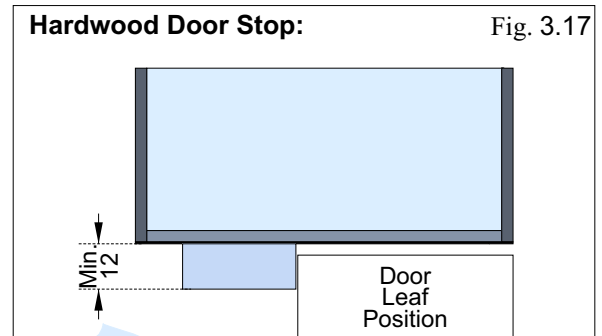


Tectonite Frames contd.:

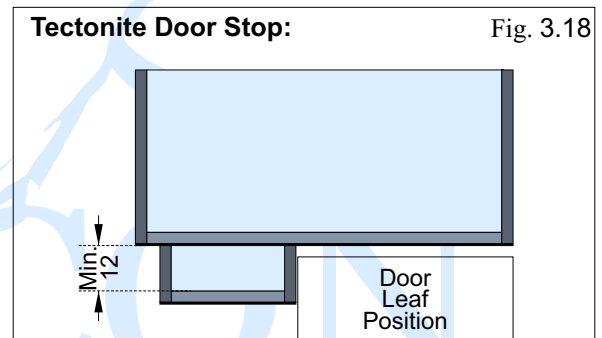
9/ Door Stops:

Door stops may be in Min. 640kg/m³ hardwood (See Page 3.1) or in Tectonite, clad as described for frame linings. Door stops must cover the operating gap and edge of the door leaf by a minimum of 12mm.

a/ *Hardwood Planted Door Stop*



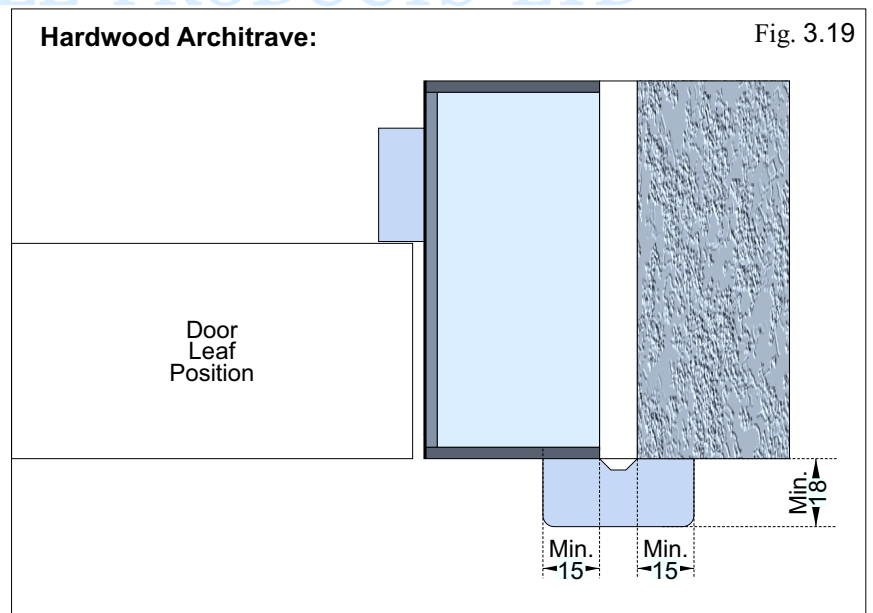
b/ *Clad Tectonite Door Stop.*



10/ Architrave:

Architrave must be in Min. 640kg/m³ Hardwood of 18mm thickness and provide for a minimum 15mm cover over the opening face of the frame and over the surrounding structure.

For certain installations, doorsets may be installed without the use of architrave. See Section 10 - Doorset Installation for further guidance.



Doorframes

Frame Extensions:

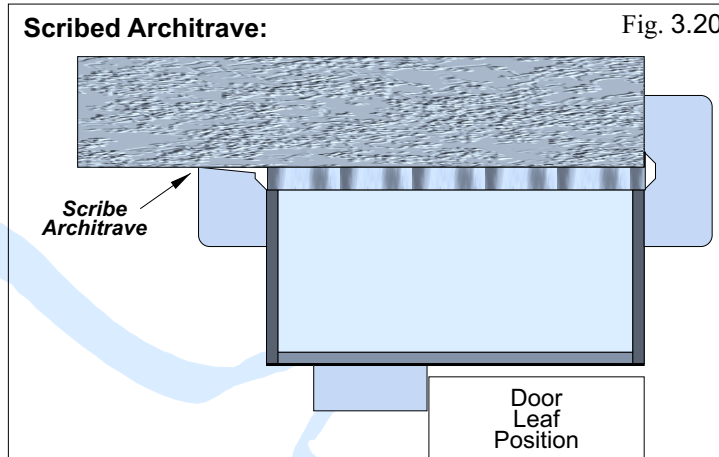
FD90 & FD120: There are various methods for adjusting frames to suit actual wall / partition thicknesses. The following methods can be applied to both FD90 Hardwood frames and FD120 Tectonite frames. (*Tectonite frames illustrated*):

a/ Scribed Architrave:

The frame is located within the structural reveal with architrave scribed to the surrounding structure.

Scribed Architrave:

Fig. 3.20

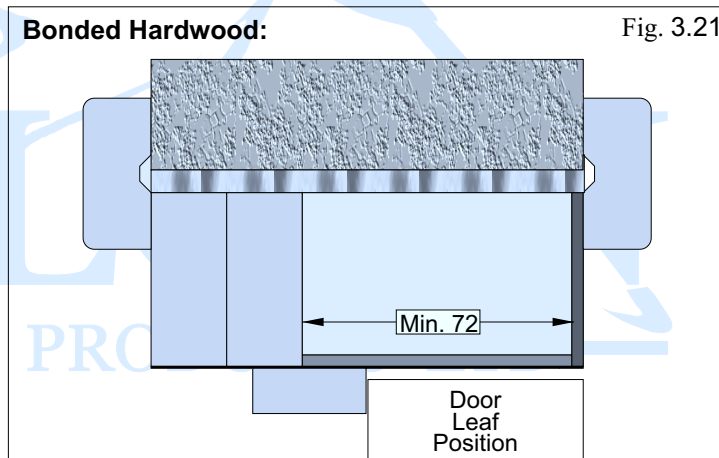


b/ Bonded Hardwood:

Effectively the lipping on the non door face of the frame is increased in thickness allowing up to 40mm extension of the Tectonite core using one or 2No. pieces 20mm thick (640kg/m³) Hardwood. This option may be used with a reduced (*Min. 72mm*) Tectonite core suitable for partition thicknesses Nom. 115 to 137mm.

Bonded Hardwood:

Fig. 3.21



c/ Dowelled Extension Lining:

A secondary hardwood frame is constructed and dowelled and glue fixed (*using Nom. 15mm dia. hardwood dowels*) to the non door side face of the frame.

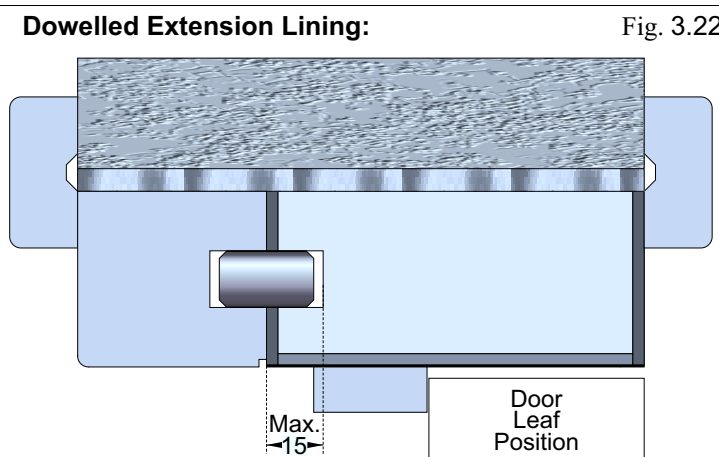
3No. dowel locations are required for the frame head with 4No. dowel locations required for each jamb.

The holes to receive the dowels must not exceed 15mm deep into the Tectonite primary frame.

The secondary (*extension lining frame*) can be independently fixed to the surrounding structure as a non load bearing structure.

Dowelled Extension Lining:

Fig. 3.22



Frame Extensions contd.:

d/ Slimline Dowelled Extension Lining:

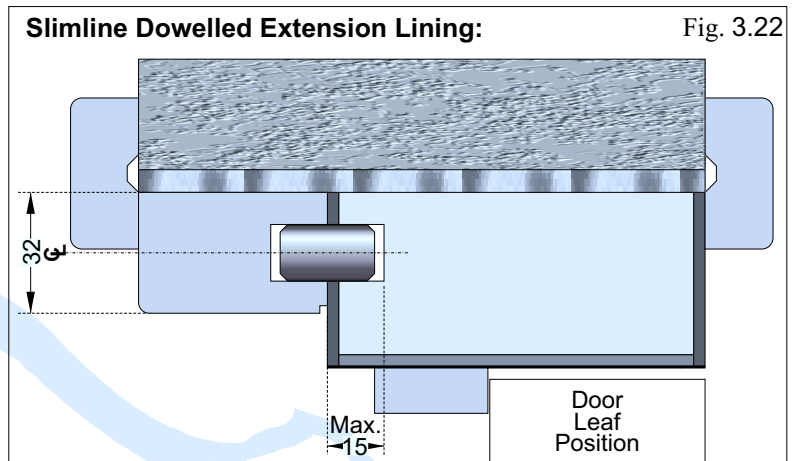
A secondary hardwood frame is constructed and dowelled and glue fixed (using Nom. 15mm dia. hardwood dowels) to the non door side face of the frame.

3No. dowel locations are required for the frame head with 4No. dowel locations required for each jamb.

The holes to receive the dowels must not exceed 15mm deep into the Tectonite primary frame.

The secondary (extension lining frame) can be of reduced dimensions with a 32mm section being a recommended minimum.

The secondary frame is independently fixed to the surrounding structure as a non load bearing structure.

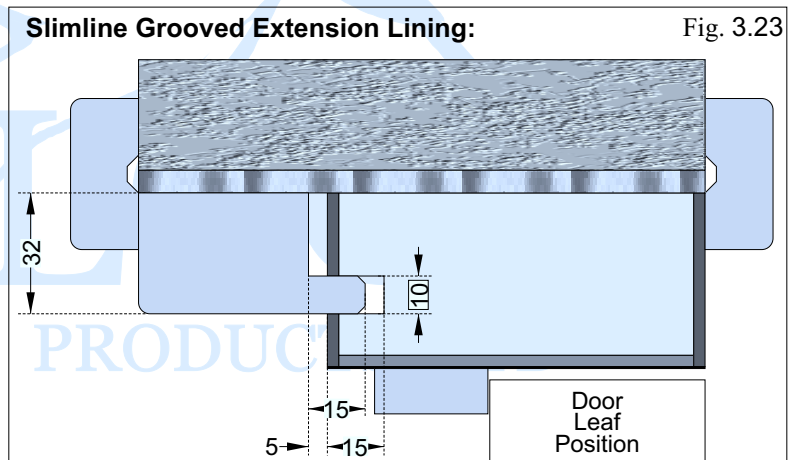


e/ 32mm Grooved Extension Lining:

32mm hardwood extension linings are fitted to a 10x15mm groove machined into the non door side of the Tectonite frame to a depth not exceeding 15mm.

This detail provides for a means of adjustment up to +/- 5mm to accommodate variations in actual structural dimensions.

The extension linings are independently fixed to the surrounding structure as a non load bearing structure.

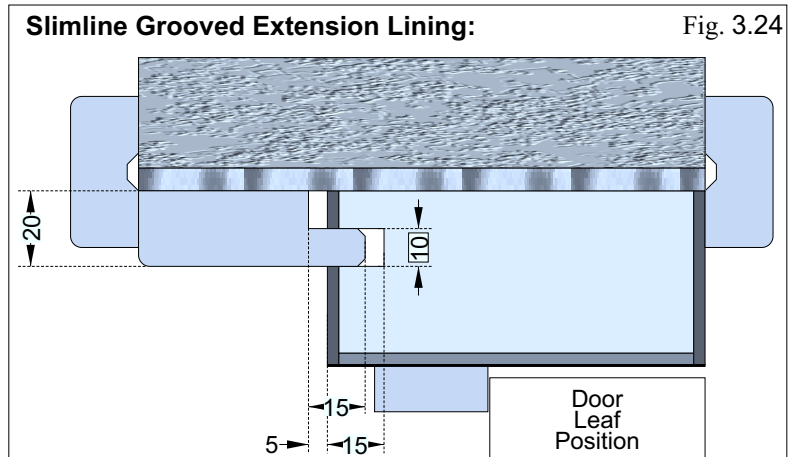


f/ 20mm Grooved Extension Lining:

20mm hardwood extension linings are fitted to a 10x15mm groove machined into the non door side of the Tectonite frame to a depth not exceeding 15mm.

This detail provides for a means of adjustment up to +/- 5mm to accommodate variations in actual structural dimensions.

The extension linings are independently fixed to the surrounding structure as a non load bearing structure.



Fire Door Applications

Fire Door Applications:

Safety provisions in the event of fire are generally described by reference to National Regulations. In addition, requirements may be influenced by:

- Local Bye Laws.
- Client specifications.

NOTE: Client specifications may take into account the particular purpose of the building e.g. HTM58 for Hospitals or Building Bulletin 100 for Schools in the United Kingdom.

The applicable Regulation for England & Wales is: Building Regulations (*England & Wales*) - Approved Document 'B' - 2006 Edition.

NOTE: Similar regulations apply in Scotland, Northern Ireland and the Republic of Ireland.

Approved Document 'B' is in two parts:
Approved Document 'B1' applies to Dwellings.
Approved Document 'B2' applies to Public Buildings.

For dwellings, the doorset designs are generally determined by the door / doorset manufacturer and are normally available in 'standard' sizes (See *BS4787 Pt.1*) from Builders Merchant sources. The doors / doorsets are generally manufactured for 'stock' with no particular final location in mind.

For public buildings, the design of the doorsets may be determined by an Architect or Designer with each doorset designed to suit a particular opening in a particular building. This may result in a wide variety of dimensional and feature requirements often with performance attributes in addition to the fire performance.

A standard (prescribed) product can be tested to the required performance standard and supplied on the basis of the base test evidence. For non standard or bespoke products it would be an impossible task to test every possible variant in size, configuration, glazing requirements and hardware variations. The method adopted in the United Kingdom is for bespoke doorset suppliers to test constructions to provide for applications 'envelopes'.

NOTE: Similar methods apply in the United States of America, Commonwealth and ex Commonwealth countries and many other Middle Eastern and Far Eastern states.

An 'applications envelope' is determined by way of 'expert opinion' based upon test evidence. The base test evidence sources include testing carried out by the door core manufacturer and other doorset component suppliers / manufacturers. e.g. intumescent seal, glass, hardware suppliers / manufacturers. etc.

The 'owners' of the base test data make their test evidence available to a 3rd. party certification body (*expert organisation*). The independent 3rd. party certification bodies create what is generally described as a 'Global Assessment' which sets out the parameters for fire door applications related to a particular construction.

As with any expert opinion, opinions may differ according to the experiences of the particular 3rd. party certification provider. This manual sets out the parameters for the application of Warm Springs based fire performance doorsets under the 'Q' Mark scheme that is administered by BM TRADA. To maintain the 'Q' Mark certification the doorset manufacturer using Warm Springs materials must also be a member of the 'Q' Mark certification scheme.

For various reasons, users of Warm Springs materials may wish to be members of alternative 3rd. party certification schemes. Falcon Panel Products Ltd. provide support for all approved 3rd. party certification providers by making base test evidence available for the purpose of assessment.

NOTE: The term 'assessment' related to the assessment provided by 3rd. party certification bodies should not be confused with the term 'assessment' used in Approved Document 'B' for the purpose of regulation. The assessment required by reference to regulations is determined by the 'authorities' responsible for the particular building, generally recognised as being the Designer, in consultation with Local Building Control, and (where applicable) the Local Fire Services. The authorities may accept the expert opinions provided by 3rd. party certification bodies as guidance but they are under no obligation to accept such expert advice.

Fire Door Applications

Fire Door Applications contd.

The particular project authorities may require:

- a/ 3rd, party certification originating from a particular 3rd. party certification provider.
- b/ A 'project assessment' related to the particular design requirements for a particular building.
- c/ Further testing of particular designs or design detail.
- d/ Additional 3rd. party certification to cover particular requirements that are outside of the scope of the Global Assessment.

There is generally an additional cost where there is a demand for certification in addition to that provided by the 'Global Assessment'. The cost will be influenced by the work required and the extent of the which any resultant data is limited to the particular project or can be applied generally for future applications.

Falcon Panel Products Ltd. will support users of Warm Springs materials by providing base test data owned by them for reference by 3rd. party certification bodies. Further, Falcon Panel Products Ltd. may provide support for users of Warm Springs materials who wish to carry out further testing by way technical support and the provision of core materials for testing purposes.

Project specifications will generally define the regulations to be applied to the particular building with a further definition of design requirements. It is generally the responsibility of the doorset manufacturer to provide for the necessary documentation to the reasonable satisfaction of the project authorities. It is strongly recommended that considerations of this nature are dealt with in advance of manufacture of the doorsets.

This section provides for general guidance for the application of Warm Springs materials based doorsets for BS476 Pt.22 related FD90 and FD120 performances. It is important to note that size envelopes may vary according to the size and type of intumescent seal used. Reference should be made to other sections in this manual to determine recommended intumescent seal locations and requirements for additional intumescent gaskets for use with hardware.

NOTE 1: The dimensional envelopes for the fire door application of Warm Springs material based doorsets will vary according to the size and type of intumescent seal selected for the particular project. To assist users, this Section identifies application dimensions related to intumescent seal type and size.

NOTE 2: More limited application dimensions apply to some intumescent seal types. This does not imply that the particular seal type is in anyway inferior but rather, this reflects the extent of testing carried out with the particular seal types at the time of publication of this manual. A continuing fire test programme is likely to result in variations to these published application dimensions and users should contact Falcon Panel Products Ltd. for further advice for applications not covered by this manual.

NOTE 3: This Section should not be read in isolation, refer to other sections for detail information.

WARNING: Various formulae are used in the manufacture of intumescent seals which may provide for different performance characteristics under fire conditions. The mixing of intumescent seal types for use in the same doorset is not approved.

Q Door Gaps / Alignment:

The following describes the maximum / minimum approved gaps and door leaf positioning for fire door applications. This advice is related specifically to the achievement of design fire performances and should not be referred to as an authority to vary the requirements of BS 4787 Pt.1 for general applications or BS9999 in respect of smoke sealed doorsets.

Location	Dimension
Head & Stile edge gaps.	Approved minimum = 2mm Approved maximum = 4mm
Threshold	Approved maximum = 10mm above finished floor level.
Alignment	Door leaves must not project beyond the face of the adjacent door / panel or the frame by more than 1mm

For further details please contact:

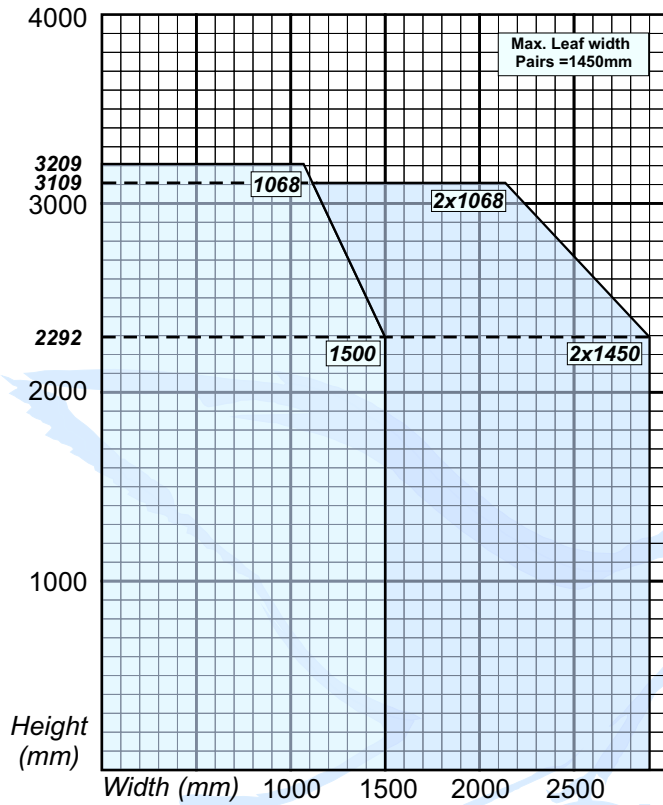
Falcon Panel Products Ltd.,
Clock House,
Station Approach,
Shepperton,
Middlesex TW17 8AN

Tel: +44 (0) 1932 256580
Fax: +44 (0) 1932 230268

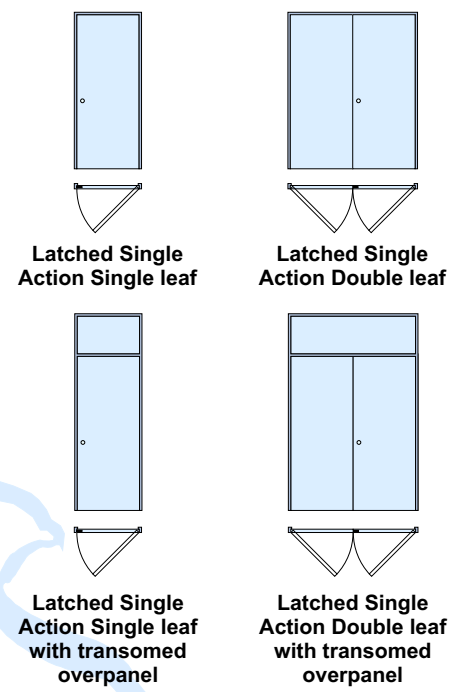
**Door Height Assemblies
&
Storey Height Assemblies with Transom**

**2No. 22x4 WSCP PVC-seal +
WSCP Flex-seal**

FD90 - BS476 Pt.22 :1987



LATCHED DOORSETS



Configuration		Height (mm)	Width (mm)
Latched Single Action Single Door (LSASD)	From	2292	1500
	To	3209	1068
Latched Single Action Double Door (LSADD)	From	2292	1450
	To	3109	1068

Maximum Glazed Area See Section 6:	Single door doorset	0.18m ²	Maximum Overpanel height	Single door doorset	500mm
	Double door doorset			Double door doorset	500mm

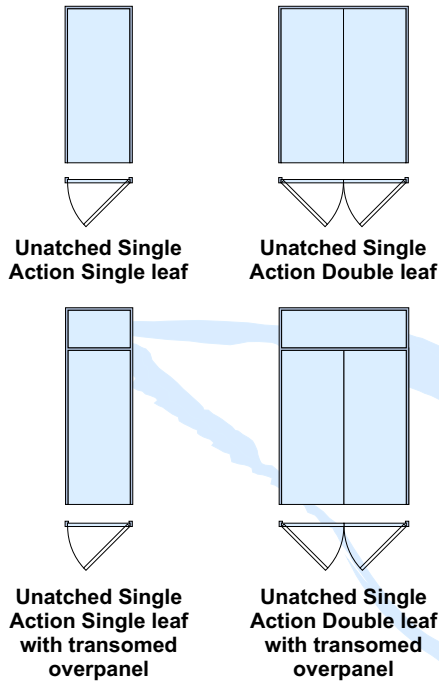
Frame Specification See Section 7	Single door doorset Double door doorset	640kg/m ³ Hardwood OR 1000kg/m ³ Clad Warm Springs Tectonite
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<p>Intumescent Seals 2No. 22x4mm WSCP PVC-seal + WSCP Flex-seal See Section 4 - Intumescent Seals and Section 9 - Hardware for further information</p>	<p>Head & Jamb: 22x4mm exposed and fitted within a groove to the frame head located 7mm from the opening face + 22x4 exposed and fitted within a groove to the frame head located 33mm from the opening face. Transoms & Overpanel: As Head & Jamb to both sides of the transom rail. Meeting edges: 1No. 22x4 exposed set in groove located 5mm from the opening face of one leaf and 1No. 22x4 exposed set in groove located 5mm from the closing face of the other leaf. Bottom of Door(s): 1No. 47x1 WSCP Flex-seal fitted centrally in a groove to the full width of the door leaf.</p>
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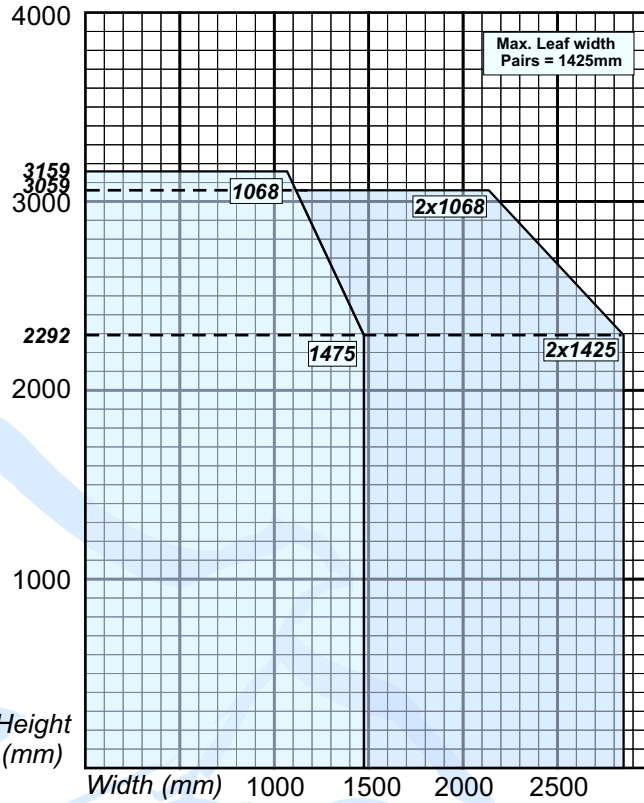
FD90 - BS476 Pt.22 :1987

UNLATCHED DOORSETS



**Door Height Assemblies
&
Storey Height Assemblies with Transom**

**2No. 22x4 WSCP PVC-seal +
WSCP Flex-seal**



Configuration		Height (mm)	Width (mm)
Unlatched Single Action Single Door (ULSASD)	From	2292	1475
	To	3159	1068
Double Action Single Door (DASD)	From	NOT APPROVED	NOT APPROVED
	To		
Unlatched Single Action Double Door (ULSADD)	From	2292	1425
	To	3059	1068
Double Action Double Door (DADD)	From	NOT APPROVED	NOT APPROVED
	To		

Maximum Glazed Area See Section 6:	Single door doorset Double door doorset	0.18m ²	Maximum Overpanel height	Single door doorset Double door doorset	500mm 500mm
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Frame Specification See Section 7	Single door doorset Double door doorset	640kg/m ³ Hardwood OR 1000kg/m ³ Clad Warm Springs Tectonite
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<p>Intumescent Seals 2No. 22x4mm WSCP PVC-seal + WSCP Flex-seal See Section 4 - Intumescent Seals and Section 9 - Hardware for further information</p>	<p>Head & Jambs: 22x4mm exposed and fitted within a groove to the frame head located 7mm from the opening face + 22x4 exposed and fitted within a groove to the frame head located 33mm from the opening face. Transoms & Overpanel: As Head & Jambs to both sides of the transom rail. Meeting edges: 1No. 22x4 exposed set in groove located 5mm from the opening face of one leaf and 1No. 22x4 exposed set in groove located 5mm from the closing face of the other leaf. Bottom of Door(s): 1No. 47x1 WSCP Flex-seal fitted centrally in a groove to the full width of the door leaf.</p>
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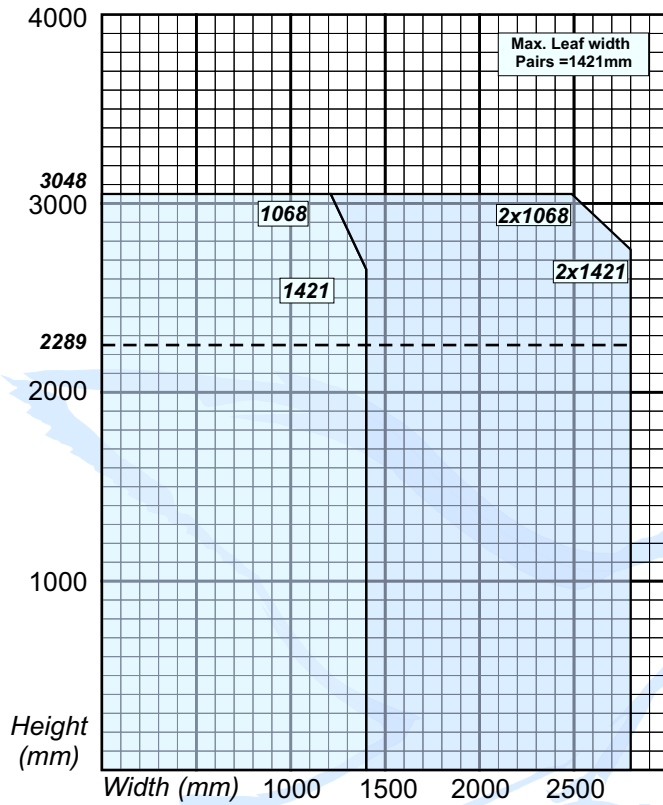
Door Height Assemblies
&
Storey Height Assemblies with Transom

**2No. 22x4 WSCP PVC-seal +
WSCP Flex-seal**

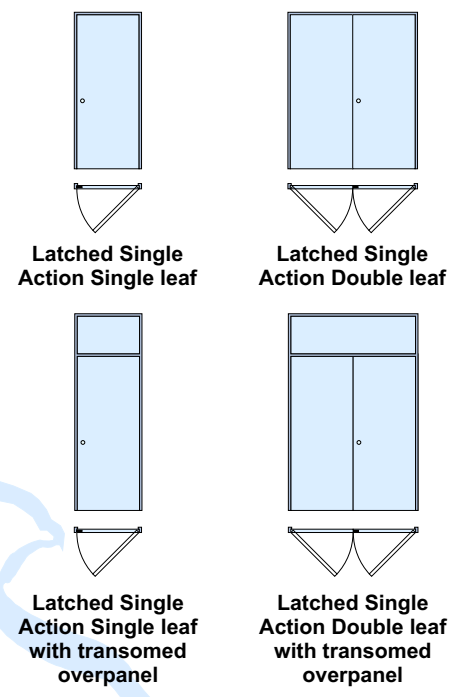
FD120 - BS476 Pt.22 :1987

4.5

Fire Door Applications



LATCHED DOORSETS



Configuration		Height (mm)	Width (mm)
Latched Single Action Single Door (LSASD)	From	2289	1421
	To	3048	1068
Latched Single Action Double Door (LSADD)	From	2289	1421
	To	3048	1068

Maximum Glazed Area See Section 6:	Single door doorset	0.18m ²	Maximum Overpanel height	Single door doorset	500mm
	Double door doorset			Double door doorset	500mm

Frame Specification See Section 7	Single door doorset Double door doorset	1000kg/m ³ Clad Warm Springs Tectonite
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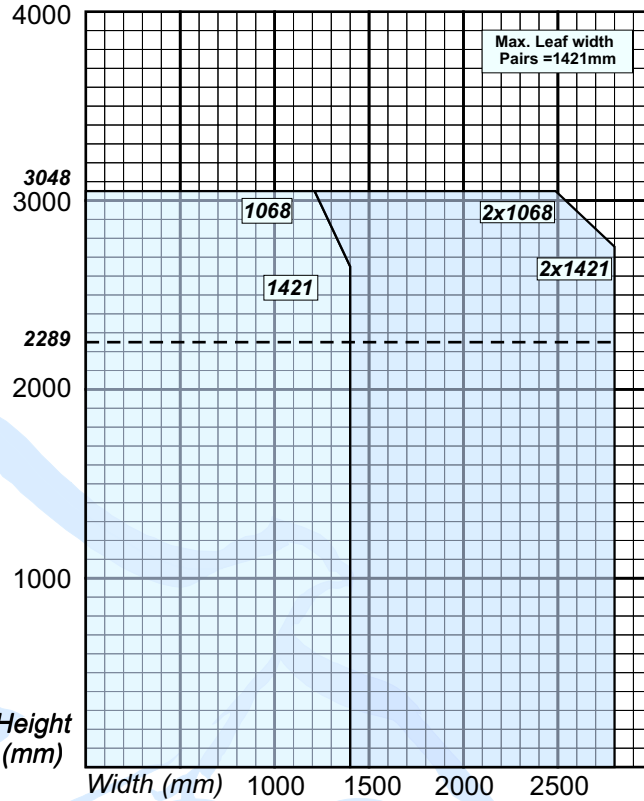
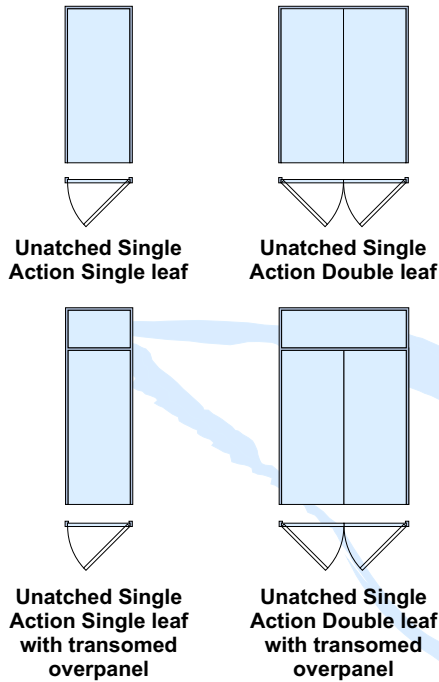
<p>Intumescent Seals 2No. 22x4mm WSCP PVC-seal + WSCP Flex-seal See Section 4 - Intumescent Seals and Section 9 - Hardware for further information</p>	<p>Head & Jambs: 22x4mm exposed and fitted within a groove to the frame head located 7mm from the opening face + 22x4 exposed and fitted within a groove to the frame head located 33mm from the opening face. Transoms & Overpanel: As Head & Jambs to both sides of the transom rail. Meeting edges: 1No. 22x4 exposed set in groove located 5mm from the opening face of one leaf and 1No. 22x4 exposed set in groove located 5mm from the closing face of the other leaf. Bottom of Door(s): 1No. 47x1 WSCP Flex-seal fitted centrally in a groove to the full width of the door leaf.</p>
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FD120 - BS476 Pt.22 :1987

**2No. 22x4 WSCP PVC-seal +
WSCP Flex-seal**

UNLATCHED DOORSETS



Configuration		Height (mm)	Width (mm)
Unlatched Single Action Single Door (ULSASD)	From	2289	1421
	To	3048	1068
Double Action Single Door (DASD)	From	NOT APPROVED	NOT APPROVED
Unlatched Single Action Double Door (ULSADD)	From	2289	1421
	To	3048	1068
Double Action Double Door (DADD)	From	NOT APPROVED	NOT APPROVED
	To		

Maximum Glazed Area See Section 6:	Single door doorset Double door doorset	0.18m ²	Maximum Overpanel height	Single door doorset Double door doorset	500mm 500mm
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Frame Specification See Section 7	Single door doorset Double door doorset	1000kg/m ³ Clad Warm Springs Tectonite
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<p>Intumescent Seals 2No. 22x4mm WSCP PVC-seal + WSCP Flex-seal See Section 4 - Intumescent Seals and Section 9 - Hardware for further information</p>	<p>Head & Jambs: 22x4mm exposed and fitted within a groove to the frame head located 7mm from the opening face + 22x4 exposed and fitted within a groove to the frame head located 33mm from the opening face. Transoms & Overpanel: As Head & Jambs to both sides of the transom rail. Meeting edges: 1No. 22x4 exposed set in groove located 5mm from the opening face of one leaf and 1No. 22x4 exposed set in groove located 5mm from the closing face of the other leaf. Bottom of Door(s): 1No. 47x1 WSCP Flex-seal fitted centrally in a groove to the full width of the door leaf.</p>
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CE Marking:

The majority of fire testing carried out by Falcon Panel Products Ltd. relates to BS476 Pt.22 to the satisfaction of Building Regulations - (*England & Wales*) - Approved Document 'B'.

Current European Standards require testing to BS EN 1634-1 for the purpose of CE marking doorsets for fire performance applications.

The scope for determining applications envelopes by way of 'expert opinion' as currently practised in the United Kingdom (*and in other world markets*) has yet to be finalised and at the time of preparation of this manual it is unclear how CE marking might be applied to bespoke products where designs (*and possibly some doorset components*) are determined 'by others' (*generally an Architect or Designer*) who is not employed by (*or under the control of*) the manufacturer - where the doorsets are not offered to the '*world at large*' - and where doorsets are purpose made, (*usually in contract related batches*) to suit a particular opening in a particular building according to a contract related time programme.

Notwithstanding this, it can be anticipated that CE marking may be required in due course for 'standard' (*prescribed*) products that are offered for sale to the '*world at large*' - are manufactured without a particular user location in mind - and where the designs are determined wholly by the doorset manufacturer.

Whereas the (*ISO related*) time / temperature curve is identical for both the BS476 Pt.22 and EN BS 1634-1 test, there are differences between the tests as follows:

Pressure normal - The pressure normal in the furnace (*point at which the pressure is equal on both faces of the door*) is 1000mm above floor level for the 476 Pt.22 test with this lowered to 500mm above floor level for the 1634-1 test.

Thermocouples - Twisted wire thermocouples are used for the 476 Pt.22 test with plate thermocouples used for the 1634-1 test. Twisted wire thermocouples react more quickly to changes in temperature thus, the front end charge required to heat the thermocouples is more aggressive for the 1634-1 test.

Proposed European Standards for the extended application of base test data have yet to be agreed but current proposals indicate that the scope for extended application by way of 'expert opinion' will be more limited as current proposals require agreement between a large number of 'experts' who may have widely differing experience.

It is likely that there will be limitations on the extent to which base test data can be assessed by way of 'expert opinion' for CE marking purposes. Apart from dimensional limitations there are also likely to be restrictions relating to the changing of doorset components e.g. glazing, hardware etc. relative to the particular 'as tested' doorset design.

Warm Springs materials provide for competitive and reliable door and frame core products that are ideally suited for the manufacture high performance fire rated doorset applications.

Falcon Panel Products Ltd. are continuing with a BS EN 1634-1 related test programme. Further testing to this standard will be related to demand and Falcon Panel Products Ltd. are committed to provide for support for manufacturers who wish to carry out further testing of their designs (*where the designs are based upon the use of the Warm Springs core materials*) for CE marking purposes.

Intumescent Seals

Intumescent Seals:

NOTE: *This section deals with the edge sealing of doors & frames only. Intumescent provisions for glazing and hardware are dealt with separately under 'Glazing' and 'Hardware'.*

The use of intumescent seals is essential to achieve the potential fire performance of wood and wood based doorsets.

Warm Springs material doorsets have been tested using dedicated PVC encapsulated intumescent seals that have been specifically developed to provide for FD90 and FD120 fire ratings.

WARNING: *Intumescent seal materials must be of the types and sizes described in this manual and must be located as illustrated in this Section.*

Intumescent seals should be carefully located and fitted in accordance with Warm Springs recommended details as illustrated in this manual.

Extended Application:

NOTE: *It may be possible to extend the dimensional applications envelope given by reference to Section 2 - Fire Door Applications Data by adjustment of the intumescent sealing. Requirements of this nature should be referred to Falcon Panel Products Ltd. in the first instance together with details of the particular application requirement. Where necessary, additional base test data may be requested together with authority for use of such data for the purpose of assessment.*

The extent to which it is possible to extend dimensional envelopes cannot be determined without the benefit of detailed knowledge of the intended application.

Where design requirements describe products that fall outside of the scope of the assessed dimensional applications envelopes described in Section 2 of this manual for any particular performance, full details of the requirement should be forwarded to:

Falcon Panel Products Ltd.,

Clock House,
Station Approach,
Shepperton,
Middlesex TW178AN

Tel: 01932 256580

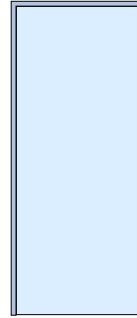
Fax: 01932 230268

WARNING: *Various formulae are used in the manufacture of intumescent seals that may provide for different performance characteristics under fire conditions. The mixing of intumescent seal types for use in the same doorset is not approved.*

Intumescent Seals **FD90 & FD120**

**2No. 22x4 WSCP PVC-seal +
WSCP Flex-seal**

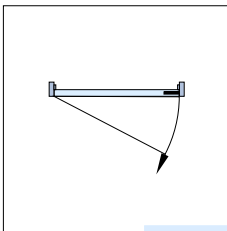
Single Leaf FD90 & FD120 applications using 2No. 22x4 WSCP PVC-seal perimeter seals + WSCP Flex-seal to bottom of door.



Single leaf
Door Height
Doorsets



Single leaf
Storey Height
Doorsets
with Transom



Latched Single leaf Single Action Doorsets:

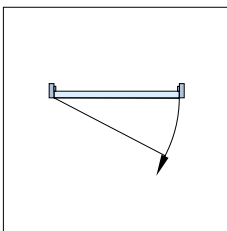
Jambs & Head = 22x4mm WSCP PVC-seal exposed and fitted within a groove to the frame head located 7mm from the opening face + 22x4 WSCP PVC-seal exposed and fitted within a groove to the frame head located 33mm from the opening face.

Bottom of door leaf: 47x1mm WSCP Flex-seal to full width of the door leaf.

Door Leaf sizes FD90: From: 2292 x 1500mm
To: 3209 x 1068mm

Door Leaf sizes FD120: From: 2289 x 1421mm
To: 3048 x 1068mm

NOTE: For storey height doorsets WSCP PVC-seal as described for Jambs and Head are fitted to both sides of the transom rail.



Unlatched Single leaf Single Action Doorsets:

Jambs & Head = 22x4mm WSCP PVC-seal exposed and fitted within a groove to the frame head located 7mm from the opening face + 22x4 WSCP PVC-seal exposed and fitted within a groove to the frame head located 33mm from the opening face.

Bottom of door leaf: 47x1mm WSCP Flex-seal to full width of the door leaf.

Door Leaf sizes FD90: From: 2292 x 1475mm
To: 3159 x 1068mm

Door Leaf sizes FD120: From: 2289 x 1421mm
To: 3048 x 1068mm

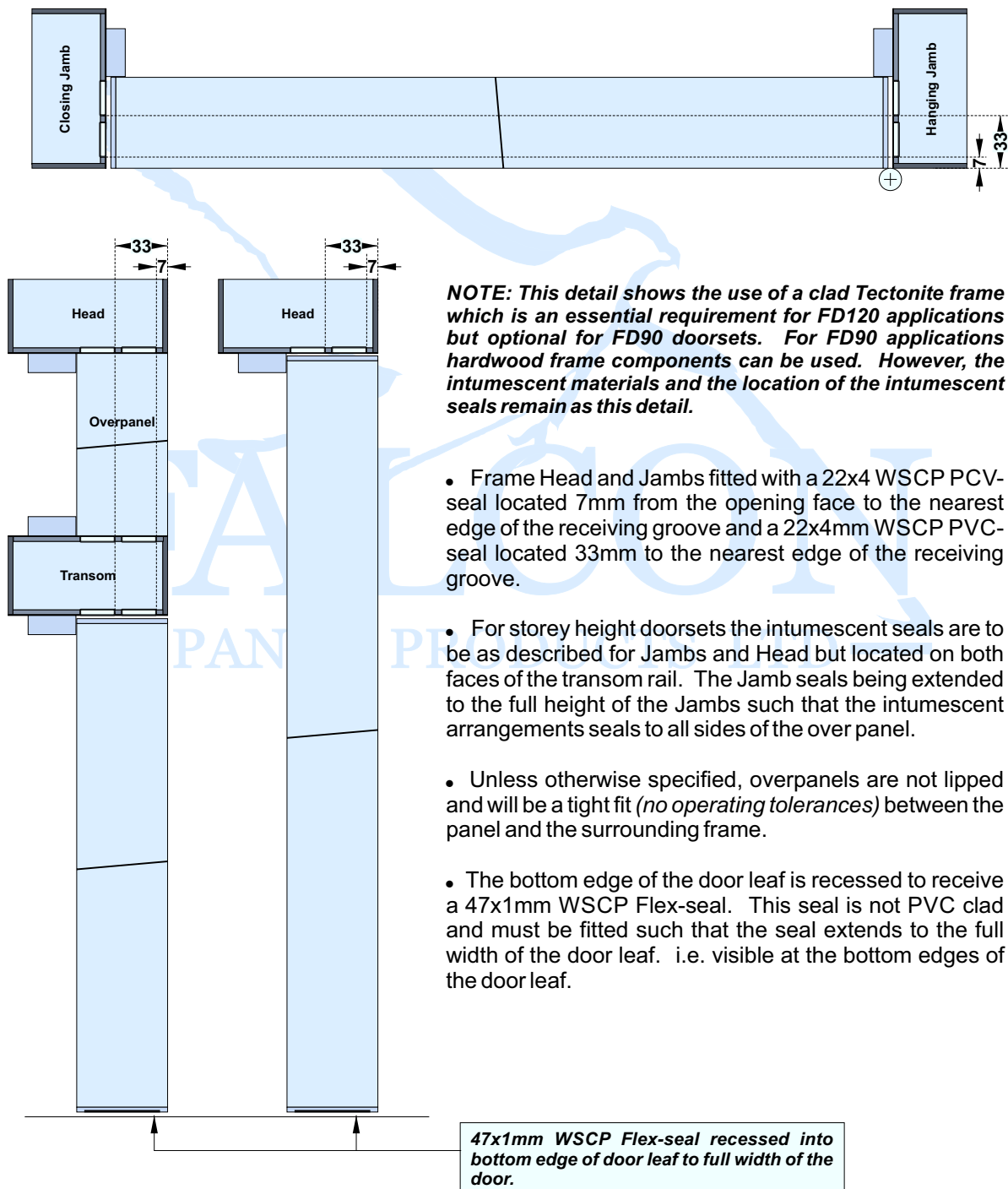
NOTE: For storey height doorsets WSCP PVC-seal as described for Jambs and Head are fitted to both sides of the transom rail.

FD90 & FD120

2No. 22x4 WSCP PVC-seal + WSCP Flex-seal

Single Action Single leaf
- Door Height Assemblies
- Storey Height Assemblies with Transom.

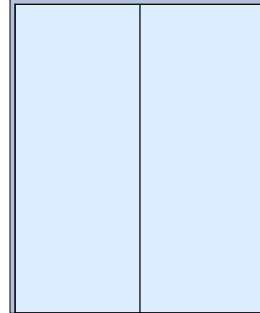
Fig. 5.1



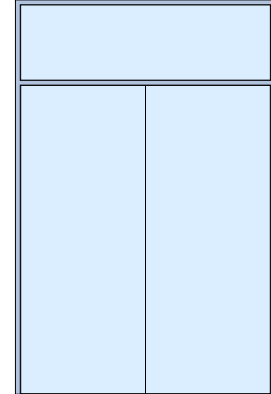
Intumescent Seals **FD90 & FD120**

2No. 22x4 WSCP PVC-seal + WSCP Flex-seal

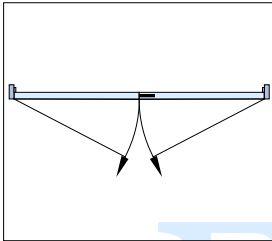
Double Leaf (pairs) FD90 & FD120 applications using 2No. 22x4 WSCP PVC-seal perimeter seals +WSCP Flex-seal to bottom of door + 2No. 22x4 WSCP PVC-seal meeting stile seals.



Double leaf Door Height Doorsets



Double leaf Storey Height Doorsets with Transom



Latched Double leaf (pairs) Single Action Doorsets:

Jambs & Head = 22x4mm WSCP PVC-seal exposed and fitted within a groove to the frame head located 7mm from the opening face + 22x4 WSCP PVC-seal exposed and fitted within a groove to the frame head located 33mm from the opening face.

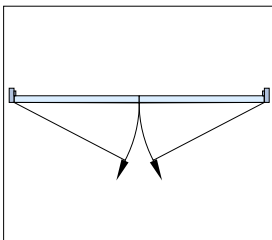
Bottom of door leaf: 47x1mm WSCP Flex-seal to full width of both door leaves.

Meeting Stiles: 1No. 22x4 WSCP PVC-seal exposed and fitted within a groove to the door edge located 5mm from the opening face of one leaf and 1No. 22x4 WSCP PVC-seal exposed and fitted within a groove to the door edge located 5mm from the closing face of the other leaf.

Door Leaf sizes FD90: From: 2292 x 1450mm
To: 3109 x 1068mm

Door Leaf sizes FD120: From: 2289 x 1421mm
To: 3048 x 1068mm

NOTE: For storey height doorsets WSCP PVC-seal as described for Jambs and Head are fitted to both sides of the transom rail.



Unlatched Double leaf (pairs) Single Action Doorsets:

Jambs & Head = 22x4mm WSCP PVC-seal exposed and fitted within a groove to the frame head located 7mm from the opening face + 22x4 WSCP PVC-seal exposed and fitted within a groove to the frame head located 33mm from the opening face.

Bottom of door leaf: 47x1mm WSCP Flex-seal to full width of the door leaf.

Meeting Stiles: 1No. 22x4 WSCP PVC-seal exposed and fitted within a groove to the door edge located 5mm from the opening face of one leaf and 1No. 22x4 WSCP PVC-seal exposed and fitted within a groove to the door edge located 5mm from the closing face of the other leaf.

Door Leaf sizes FD90: From: 2292 x 1425mm
To: 3059 x 1068mm

Door Leaf sizes FD120: From: 2289 x 1421mm
To: 3048 x 1068mm

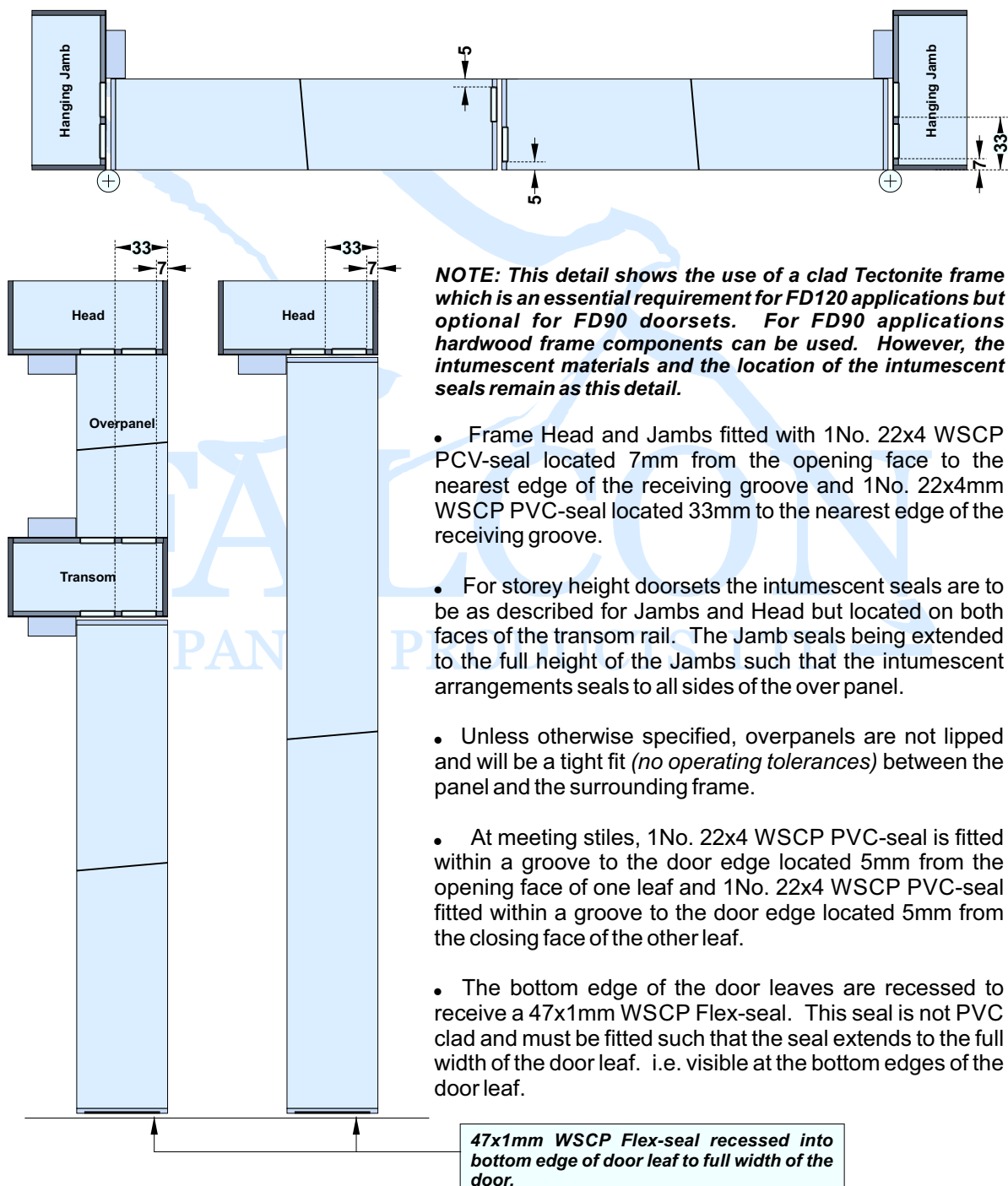
NOTE: For storey height doorsets WSCP PVC-seal as described for Jambs and Head are fitted to both sides of the transom rail.

FD90 & FD120

**2No. 22x4 WSCP PVC-seal +
WSCP Flex-seal**

Single Action Double leaf (pairs).
- Door Height Assemblies
- Storey Height Assemblies with Transom.

Fig. 5.2



Smoke Sealing

General:

The test procedure for smoke sealed doorsets is given by reference to BS476 Section 31.1.

The performance criteria for smoke sealed doorsets is given by reference to BS5588 (and BS9999) in the following terms:

'A fire door required to resist the passage of smoke at ambient temperature conditions should, when tested in accordance with BS476 : Section 31.1 with the threshold taped and subjected to a pressure of 25Pa, have a leakage rate not exceeding 3m³/m/h. The threshold gap should be sealed either with a leakage rate not exceeding 3m³/m/h at 25Pa or just contacting the floor; where this is impracticable the threshold gap should not exceed 3mm at any point.'

NOTE 1: Reference to BS476 Section 31.1 shows that the performance is measured with seals in a new condition. i.e. There is an operational test but this is not a durability test.

NOTE 2: The performance requirement does not state at which point during the swing of the door that the maximum permitted 3mm gap should be achieved. However, it is reasonable to believe that this maximum gap should apply to the door in its closed position.

Smoke sealing is a separate performance requirement to fire rating. i.e. there is no regulation that requires specifically that a fire rated door should also be a smoke sealed door. General purpose doors that are not fire rated may be specified as smoke sealed.

Under Door Sealing:

Unless used with a sill (with a four sided frame), the under door gap cannot be controlled by the doorset manufacturer who can only assemble doorsets to provide for a nominal dimension from the bottom of the door to the bottom of the frame jamb (subject to BS4787 tolerances). Similarly, it may be difficult for the Installation Contractor to control under door gaps as these are influenced to a major degree by the quality of the surrounding structure, and in particular the quality and nature of the floor preparation and finish.

Thresholds may be used to control under door gaps but these tend to be rejected where these might interfere with wheeled 'traffic'.

Mechanical drop seals (Automatic Door Bottoms) provide for an effective method for sealing the bottom edge of the doors (e.g. Norsound NOR810).

NOTE: This is the preferred option for sealing the bottom edge of doors where the under door gap cannot be controlled to the precision required by reference to BS5588 (BS9999). These may be fitted on site as a variation to existing doorsets as necessary, to suit particular location requirements.

Brush seals may be used at the bottom edge of the door. However, the effectiveness of these will vary according to the variation in the operating gap during the swing of the door. i.e. They must essentially be set to suit the minimum gap through the swing of the door.

NOTE: Fixed bottom edge door seals should generally be used with threshold strips to ensure that the seals clear the floor through the whole swing of the door.

Edge Sealing:

Most intumescent seal manufacturers supply combined intumescent / smoke seals that have been tested to BS476 Section 31.1 and that are suitable for sealing stiles and heads.

Fundamentally there are two types of combined intumescent / smoke seal.

- 1/ Brush seals
- 2/ Elastometric blade seals.

The force acting on the seals at the hanging stile is different to the force acting at the closing stile. The hanging stile seals will be subjected to a compression force with minimal shear force while the closing stile seals will be subjected to shear forces but with some compression force. The head seals will generally be subjected to shear forces with some compression force.

Brush seals subjected to compression forces will often retain their compressed state within a short time after fitting.

(NOTE: Some brush seals incorporate a plastic membrane that improves the life of the seal before settling at the compressed state).

Brush seals subjected to shear and compression forces will generally retain the compressed state within a short period after fitting, the shear forces (friction) may also cause wear.

Combined intumescent / elastometric blade seals tend to suffer less from compression forces. However, shear forces, particularly if applied at the joint between the blade and the intumescent carrier can result in separation of the blade from the carrier.

Smoke Sealing

Edge Sealing contd.:

Shear loadings, if excessive, can influence operating forces. There is a tendency to 'wind up' closers to overcome seal and possibly latch resistance to the extent that the forces necessary to use the doors may exceed those required by reference to Building Regulations - (England & Wales) - Approved Document 'M' and BS8300.

The smoke sealing element of edge fixed seals may need to be removed to accommodate hardware. Further, when using edge fixed seals, it may difficult to accommodate variations in operating gap tolerances permitted by reference to BS4787 and BS1567. Variations in environmental conditions can affect the moisture content of the door or frame resulting in variations in the size of the operating gaps.

To overcome the problems identified above it is recommended that compression seals are applied to the doorstops to act at hanging stiles, head and the closing stiles of single leaf doorsets. Multi blade type seals available from a number of sources are suitable for this application. Alternatively 'O' seals or single blade seals fitted to the face of the doorstop could be used. These act on the face of single action doors allowing for variations in operating gaps without detriment to the sealing. The seals remain unbroken when fitting hardware to the edge of the door.

NOTE: It is recommended that the stiles and head of the doors (particularly to the closing face of the doors) are slightly rounded (3mmR) or splayed, to act as a lead for the compression of seals. This will provide for improved durability with a reduction in the operating forces necessary to use the doors.

Single action pairs of fire doors should generally provide for simultaneous opening. It is also desirable to maintain a continuous seal, i.e. not interrupted to accommodate hardware, if possible. Use of combined intumescent seals with blades off set to one edge of the seal may be used for this application. It is recommended that the seal is recessed into the door edge such that the smoke seal blade overlaps the adjacent doors by 0.5 to 1mm. This has an added advantage in that the forces applied during operation are felt more on the flexible blade and less at the vulnerable blade / carrier joint. As the recommended frame seals overlap the face of the door, it is possible to adjust the meeting stile gap by use of packing at the hinge positions without detriment to the perimeter sealing. i.e. There is only one gap to adjust.

The meeting stiles of pairs of doors treated in this manner will need to be beveled (*provided with a 'leading edge' generally not greater than 2°*) to ensure that the doors may be opened simultaneously without damage to the smoke sealing blade and to ensure that the doors can be operated using acceptable forces.

It is recommended that the smoke sealing blade should be positioned as near to the opening face of the door as possible. This should allow for the fitting of hardware without the necessity to remove any of the smoke seal.

General Notes:

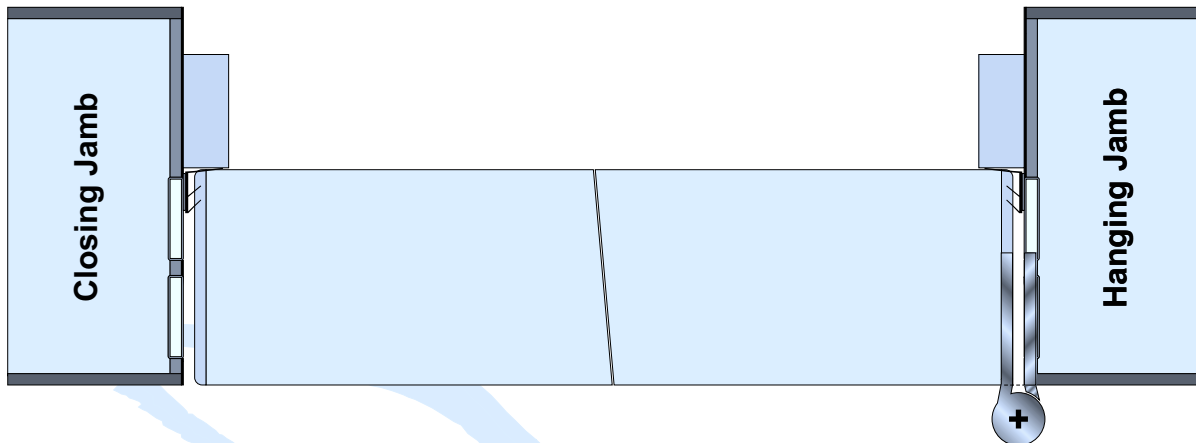
NOTE 1: For optimum performance seals should compress to approx. 50% of maximum. Over compression can lead to distortion of the seal with subsequent leakage and possible interference with the door operation.

NOTE 2: Whereas it is desirable for smoke seals to be continuous and unbroken to accommodate hardware, some sealing systems have been successfully tested to provide for the performances described by reference to BS5588 (BS9999) with part of the seals removed to suit hardware items. Reference should be made to the seal manufacturer's / supplier's test data where this consideration applies.

NOTE 3: The fitting of smoke seals must not compromise the operation of the door.

Jamb / Stile Sealing 1:

Fig. 6.1



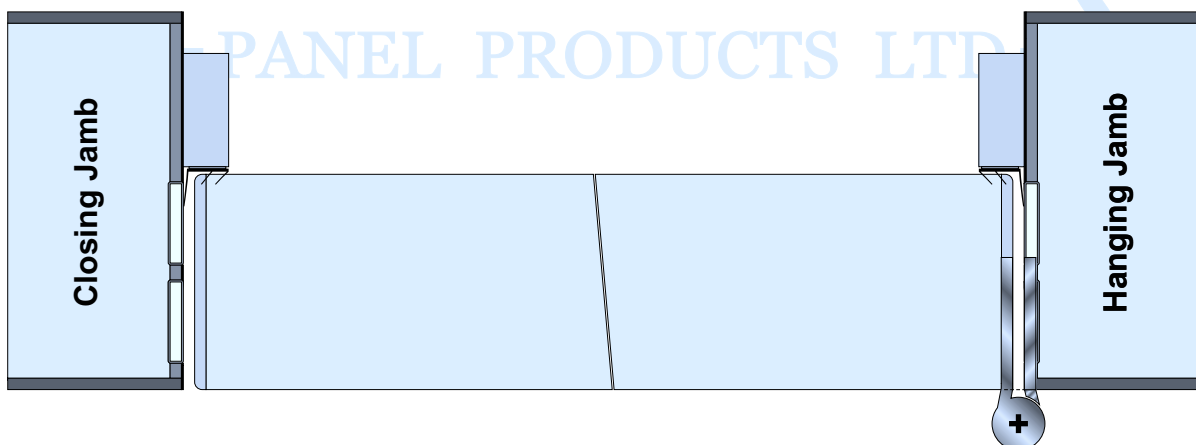
The use of separate smoke seals (*independent of intumescent seals*) is recommended.

This illustration shows the use of the Norsound 710 seal that has been tested to BS476 Section 31.1 and which can be fitted to frame reveal near to the doorstep. Seals located in this position provide for optimum smoke sealing performances and are less likely to suffer from conflicts with hardware or other seals. The Norsound 710 seal located in this position will also have a minimal influence on door leaf operating forces.

NOTE: The use of a small pencil round is recommended, to be applied particularly to the closing edges of the door leaf to provide for a lead for the compression of seals and to improve seal durability.

Jamb / Stile Sealing 2:

Fig. 6.2

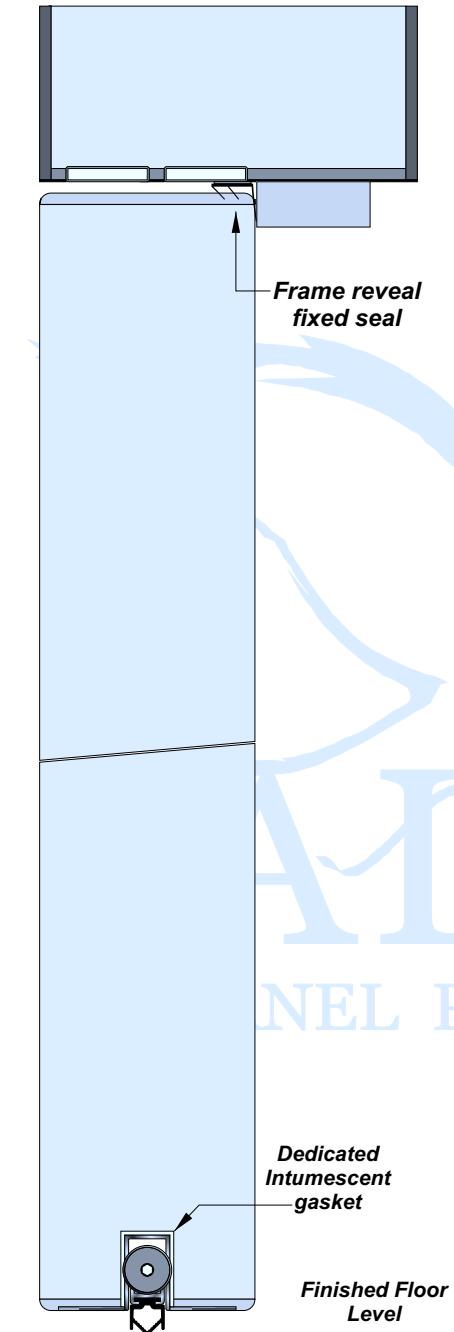


Although providing for optimum smoke sealing performances when fitted to the frame reveal, the Norsound 710 seal design included consideration for face fixing onto the face of a min. 12mm doorstep while still providing for a leakage rate of less than 3m³/m/hr. @ 25Pa. required by reference to the relevant standards, thus providing for increased scope for the avoidance of conflict with hardware.

This location will also provide for a limited slamming buffer performance to reduce noise when the door is operated.

Smoke Sealing

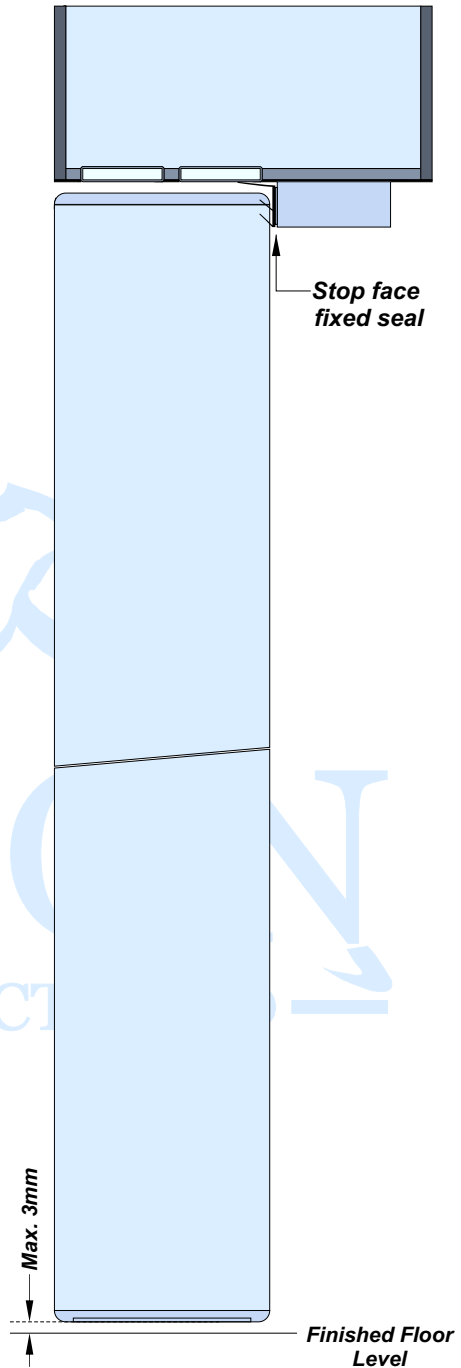
Head / Threshold Sealing 1: Fig. 6.3



Sealing at the head of the door should (*where possible*) be of the same type and aligned with the seals at the door stiles.

BS5588 (BS9999) requires that seals should be used at the threshold of smoke sealed doorsets. The Norsound NOR810S Automatic Drop seal is illustrated as one option for threshold sealing, used with a dedicated intumescent gasket.

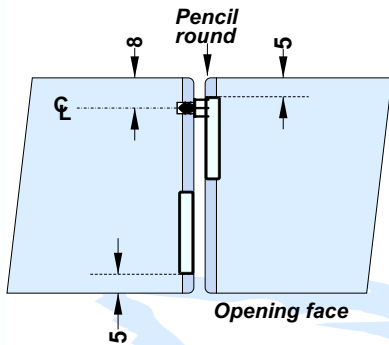
Head / Threshold Sealing 2: Fig. 6.4



BS5588 (BS9999) requires that: Where it is impractical to provide for seals at the threshold, the maximum threshold gap between the bottom of the door and the top of the finished floor should not exceed 3mm.

Meeting Stile Sealing 1:

Fig. 6.9



The approved 22x4mm intumescent seals must be used at the meeting stiles for FD90 and FD120 applications and the use of combined intumescent / smoke seals is not recommended.

Separate elastometric bladed smoke seals (*Norsound NOR720 illustrated*) can be considered but these need to be carefully located to minimise interference with the operation of the doors and conflicts with hardware.

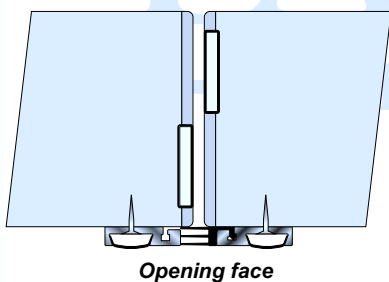
To provide for minimal influences on operating forces and to improve the durability of the smoke seal it is recommended that the seals are recessed such that the blade overlaps the adjacent door by 0.5 ~ 1mm.

To avoid conflicts with the intumescent seals it should be considered that the doors will be sequential opening with intumescent seal located towards the closing face of the primary leaf and towards the opening face of the secondary leaf. The smoke seal can then be located towards the closing face of the secondary leaf such that the primary leaf is in contact with the smoke seal by a minimum amount during the swing of the doors.

A small pencil round, particularly at the closing side edge of the primary leaf will act as a lead for the compression of the smoke seal blades thus extending seal life and ensuring minimal interference with the operation of the doors.

Meeting Stile Sealing 2:

Fig. 6.12



There are various seal designs that can be used to provide for the smoke sealing of meeting stiles for newly installed doorsets or for upgrading existing installations.

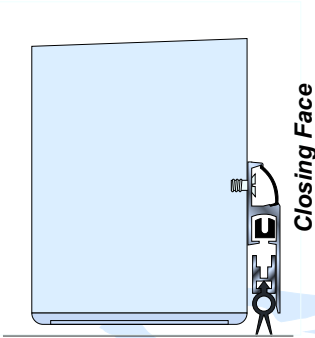
This detail shows the use of the Norsound NOR855 used in conjunction with the NOR855 carrier only.

This particular sealing arrangement allows pairs of doors to be simultaneously opened.

Smoke Sealing

Alternative Threshold Sealing 1:

Fig. 6.6



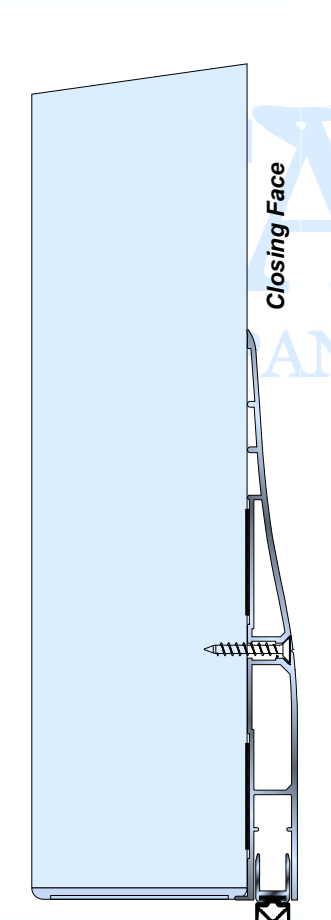
Surface mounted Automatic Drop Seal such as the Norsound NOR815 may be considered as an alternative threshold smoke sealing device.

These are surface mounted onto the closing face of the door and scribed between the jamb doorstops.

These devices generally provide for minimal interference with intumescent sealing or hardware and are generally suitable for the upgrading of existing installations.

Alternative Threshold Sealing 2:

Fig. 6.6



The Norsound WAVE provides for a combined surface mounted Automatic Drop Seal and door protection plate and may be considered as a further alternative threshold smoke sealing device.

This device, and other similar devices, are surface mounted onto the closing face of the door and scribed between the jamb doorstops.

Extensive testing for smoke sealing performances to BS 476 Section 31.1 has been carried out by a number of seal manufacturers and suppliers providing for sufficiently similar results that may be referred to as a basis for selecting smoke seals from a number of sources.




Seal manufacturers / suppliers who can provide suitable sealing systems for this purpose include:

<i>Norseal Ltd. - Norsound</i>	<i>Pyroplex Plc.</i>
<i>Lorient Polyproducts Ltd.</i>	<i>Sealmaster Ltd.</i>
<i>Raven Seals (Royde & Tucker Ltd.)</i>	<i>Pemko UK</i>


NOTE: This listing is advisory only and reference should be made to the seal suppliers smoke sealing test data for further guidance and for recommended methods of fixing.

The following seal types may be considered as being suitable for smoke sealing applications when used with Warm Spring materials based doorsets for FD90 and FD120 applications subject to manufacturers / suppliers fire test / assessment evidence.

Jamb & Head Seals:



	Norsound	Lorient	Raven	Pyroplex	Pemko
		IS1212 / 1515 Batwing	RP120 / RP150 Delta	7516 / 7209 Double Flipper	
	NOR 710				S773
					S88 PK55

Surface Mounted Threshold Automatic Drop Seals:

	Norsound	Lorient	Raven	Pyroplex	Pemko
	NOR 815 Norsound WAVE	IS8070S IS8080SI IS8090SI IS8091SI	RP38Si RP99Si RP60 RP92		4301 4131 430 412

NOTE: All mechanical drop seal manufacturers recommend that these seals are used with hard floor finishes or threshold plates to provide for maximum durability.

Meeting Stile Seals:

	Norsound	Lorient	Raven	Pyroplex	Pemko
	NOR 755	IS7025 / 7025SI	RP78 / 78Si. RP93 / 93Si RP94 / 94Si		290 293 297 299 316 319
	NOR 720	IS1511	RP73		5025, 369, 371P, 372P

Glass & Glazing

General:

Doors are glazed primarily for the safety of users of a building. However, glazing is often used as a means for expressing aesthetic considerations.

For fire rated doorsets providing for FD90 and FD120 fire performances the choice of glass types and glazing systems is more limited than for lower performance products.

It would be an almost impossible task for one manufacturer or supplier to test every conceivable variation in glass type and beading system. This section sets out some options that have been tested with Warm Springs based doorsets. Other options may be considered subject to supporting fire test / assessment documentation.

NOTE 1: Further information with regard to glass and glazing systems for fire rated doorsets can be obtained by reference to 'A Guide to Best Practice in the Specification and Use of Fire Resistant Glazed Systems' (2008) published by the GGF (Glass & Glazing Federation).

Glass Types:

Generally glass will fall into one of two categories:

Uninsulated: Glass in this category would include 6mm Georgian Wired e.g. Pilkington's Pyroshield; Borosilicate glass e.g. Shott Glass Pyran; Ceramic glass e.g. Southern Ceramics Firelite. Some of these glass types have the potential to provide for integrity performances covered by this manual when used with appropriate intumescent beading systems but they do not stop the transfer of heat from the fire side to the non fire side of the door.

Currently there are only two uninsulated types of glass available for FD90 and FD120 performances with Warm Springs material based doorsets.

Insulated: Glass in this category is generally made up of multiple layers of float glass interleaved with clear hydrated sodium silicate intumescent material.

Glass types in this category include: Pyrobel (AGC Flat Glass Europe) and Pyrostop (Pilkington Glass Ltd.)

NOTE: These glass types should be handled and fitted with care and in strict conformity with the glass manufacturers recommendations. Exposure of the edges of the glass can cause a breakdown in the intumescent interlayers visible as discolouration on the face of the glass.

Currently there are no insulated types of glass available for FD90 and FD120 performances with Warm Springs material based doorsets.

Wood doors, including wood appearance doors made using Warm Springs materials provide for insulating properties up to FD90 as flush doors.

BS 476 Pt.22 provides for tests of fully insulated or partially insulated specimens.

For fully insulated performances an insulating glass must be used to prevent the temperature on the non fire face from rising above (average) 140°C above ambient temperature or 180°C above ambient temperature at any point.

For partially insulated specimens the 140°C average may be exceeded to an unspecified level over an area not exceeding 20% of the area of the test specimen.

If full insulation is required, the insulation performance of the glass should be at least equal to the insulation performance of the door construction. However, for most applications, an insulation performance equal to 50% of the integrity performance is satisfactory.

Where the insulation performance of the glass is 50% (or more) than the integrity performance of the door, the risk of ignition on the non fire face of the door due to heat transmission is considerably reduced providing for greater scope in the design of the bead profile.

BS 6206 (BS EN 12600) Safety Class:

In addition to fire performances, consideration must also be given to the BS 6206 Safety Performance. The Safety Class will vary according to the location of the glass aperture in the door leaf (assembly). (See Building Regulations - [England & Wales] - Approved Document 'N'). In addition, certain projects (e.g. Schools) may require special Safety Class requirements.

NOTE: Whereas Building Regulations (England & Wales) Approved Document 'N' make reference to BS 6206 safety classes, impact performances determined by reference to BS EN 12600 may be substituted for the BS 6206 Classes by reference to the following:

<u>BS6206</u>	=	<u>BS EN 12600</u>
Class 'A'	=	Class 1
Class 'B'	=	Class 2
Class 'C'	=	Class 3

General Notes:

NOTE 1: Building Regulations - (England & Wales) - Approved Document 'N' requires that a safety glass (BS 6206 Class C for pane widths up to 900mm - Class B for pane widths over 900mm) is used for the glazing of doors up to a height of 1500mm above floor level.

NOTE 2: Building Regulations - (England & Wales) - Approved Document 'B' (Table A4 note 5) requires that fire-resisting glass should be marked with the manufacturer and product name.

NOTE 3: BS 6262-4:2005 (clauses 7.1 & 7.2) requires that safety glass should be indelibly marked to be visible after beading.

Glass & Glazing

Beading Systems for Fire Doors:

To perform correctly, the glass must be retained in a beading system that generally incorporates intumescent sealing.

NOTE: All glass types must be fitted fully in accordance with the manufacturers tested details / installation requirements, particularly in respect of edge cover and expansion clearance.

Propriety Intumescent Glazing Systems:

Glass types and glazing / beading systems must be tested or assessed as being suitable for FD90 and FD120 performances with Warm Springs material based doorsets.

Manufacturers / suppliers offering Intumescent Glazing Systems for use with fire doors include:

Norsound Ltd. (*Universal*)

Lorient Polyproducts Ltd. (*System 90*)

NOTE: These systems must be used strictly in accordance with the seal manufacturers fitting instructions.

Dimensions and Margins:

When glazing doors manufactured from Warm Springs materials, the total clear glass area of the glazing must not exceed the area permitted by reference to this manual.

Further, the glass apertures must be located to ensure an adequate margin between the nearest edge of the door and the sight line of the aperture in the door to receive glazing and between the sight line of adjacent glazing apertures.

NOTE: This data is constantly changing as a consequence of on going fire test programmes.

Bead Fixings:

Beading and trim must be fixed strictly in accordance with the guidance given in this manual.

Technical Support:

Where design requirements describe glazing that falls outside of the scope of the assessed applications envelopes described in this manual for any particular performance, details of the requirement should be forwarded for further comment to:

Falcon Panel Products Ltd.,
Clock House,
Station Approach,
Shepperton,
Middlesex TW178AN
Tel: 01932 256580
Fax: 01932 230268

The following glass types are approved for FD90 applications.

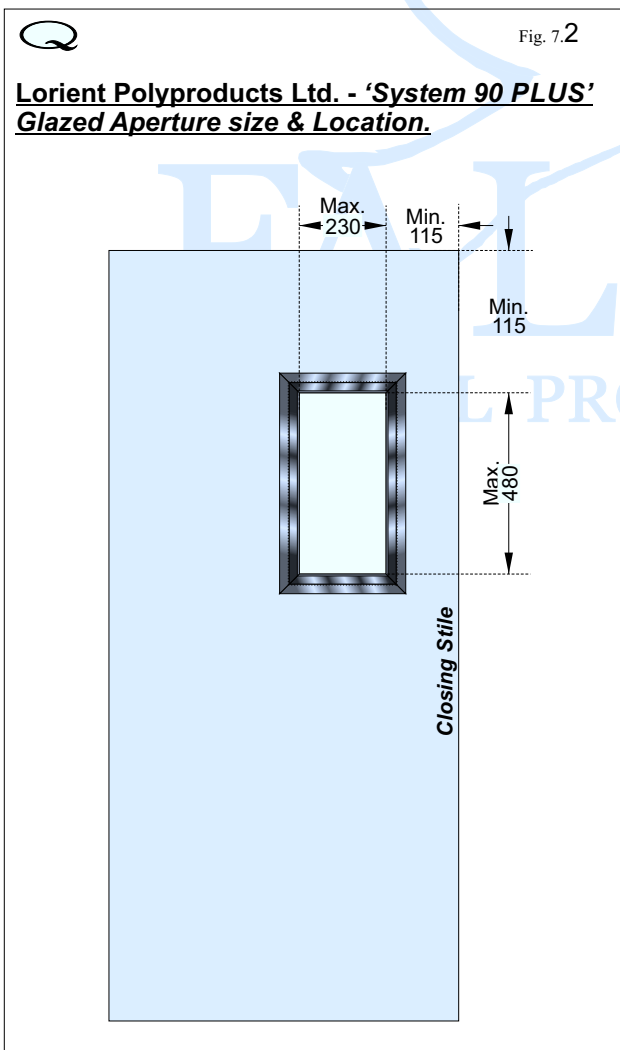
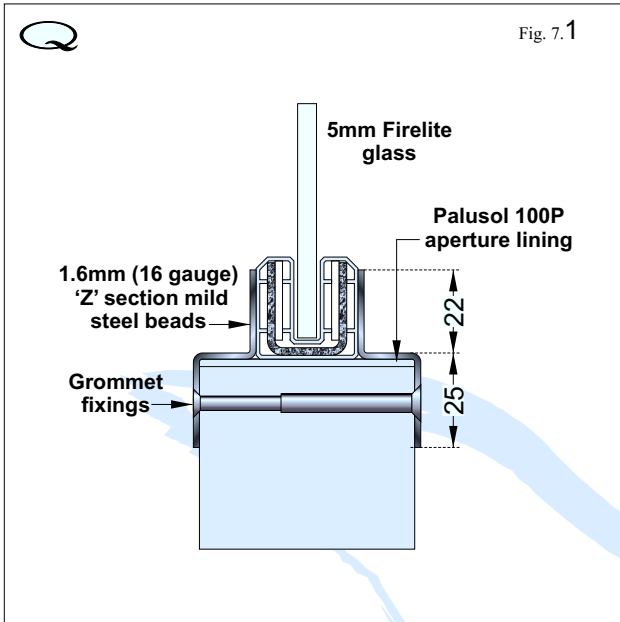
The maximum approved glazed area may be reduced according to the glazing system used. See Glazing system Pages 7.3 ~ 7.5.

FD90 Glass Type		Max. Approved Glazed Area m ²	Nom. Thickness mm	Insulation	BS6206 Safety Class
Q	PYRAN S - Schott Glass Ltd.	0.2	6	Nil.	A
Q	PYRAN S - Schott Glass Ltd.	0.2	8	Nil.	A
Q	Firelite - Southern Ceramic Supplies Ltd.	0.2	5	Nil.	Nil.

The following glass types are approved for FD120 applications.

The maximum approved glazed area may be reduced according to the glazing system used. See Glazing system Pages 7.3 ~ 7.5.

FD120 Glass Type		Max. Approved Glazed Area m ²	Nom. Thickness mm	Insulation	BS6206 Safety Class
Q	Firelite - Southern Ceramic Supplies Ltd.	0.2	5	Nil.	Nil.

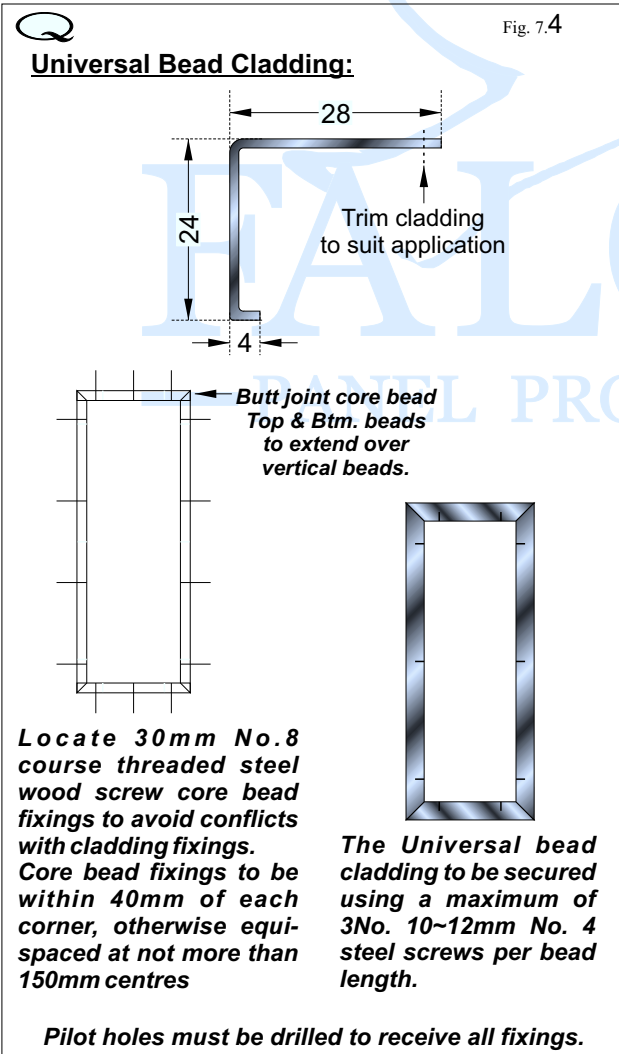
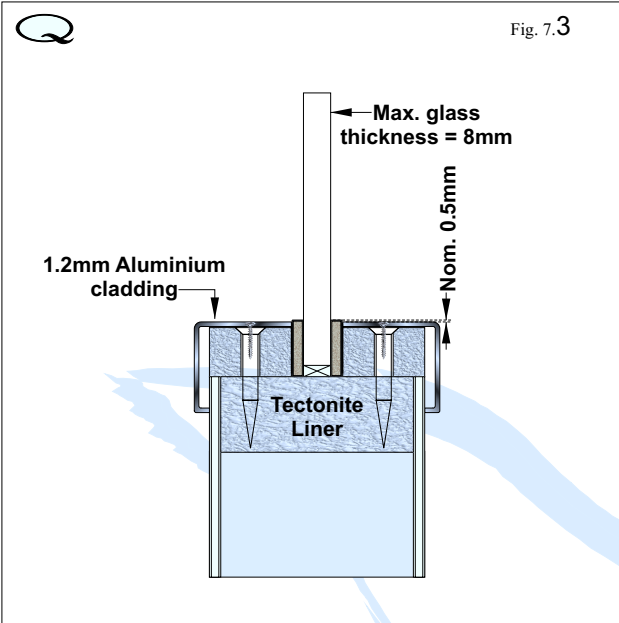


Lorient Polyproducts Ltd. - 'System 90 PLUS'

- This system must be used with its dedicated 2mm thickness Palusol P100 intumescent lining to the aperture.
- The glazing system is fixed using mild steel 'Z' beading brackets secured with bolt through fixings using 37mm long x 4.9mm dia. threaded sleeve to receive 43mm long x 3.8mm bolt through grommet fixings located not more than 45mm from each corner otherwise equi-spaced between fixings at not more than 125mm centres with a minimum of 3No. fixings per bead length.
- The clear sight line of the glass (*after beading*) must not be more than 230mm wide x 480mm high with a minimum margin of 115mm from the leaf head or the closing stile to the nearest sight line of the glass.
- Multiple glass apertures are permitted provided that the total clear glass area does not exceed the maximum approved area for this system and that the minimum dimension between the sight line of adjacent glazed apertures is not less than 100mm.

**Maximum approved glazed area:
System 90 PLUS = 0.18m²**

Glass & Glazing



Norsound Ltd. - 'Universal 90'

NOTE: Preparation to receive glazing must be carried out when manufacturing the door leaf. See Section 2 Page 2.6.

- The aperture must be lined using minimum 20mm fin. Warm Springs Tectonite when assembling the door leaf.
- The glass is secured using 13mm finished height Tectonite beads in conjunction with Norsound 1503B intumescent glazing seals. There must not be any gaps between the intumescent seal and the Tectonite aperture liner.
- The Tectonite beads must be butt jointed at corners with the horizontal beads applied to the full width of the aperture. The beads being fixed using min. 30mm No.8 course threaded steel wood screws located within 40mm of each corner and otherwise equi-spaced at not more than 150mm centres. Fixing holes for the Tectonite beading must allow a 0.5mm clearance around the screw fixing. Pilot holes must be drilled into the Tectonite liner to receive these fixings.
- The Tectonite core bead is then clad with the Norsound Universal aluminium section that is secured to the core bead by use of a maximum of 3No. 10 ~ 12mm No. 4 grub screws per length. Pilot holes must be drilled to receive these fixings.
- The Norsound 1503B intumescent glazing seal must project Nom. 0.5mm above the sight line of the aluminium cladding bead cover.
- The aluminium cladding is supplied in a 24x28mm section with a 4mm return. The 28mm leg of the cladding is reduced to suit the particular glass and door thickness.
- Subject to possible quantity requirements, the aluminium cladding can be supplied powder coated to any BS or RAL colour with alternative metallic or wood grain finishes also available.
- The Norsound Universal 90 system can be used with 6 ~ 8mm thickness Pyran S glass or 5mm Firelite glass for FD90 applications.

Maximum approved glazed area:

- Norsound Universal 90 6mm Pyran S = 0.2m²**
- Norsound Universal 90 8mm Pyran S = 0.2m²**
- Norsound Universal 90 5mm Firelite = 0.2m²**

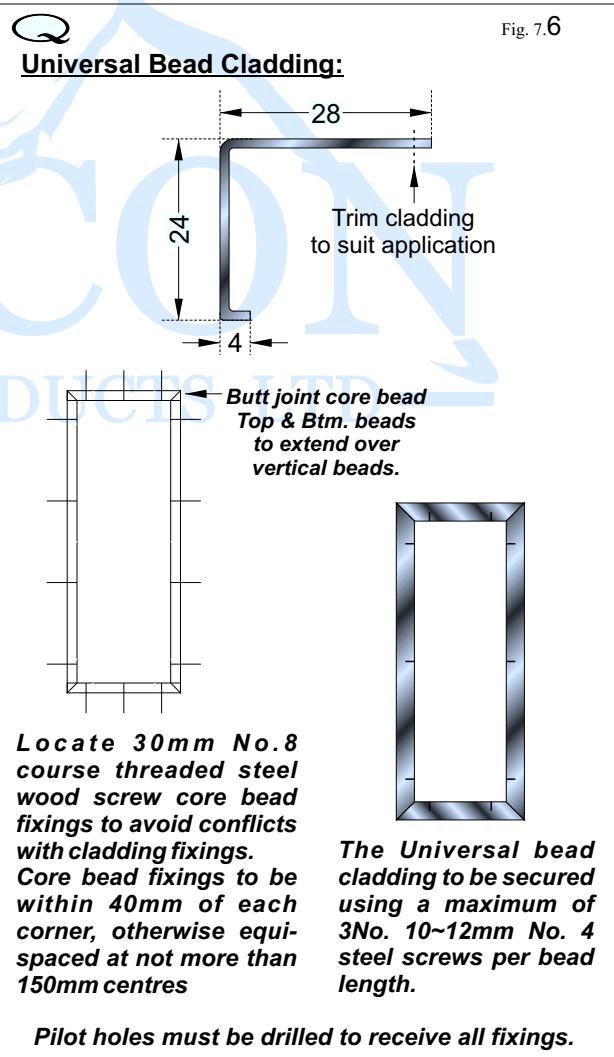
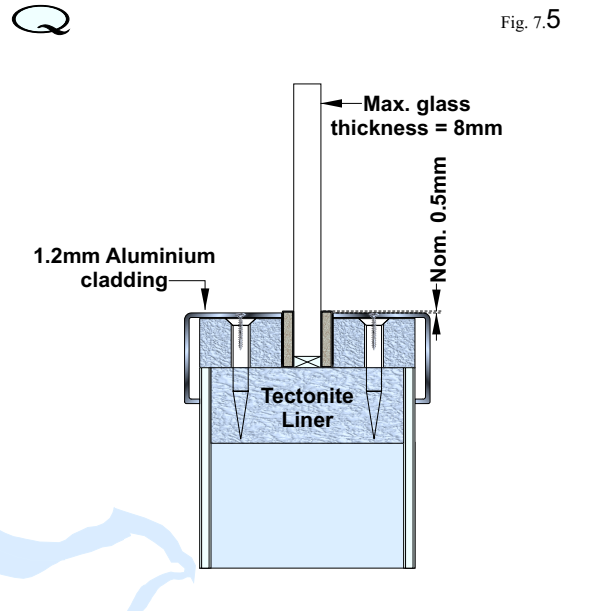
Norsound Ltd. - 'Universal 120'

NOTE: Preparation to receive glazing must be carried out when manufacturing the door leaf. See Section 2 Page 2.6.

The aperture must be lined using minimum 20mm fin. Warm Springs Tectonite when assembling the door leaf.

- The glass is secured using 13mm finished height Tectonite beads in conjunction with Norsound 1503B intumescent glazing seals. There must not be any gaps between the intumescent seal and the Tectonite aperture liner.
- The Tectonite beads must be butt jointed at corners with the horizontal beads applied to the full width of the aperture. The beads being fixed using min. 30mm No.8 course threaded steel wood screws located within 40mm of each corner and otherwise equi-spaced at not more than 150mm centres. Fixing holes for the Tectonite beading must allow a 0.5mm clearance around the screw fixing. Pilot holes must be drilled into the Tectonite liner to receive these fixings.
- The Tectonite core bead is then clad with the Norsound Universal aluminium section that is secured to the core bead by use of a maximum of 3No. 10 ~ 12mm No. 4 grub screws per length. Pilot holes must be drilled to receive these fixings.
- The Norsound 1503B intumescent glazing seal must project Nom. 0.5mm above the sight line of the aluminium cladding bead cover.
- The aluminium cladding is supplied in a 24x28mm section with a 4mm return. The 28mm leg of the cladding is reduced to suit the particular glass and door thickness.
- Subject to possible quantity requirements, the aluminium cladding can be supplied powder coated to any BS or RAL colour with alternative metallic or wood grain finishes also available.

**Maximum approved glazed area:
Norsound Universal 120 5mm Firelite = 0.2m²**



Hardware

General:

Doors manufactured using Warm Springs door construction products for FD90 and FD120 applications must be prepared to receive hardware without the use of additional timber backing. However care must be taken to ensure that fixings are secured into the higher density Tectonite material, particularly for load bearing items of hardware.

It is recommended that hardware fitted to Warm Springs material based doors is fixed using Minimum 30mm No.8 or No.10 course threaded wood screws. Pilot holes must be drilled to receive fixings.

NOTE: The 1000kg/m³ high density Tectonite provides for excellent screw holding properties. However it is essential that pilot holes are drilled to receive fixings and that care is taken not to over tighten screws.

For general guidance with regard to the use of hardware with fire rated doorsets reference should be made to:

a/ BS8214 : 2008. Code of Practice for Fire Door Assemblies with non metallic leaves.

b/ 'Hardware for Timber Fire and Escape Doors' Code of Practice published jointly by the DHF (Door & Hardware Federation) and the GAI (Guild of Architectural Ironmongery).

Fire Door Applications:

NOTE: For 'product assured' items of hardware, the particular item of hardware must have been tested or assessed as suitable for use with fire rated doorsets of the required performance and the fixing instructions provided by the hardware manufacturer should be strictly adhered to with these instructions to take precedence over BS8214 and Code of Practice general recommendations in the event of any conflict.

Intumescent seals are used to fill gaps around the door(s) that may occur as a result of shrinkage or distortion under fire conditions. The removal of core and intumescent material to accommodate hardware creates weaknesses that can be exploited under attack by fire. Large areas of metal, when used with a wood door can induce excessive distortion and premature failure. It is recommended that hardware is selected with care in consideration of these risks.

It is not unusual for hardware to be specified prior to the specification of the doors and without knowledge, at the time of preparation of hardware schedules, of the fire performances that need to be satisfied. It is a Designer's responsibility to ensure that the dooset designs meet the requirements of national and local regulations for the purpose of fire certification. (See: BS5588 or BS9999).

Under BS476 Pt.20 fire test conditions the pressure 'normal' in the furnace occurs at (approx.) 1000mm above floor level. Areas of door above the normal are subjected to increasing positive pressure from the furnace side while areas below the normal are subjected to negative pressure from the furnace side. This results in 'cold' air entering the furnace under the door with a cooling effect on this edge. Hardware items, particularly locks & latches, should be positioned below the 'normal' where possible.

NOTE: The pressure normal is lowered to 500mm above floor level for testing to BS EN 1634-1.

Where the door / frame seals are interrupted to receive hardware it may be necessary to provide for replacement sealing. The use of pressure intumescent seals (e.g. Palusol P100 or Graphite) may be unsuitable for this purpose due to a risk that some pressure seals could compete with door / frame perimeter seals in an unpredictable manner. The hardware protection intumescent sealing should generally be of the low pressure type. (Usually Phosphate based).

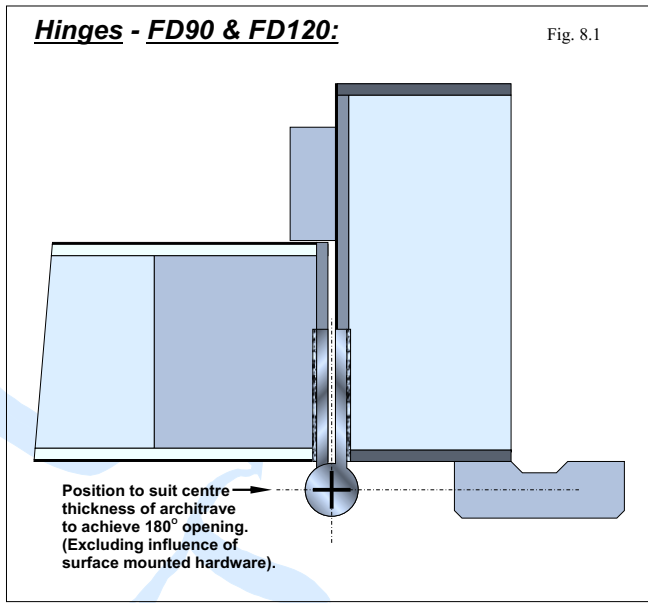
NOTE: WSCP Strip-seal and WSCP Flex-seal are approved intumescent materials for these applications and are available from Falcon Panel Products Ltd.

Hardware

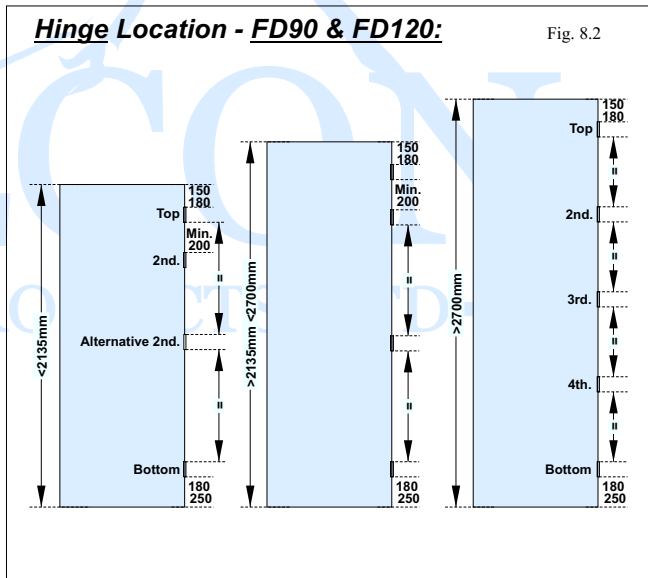
Fire Door Applications - Hanging devices - Hinges:

Hinge Specification FD90 & FD120:

Blade Height	90~120mm
Blade Width (excluding knuckle)	32~35mm
Blade Thickness	2.5 ~ 4mm
Fixings	Min. 4No. 30mm No.8 or No.10 course threaded steel wood screws per hinge blade.
Materials	Steel or stainless steel
Intumescent Protection	2mm thickness WSCP Strip - Seal under both hinge blades of all hinges.



Hinge Positions: Leaf dimensions <2135mm	Top = 150 ~ 180mm from top of door to top of hinge. Centre: Min. 200mm from top hinge or equispaced between top & bottom hinge. Bottom: 180 ~ 250mm from bottom of door to bottom of hinge.
Hinge Positions: Leaf dimensions >2135mm <2700mm	Top = 150 ~ 180mm from top of door to top of hinge. 2nd. Hinge 200mm from top hinge 3rd. Hinge Equispaced between 2nd. and bottom hinge. Bottom: 180 ~ 250mm from bottom of door.
Hinge Positions: Leaf dimensions >2700mm	Top = 150 ~ 180mm from top of door to top of hinge. 2nd. 3rd. & 4th. Hinges Equispaced between and bottom hinge. Bottom: 180 ~ 250mm from bottom of door.



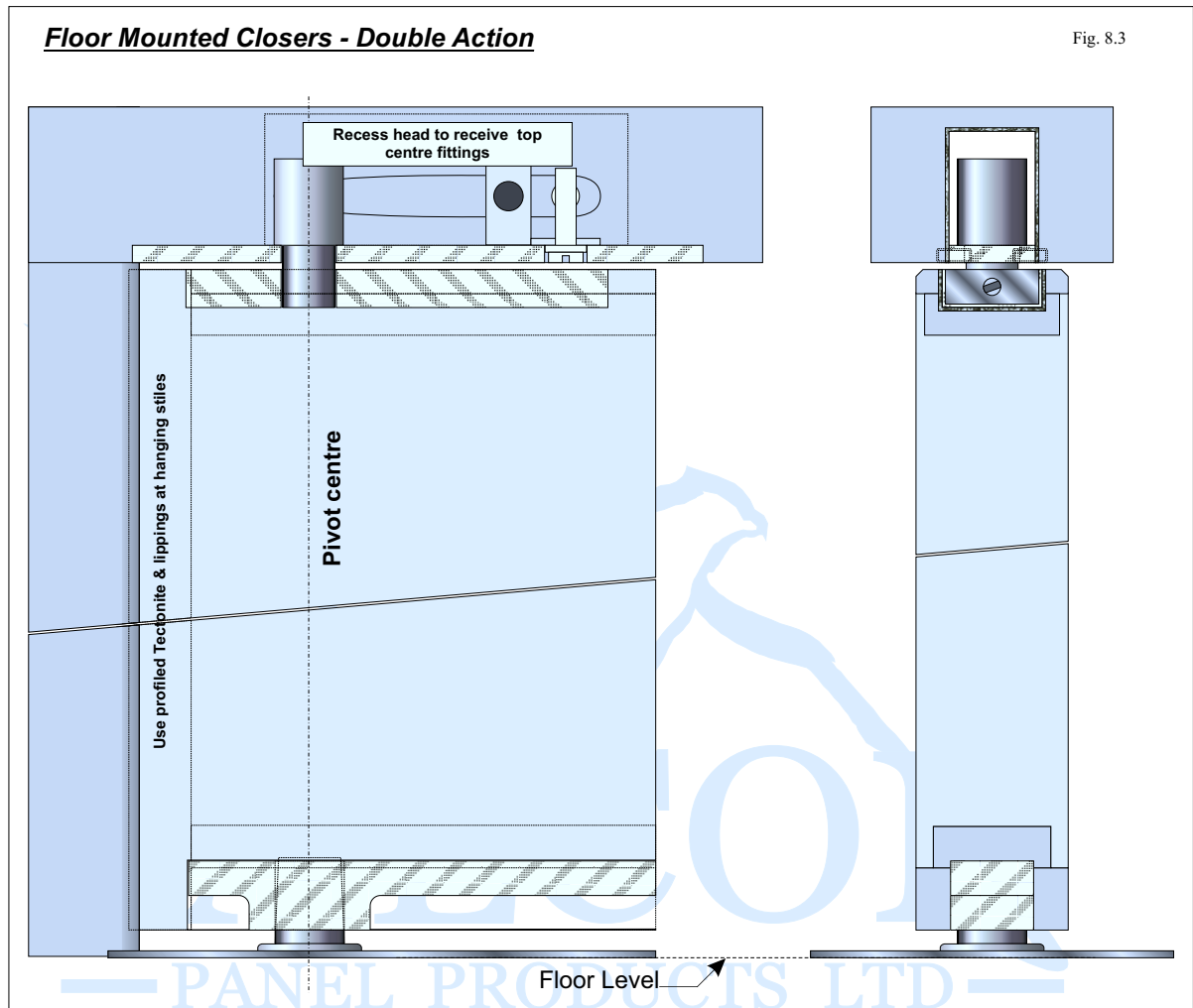
In addition, the hinges must provide for the appropriate BS EN 1935 : 2002 performance according to the door weight and anticipated usage.

The hinge knuckle centre should be set as near to the door face as possible to minimise the 'door growth' during operation.

A hinge knuckle centre at the centre line of the architrave thickness will allow for 180° opening (excluding the influence of other surface mounted hardware).

Pilot holes must be drilled to receive hinge fixing screws with hinges fixed to the door leaf using Min. 30mm. No.8 course threaded wood screws.

Fire Door Applications - Hanging devices - Floor Mounted Closers - Double Action:



Double Action Pivots FD90 & FD120:

WARNING: Use of floor springs for either double action or single action operation is not 'Q' Mark approved for FD90 or FD120 fire door applications on the basis of current fire test / assessment data.

Automatic floor mounted closing devices may be used in reliance upon base test data owned 'by others'. The base test data must demonstrate the hardware is capable of providing for the required performance when used with a doorset of a similar design when tested to BS 476 Pt.22 : 1987 or BS EN 1634-1 : 2000 (or 2008).

The pivots to floor spring assemblies must be protected with intumescent gaskets. Alternatively a dedicated intumescent pack may be provided by the floor spring supplier.

The above illustration indicates use of the DORMA BTS series floor mounted closer with double action fittings.

Tectonite hanging stile lippings must be profiled (to suit pivot centre).

Pilot holes must be drilled to receive screw fixings Minimum 30mm No.8 or No.10 course threaded wood screws.

NOTE: Bottom strap fittings can be over recessed to provide for required under door clearances.

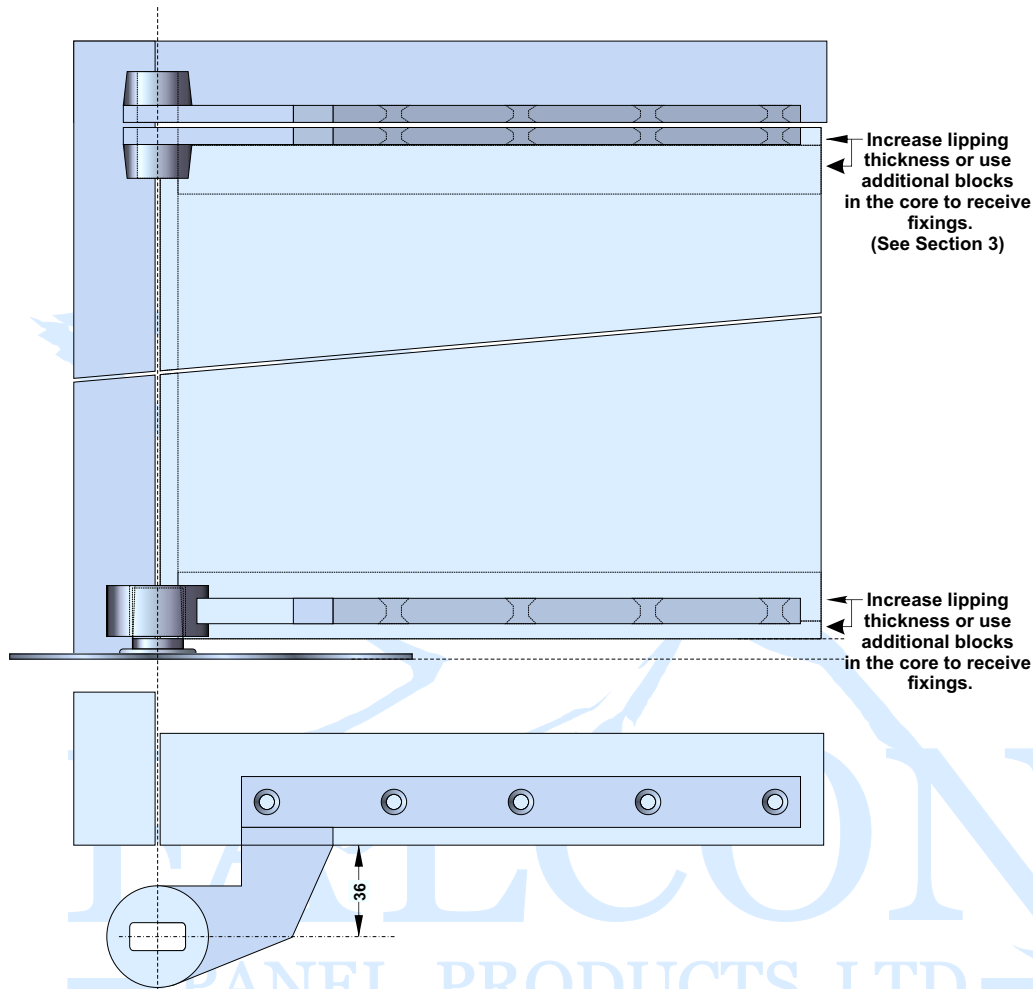
NOTE: Transom mounted double action closers are not approved for 'Q' Mark applications but may be used in reliance upon test / assessment data provided 'by others'. (e.g. Dorma RTS 85).

Hardware

Fire Door Applications - Hanging devices - Floor Mounted Closers - Single Action:

Floor Mounted Closers - Single Action

Fig. 8.4



Single Action Pivots FD90 & FD120:

WARNING: Use of floor springs for either double action or single action operation is not 'Q' Mark approved for FD90 or FD120 fire door applications on the basis of current fire test/assessment data.

Automatic floor mounted closing devices may be used in reliance upon base test data owned 'by others'. The base test data must demonstrate the hardware is capable of providing for the required performance when used with a doorset of a similar design when tested to BS 476 Pt.22 : 1987 or BS EN 1634-1 : 2000 (or 2008).

The pivots to floor spring assemblies must be protected with intumescent gaskets. Alternatively a dedicated intumescent pack may be provided by the floor spring supplier.

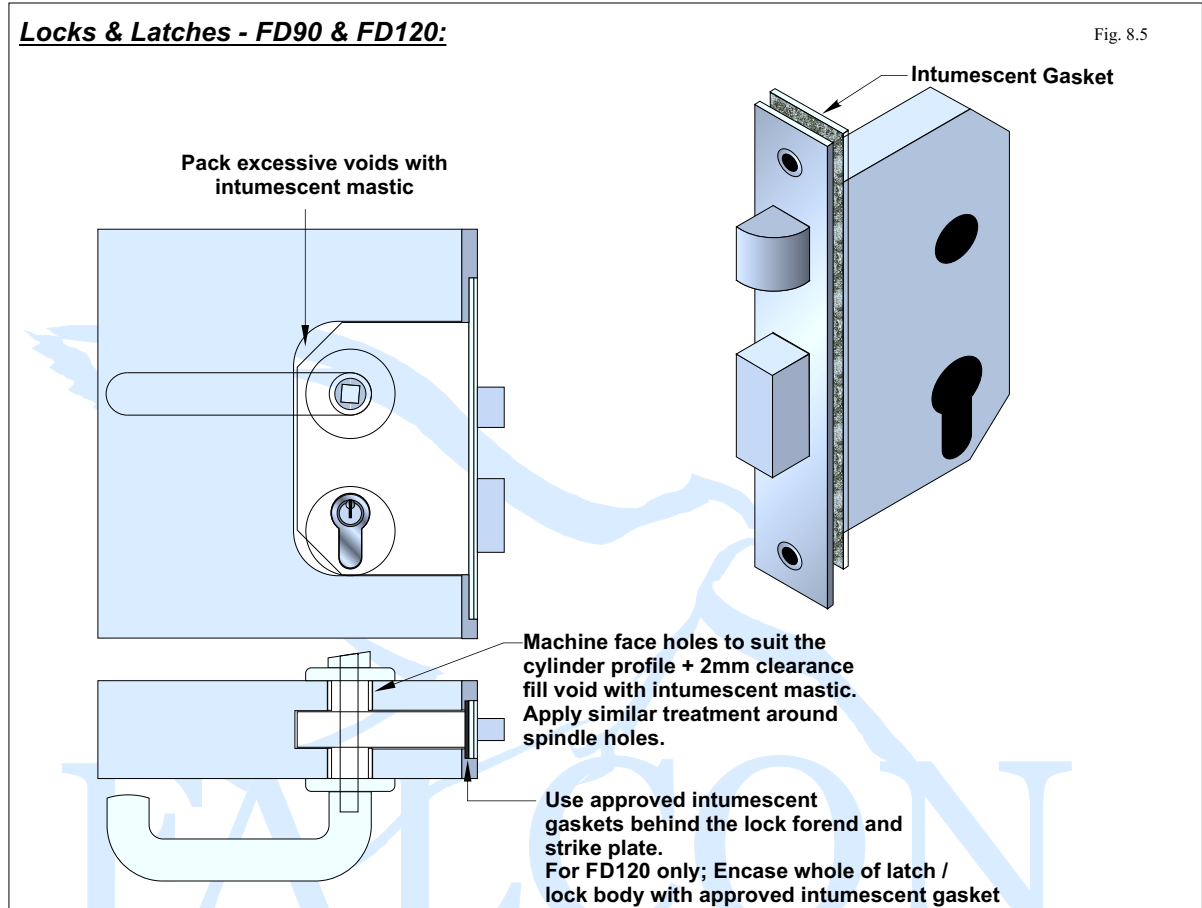
The above illustration indicates use of the DORMA BTS series floor mounted closer with single action fittings.

Pilot holes must be drilled to receive screw fixings Minimum 30mm No.8 or No.10 course threaded wood screws.

NOTE: Bottom strap fittings can be over recessed to provide for required under door clearances.

WARNING: The pivot centre for these fittings extends a considerable distance from the opening face of the door. This can give rise to operational problems when used with narrow or thick door.

Fire Door Applications - Securing devices - Locks & Latches:



Lock / Latch Specification FD90 & FD120:

Latches and locks must be either as tested, alternatively components with the following specifications are acceptable:

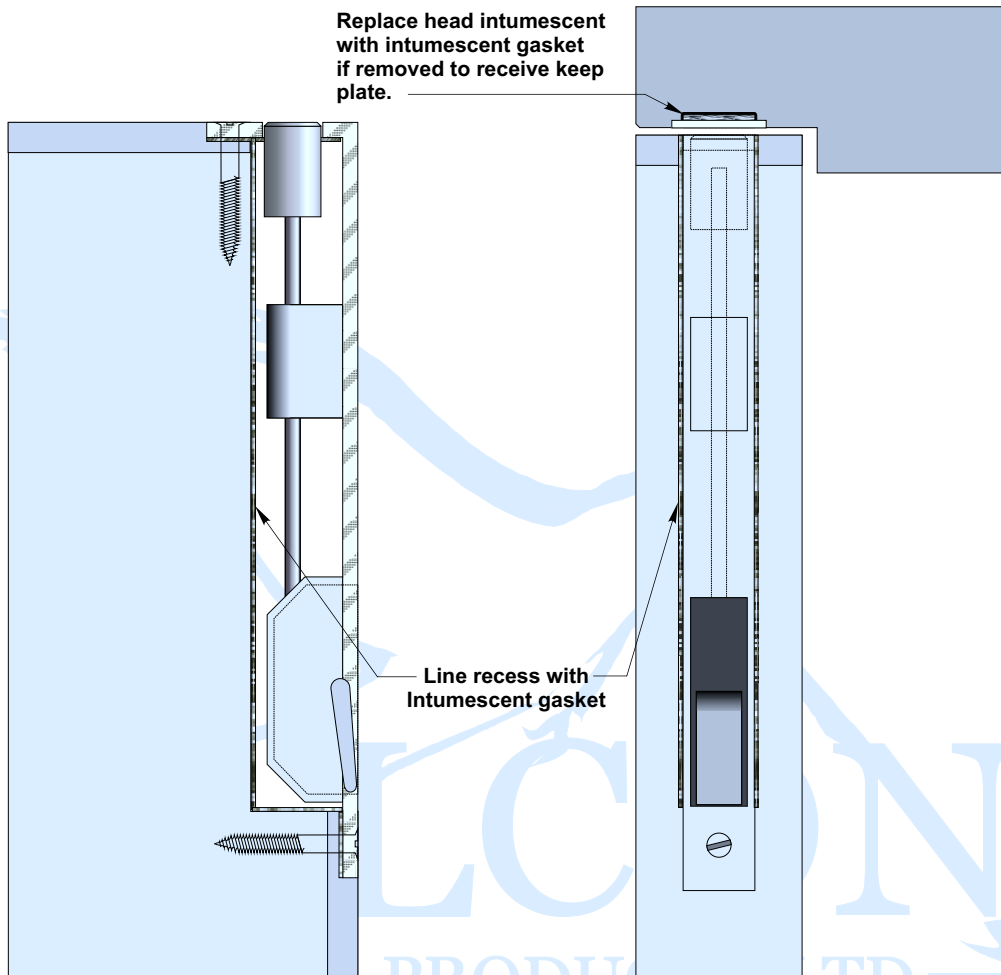
Maximum forend & strike plate dimension.	235mm high x 25mm wide x 4mm thick
Maximum body dimensions	18mm thick x 100mm wide x 165mm high
Intumescent Protection	Under latch / lock forend: Intumescent Seals - 1mm WSCP Strip-seal. Under latch / lock strike plate: Intumescent Seals - 1mm WSCP Flex-seal. Encasing latch / lock body - FD120 only: Intumescent Seals - 1mm WSCP Flex-seal.
Materials	All parts essential to the locking / latching action (including the latch bolt, forend and strike) to be steel.

Hardware

Fire Door Applications - Securing devices - Flush Bolts:

Flush Bolts

Fig. 8.6



Flush Bolts FD90 & FD120:

WARNING: The use of recessed flush bolts is not 'Q' Mark approved for FD90 or FD120 fire door applications on the basis of current fire test / assessment data.

Bolts may be required to secure the secondary leaf of pairs. There are no restrictions on the use of surface mounted bolts (e.g. Barrel bolts) that do not require recessing into the door leaf or frame or otherwise interfere with the edge sealing of the doors.

Flush bolts may otherwise be used in reliance upon base test data owned 'by others'. The base test data must demonstrate the hardware is capable of providing for the required performance when used with a doorset of a similar design when tested to BS 476 Pt.22 : 1987 or BS EN 1634-1 : 2000 (or 2008).

Recessed flush bolts must be protected with intumescent gaskets. Alternatively a dedicated intumescent pack may be provided by the flush bolt supplier.

Fire Door Applications - Other Hardware:

Operating Devices - Automatic Closing - FD90 & FD120:

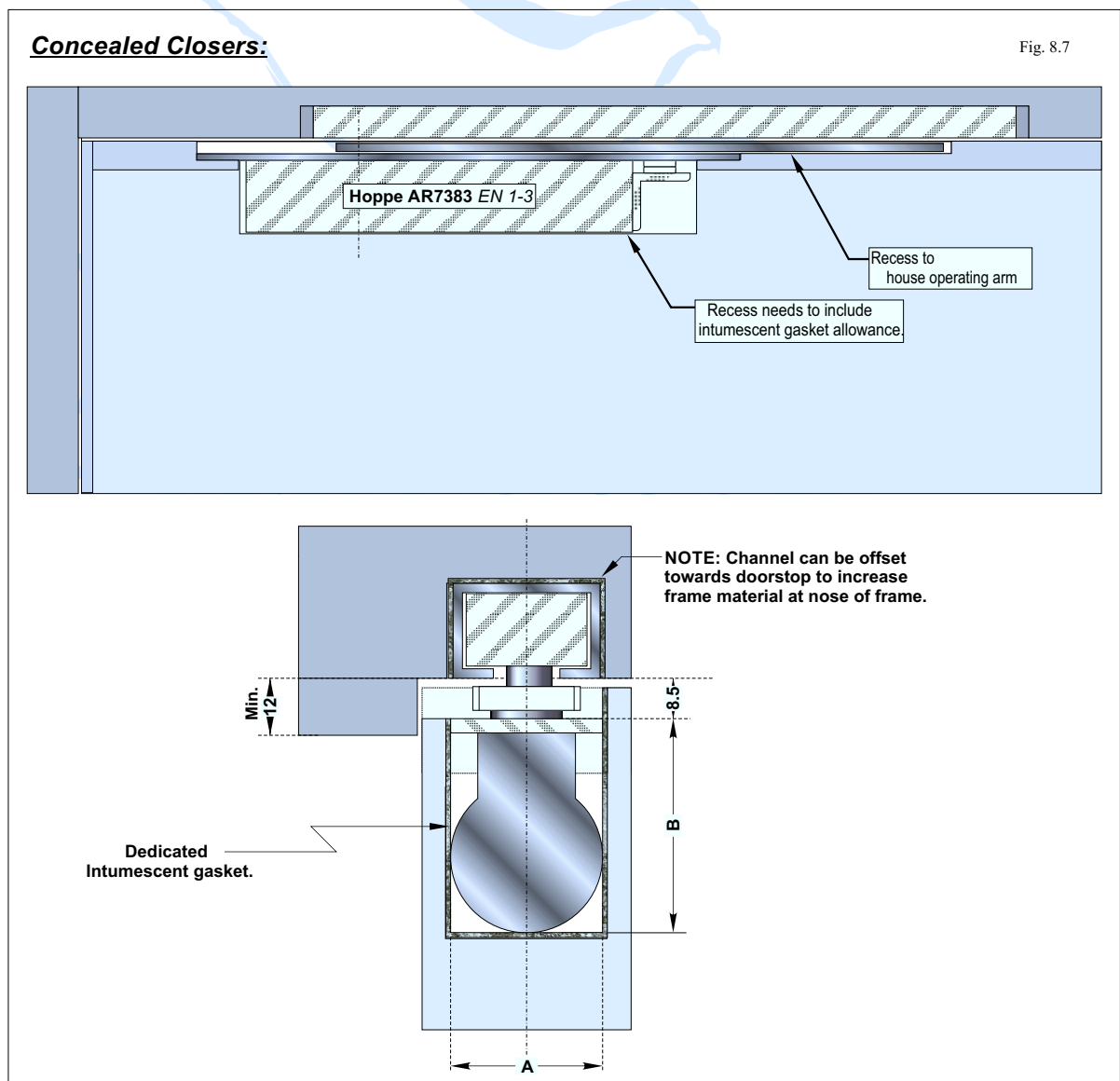
Single Action Overhead Closers:

Automatic closing devices e.g. Single Action Overhead Closers, must either be tested or components of equal specification that have demonstrated contribution to the required performance of these types of FD90 or FD120 doorset designs when tested to BS476 Pt.22 : 1987 or, BS EN 1634-1 : 2000 (or 2008).

Concealed Closers:

Warning: Only the Hoppe AR7383 with the supplied intumescent pack is covered under Chilt/A06218 Rev E assessment.

Recessed concealed closers must be protected with intumescent gaskets. Alternatively a dedicated intumescent pack may be provided by the concealed closer supplier.



Hardware

Fire Door Applications - Other Hardware:

Operating Devices - Pull Handles - FD90 & FD120:

Pull handles may be surface fixed to both FD90 & FD120 doors provided that they are steel and the length is limited to Max. 1000mm between the fixing points.

Bolt through fixing pull handles up to the same maximum length may also be used for FD90 & FD120 fire door applications with additional 1mm thick Interdens (*intumescent sealing*) wrapped around the full length of the stud. The hole through the leaf is to provide for a tight fit around the stud & intumescent sealing.

Operating Devices - Push, Buffer and Kick Plates - FD90 & FD120:

Face fixed only push, buffer and kick plates may be fitted to Warm Springs based doorsets for FD90 & FD120 fire door applications provided that their fitting does not require the removal of any part of the door leaf.

These items of hardware are permitted up to a maximum of 20% of the door leaf area.

Operating Devices - Panic Hardware - FD90 & FD120:

Panic hardware may be fitted to Warm Springs based doorsets for FD90 & FD120 fire door applications, provided that the installation does not require the removal of any timber from the door leaf, door stop or frame reveal. Further, the panic hardware must not, in any way, interfere with the self-closing action of the fire doors.

Miscellaneous Devices - Smoke Sealing & Acoustic Perimeter Seals - FD90 & FD120:

Smoke and Acoustic seals with a proven flame retardant performance may be fitted to Warm Springs based doorsets for FD90 and FD120 fire door applications providing that the fitting of the seals does not interfere with the activation of the doorset intumescent seals or hinder the self closing function of the door leaves.

NOTE: The use of separate smoke / acoustic perimeter seals is recommended to minimise the risks of conflicts with intumescent sealing and hardware. Recommended products: Norsound NOR710, Lorient IS1212 (Batwing), Raven RP120 (Delta), Pyroplex 7516 (Double Flipper).

Miscellaneous Devices - Automatic Threshold Seals - FD90 & FD120:

Fully mortised automatic threshold drop seals may be fitted to Warm Springs based doorsets for FD90 & FD120 applications where additional smoke sealing and / or acoustic performances are required. The automatic door bottom must be as small as possible with the recess to receive the automatic door bottom lined with a dedicated intumescent gasket. The body of the automatic door bottom must be in metal, aluminium or steel and the device is to be mortised centre thickness of the door.

NOTE: Subject to supporting fire / smoke & acoustic test evidence; Approved automatic threshold drop seals for this application include:

Norsound

NOR 810S

Other tested brands may be available for these applications.

Alternatively, surface mounted automatic drop seals may be used where the fitting of these does not require the removal of any core material.

NOTE: Subject to supporting fire / smoke & acoustic test evidence; approved surface mounted automatic threshold drop seals for this application include:

Norsound

WAVE

Lorient

IS8020

Raven

RP99

Pemko

4131

Other tested brands may be available for these applications.

Miscellaneous Devices - Letter Plates

WARNING: The use of recessed letter plates is not 'Q' Mark approved for FD90 or FD120 fire door applications on the basis of current fire test / assessment data.

Letter Plates may otherwise be used in reliance upon base test data owned 'by others'. The base test data must demonstrate the hardware is capable of providing for the required performance when used with a doorset of a similar design when tested to BS 476 Pt.22 : 1987 or BS EN 1634-1 : 2000 (or 2008).

Letter Plate apertures must be protected with intumescent gaskets or suitable liner. Alternatively a dedicated intumescent pack may be provided by the letter plate supplier.

Fire Door Applications - Other Hardware:

Miscellaneous Devices - Cable Ways for electric locks / strike plates - FD90 & FD120:

WARNING: *The use of cable ways passing through the width of the door leaf is not 'Q' Mark approved for FD90 or FD120 fire door applications on the basis of current fire test / assessment data.*

Where it is necessary to pass electronic data or electrical signals from one side of the door to the other the use of a surface mounted conduit may be considered provided that the design does not require the removal of door materials or intumescent sealing in excess of that approved for locks / latches. (See page 9.5 for further guidance with regard to locks / latches & strike plates)

Electrically operated frame fixed strike plates (*not requiring a conduit route across the width of the door leaf*) may otherwise be used with single leaf doorsets, in reliance upon base test data owned 'by others'. The base test data must demonstrate the hardware is capable of providing for the required performance when used with a doorset of a similar design when tested to BS 476 Pt.22 : 1987 or BS EN 1634-1 : 2000 (*or 2008*).

Miscellaneous Devices - Air Transfer Grilles - FD30 & FD60:

Air transfer grilles may be fitted to Warm Springs based doorsets for FD90 & FD120 applications provided that the particular grille design is supported by fire test evidence to BS476 Pt.22 : 1987 or BS EN 1634-1 : 2000 (*or 2008*) that demonstrates an integrity performance that is at least equal to the desired fire performance of the doorset when installed in a door leaf of a compatible thickness.

Margins for apertures to receive grilles are to be as described for glazing (See Section 7 - Glass & Glazing). The position of the grille will be dictated by the pressure regime tested in the proving evidence (*normally below mid height*). The area occupied by the air transfer grille must not exceed 0.2m² with the grille area deducted from the maximum approved area for glazing, if both elements are fitted.

Grilles must be fitted precisely in accordance with the grille manufacturers test / assessment data, including all linings, intumescent seals, fixings etc. as required for the relevant fire performance.

WARNING: *The use of hardware items with a proven fire performance when used with metal doors should not be used with wood or Warm Springs materials based fire doors without the benefit of further testing.*

Acoustics

Acoustics Explained:

This introduction attempts to simplify what is an extremely complex subject. Where acoustic considerations are critical, reference should be made to qualified Acoustic Engineers.

'Acoustic' is a term that is used loosely in connection with doorsets. When considering the 'acoustics' of a room or space, acoustics relates to a number of considerations.

When sound is generated, the 'loudness' refers to sound pressure which is expressed in decibels 'dB'. When striking a surface, some sound will be reflected, some will be absorbed (*converted to heat*) and some will pass through the structure. Sound will lose energy with distance in accordance with the inversed square law.

The time taken for the sound pressure to drop by 60dB is measured. This loss of sound pressure related to time is measured as a 'reverberation time'. If the time it takes for the sound pressure to reduced by 60dB is less than 0.3 seconds the room will sound 'dead' with hearing made difficult due to an apparent loss of bass. If the reverberation time is in excess of 5 seconds the reverberation (*or echos*) can give rise to confusion which again makes hearing difficult. The optimum reverberation times may vary according to the intended use of the space. A reverberation time of 1 second might be ideal for a lecture hall providing for clear speech but this might not be ideal for a concert hall where a reverberation time of up to 3.5 seconds would provide for fuller and richer musical sound. For 'general purpose' use Acoustic Engineers will generally try to 'tune' the space to provide for reverberation times between 1.5 ~ 2.5 seconds.

The reverberation times can be adjusted by the use of sound absorbers. i.e. by the use of materials that are less likely to reflect sound. Soft furnishings, carpet and curtains will provide for some sound absorbing properties. Mineral wool provides for a good example of a material that will readily convert sound energy into heat energy thus absorbing sound and consequently reducing the reflected sound. The performance of a sound absorber is measured by a 'coefficient of adsorption'.

The other issue of concern to Acoustic Engineers is the influence of sound created outside of the measured space and the ability of a structure to minimise the influence of an acoustic space by preventing or reducing the transfer of external sound through a structure. This is referred to as

'sound attenuation' and it is the measure that generally applies to structures between spaces. e.g. walls, windows and doorsets. Thus, when referring to 'acoustic' doors we generally mean 'sound attenuating' doorsets.

Sound is generated at different frequencies. The 'frequency' is the number of sound waves that pass through a given point in a second and described in 'Hertz' (Hz.) where 1 hertz = one wave per second. Differences in frequency can be identified by a change of pitch. An example of a high frequency sound might be a computer bleep (*approx. 2,500Hz.*) while a low frequency sound might be the hum of an electrical generator (*approx. 100Hz.*). Few sounds are made up of a pure single frequency. Sound is generally produced simultaneously over a range of frequencies. We might refer to the random structure of sound over a range of frequencies as noise, while sound produced over a range of frequencies in a structured manner might be referred to as speech or music. (See Fig. 10.1 & 10.2).

The average human ear is not a perfect sound receiver. We cannot hear some very low frequency sounds e.g. at frequencies below (*about*) 20Hz. referred to as 'sub sonic'. However, we might feel low frequency sound as vibration. At the other end of the spectrum human hearing may not notice sound at frequencies in excess of (*about*) 20,000Hz. (20kHz.). This is referred to as the 'ultra sound region'. Bats navigate using sound in the ultra sound range and ultra sound can be used for medical purposes to create images. (See Fig. 10.2).

Even within the audible range (*approx. 20Hz. ~ 20kHz.*) the human ear is less than perfect, being more sensitive to sound produced at frequencies of about 3,000 ~ 4,000Hz. (3 ~ 4kHz.) than sound produced at other frequencies. Thus, if sound is produced at the same amplitude (or loudness) at all frequencies, sound in the 3~4kHz. range will be perceived to be predominant. (See Fig. 10.3).

ISO 140 sets out the range of frequencies used for the purpose of testing for acoustic performances. The test procedure for the measurement of sound attenuation is described by reference to BS EN ISO 140-3: 1995. This measures performances over a frequency range of 100Hz. (Hertz) to 3,150Hz.

NOTE: A frequency range of 125Hz. ~ 4000Hz. is used for testing in the United States and Australia.

Acoustics

Acoustics Explained:

The basic principles associated with testing for sound attenuating performances are quite simple. The 'specimen' is located between a transmitting room and a receiving room. Sound is generated across the full frequency range determined by reference to the test standard in the transmitting room. The sound pressure levels on the receiving room side of the specimen are then measured. The sound pressure levels recorded in the receiving room can then be deducted from the sound pressure levels in the transmitting room with the resultant loss in sound pressure levels measured in decibels recorded at each of the measured frequencies.

For some purposes it is necessary to know the performances at particular frequencies but for most applications an average performance over the measured range is required. To determine this, the decibel reduction over the measured range could simply be averaged out. However, this would be misleading as this would not reflect human perception resulting from the imperfections of human hearing.

To relate to human perception, the average sound reduction is amended to provide for a 'weighted index' identified by the use of the prefix 'Rw'. The weighted index is calculated by reference to BS EN ISO 717-1 : 1997.

In the absence of a vacuum, most spaces will be subject to a background noise.

Typical Background Noise Levels:

	dBA
Library or Museum	40
Private Office	45
Quiet Restaurant	50
General Office	55
General Store	60
Average Restaurant	65
Mechanised Office	70
Noisy Canteen	75
Factory Machine Shop	80
Main Street (at kerbside)	85
Plant Room	90

The sound attenuating performances determined by testing can be applied by deducting the measured performance weighted index (*Rw*.) from the source sound. Thus, a sound attenuating barrier providing for a performance of (say) *Rw*.30dB will reduce the sound pressure level generated in (say) a Plant Room from 90dBA to 60dBA. Conversely, to reduce the sound level in a Plant Room to the background sound level in (say) a Private Office, the sound attenuating barrier needs to provide for a performance of 90dBA - 45dBA = *Rw*.45dB.

NOTE: The 'A' suffix indicates a 'weighted' measurement.

On site, sound attenuating measurements relate to the complete barrier between the sound source and the receiving area and will measure the overall performance of the wall, doorset, window etc. that makes up the barrier. (See page 10.16).

Other Acoustic Terms:

Octave: Expressed simply, one octave is a difference in frequency (*or pitch*) that can be discerned by the average human ear. i.e. The average human may notice the difference between sound produced at (say) 200Hz. and 400Hz. (*1 octave*) but may not notice a difference between sounds produced at (say) 200Hz. and 250Hz. (*1/3rd. octave*).

STC: By reference to European tests, the weighted index is expressed by the use of the prefix 'Rw'. For tests carried out in the United States over a slightly different frequency range (125Hz. ~ 4,000Hz. as opposed to the European 100Hz. ~ 3,150Hz.) the prefix 'STC' might be used. STC = Sound Transmission Class.

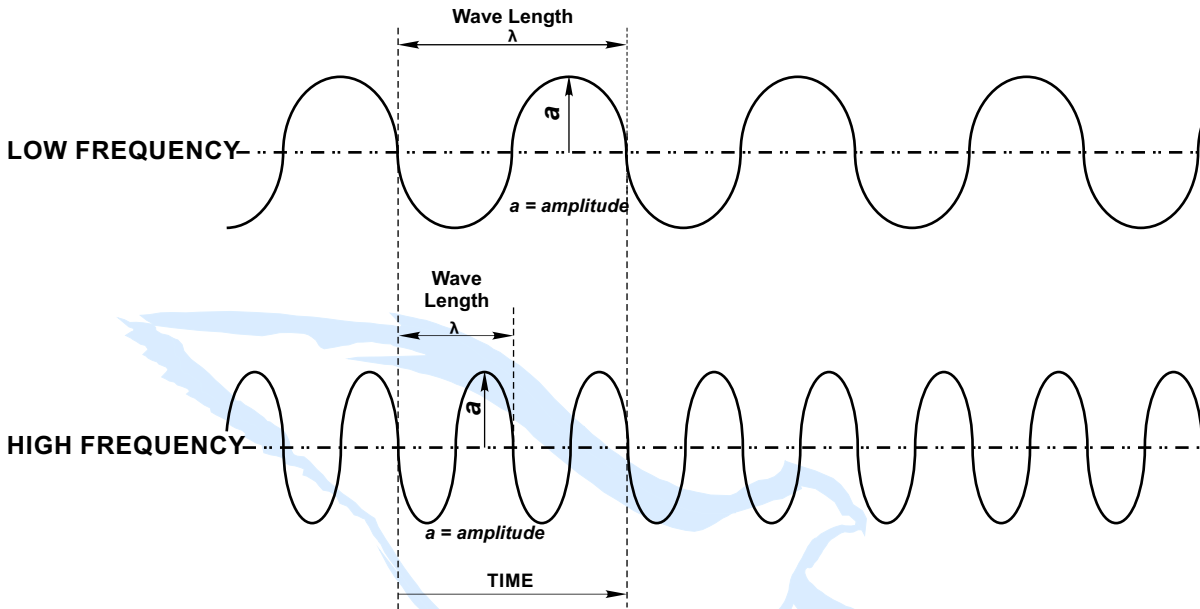
For all practical purposes *Rw*. & STC may be taken to be equal performances +/- 1dB.

Rule of Thumb:

Sound attenuation is measured using a logarithmic scale. Within the range applicable to most doorsets, an *Rw*.3dB variation in performance may be taken to be a doubling or halving of performance. e.g. an *Rw*.36dB doorset provides for double the performance of an *Rw*.33dB doorset.

Wavelength Amplitude & Frequency

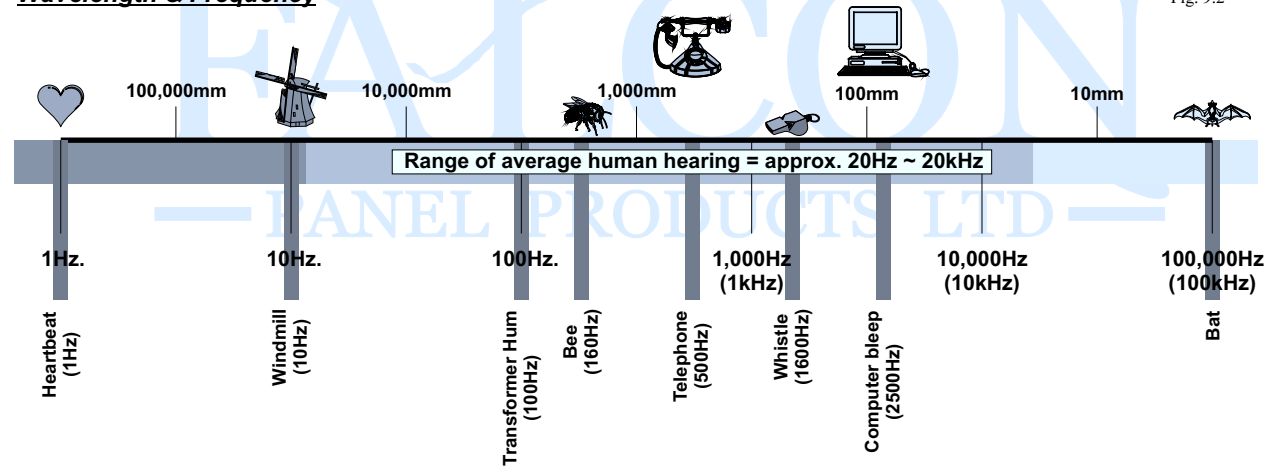
Fig. 9.1



Wave Length = The dimension from one point of a wave to the next corresponding point.
Amplitude = The sound pressure or loudness.
Frequency = The number of sound waves that pass a fixed point in a second. (Hz. = Hertz.)

Wavelength & Frequency

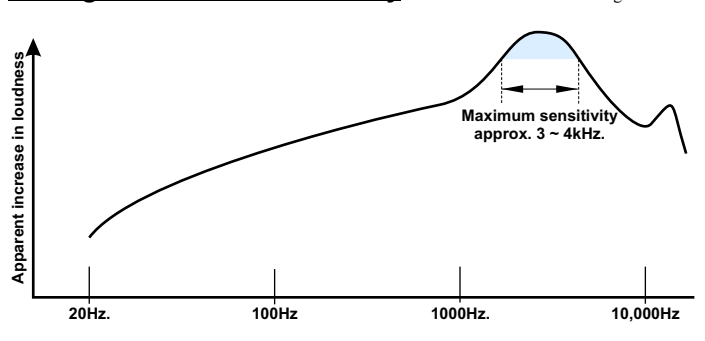
Fig. 9.2



Human sensitivity to sound is an individual thing and may vary from person to person for a number of reasons, including age. If sound is generated at the same sound pressure levels (*loudness*) over the full range of audible frequencies then sound in the region of 3 ~ 4kHz. would be perceived to be predominant. Standards for acoustic measurements relate to a frequency range between 100Hz. ~ 4,000Hz. being the most sensitive range for average human hearing.

Average Human Ear Sensitivity

Fig. 9.3



Acoustics Sound Attenuating Doorsets:

Generally any material will provide for a sound attenuating performance if used as a barrier between a sound source and a 'protected' area. Some materials provide for better performances than others.

Doorsets are essentially functional products with a primary purpose to provide for a means for 'traffic' to pass from one side of a wall to the other. For this purpose the door must be open. As the thing that we are trying to stop is the transfer of airborne sound then an open door will not provide for any performance. When the door is closed, the sound attenuating performance will be influenced by the residual airflow across the doorset. To minimise the airflow it is necessary to use sealing systems.

Some door constructions have been specifically developed to provide for excellent sound attenuating performances when used with suitable sealing systems. Some of these 'specialist' constructions rely on the mass law technology. i.e. generally increased mass provides for improved sound attenuating performances. However, there is not a direct relationship between mass and sound attenuating performances. Adding a dense material such as lead will generally improve performances but this will also change the characteristics of the doorset resulting in significant improvements at some frequencies with no improvement or even a loss of performance at other frequencies. Other 'specialist' door constructions rely on air gap technology in a similar manner to that used for glazed units. Essentially the air trapped in a gap will convert sound energy into heat energy with an improvement in sound attenuating performances. Use of facing materials that change the stiffness of the door or hardware fittings that bridge the door thickness can have an adverse influence on doors of this design.

To determine the precise performance of a sound attenuating doorset design it is necessary to carry out testing of a specimen that is identical in all respects to the design that is intended for use. The following factors can influence sound attenuating performances:

- Door size.**
- Door configuration.**
- Facing materials.**
- Glazing.**
- Choice of hardware.**
- Frame section dimensions.**
- Sealing systems.**
- Nature of the surround structure.**
- Method and quality of installation.**

The only method for determining the precise performance to be expected of a doorset design is to test a product that is identical in all respects to the product that is intended for use in the building with the specimen installed into a structure in a manner that replicates precisely the methods intended for use.

Warm Springs material based doorsets are primarily intended to provide for high performance fire door applications that are not intended for use as 'dedicated' sound attenuating products. However, Falcon Panel Products Ltd. have carried out an extensive range of tests to determine potential sound attenuating performances and to develop the product to suit the demands of published regulations, specifically:

Building Regulations - (England & Wales) - Approved Document 'E' = Rw.29dB for entrance doors to residential units.

Building Bulletin 93 - Educational Establishments - Classroom and Lecture areas = Rw.30dB.

Building Bulletin 93 - Educational Establishments - Music Rooms = Rw.35dB.

To determine potential performances, tests were carried out using a 2040x926mm door leaf size, being the largest size single leaf dimension anticipated by reference to BS4787 Pt.1. The influence of meeting stiles was determined by use of smaller sized doors to create an unequal pair that would fit in the 'standard' frame used for the single leaf door tests.

When tested with glazing, the glass aperture details conformed with requirements for FD120 fire door applications.

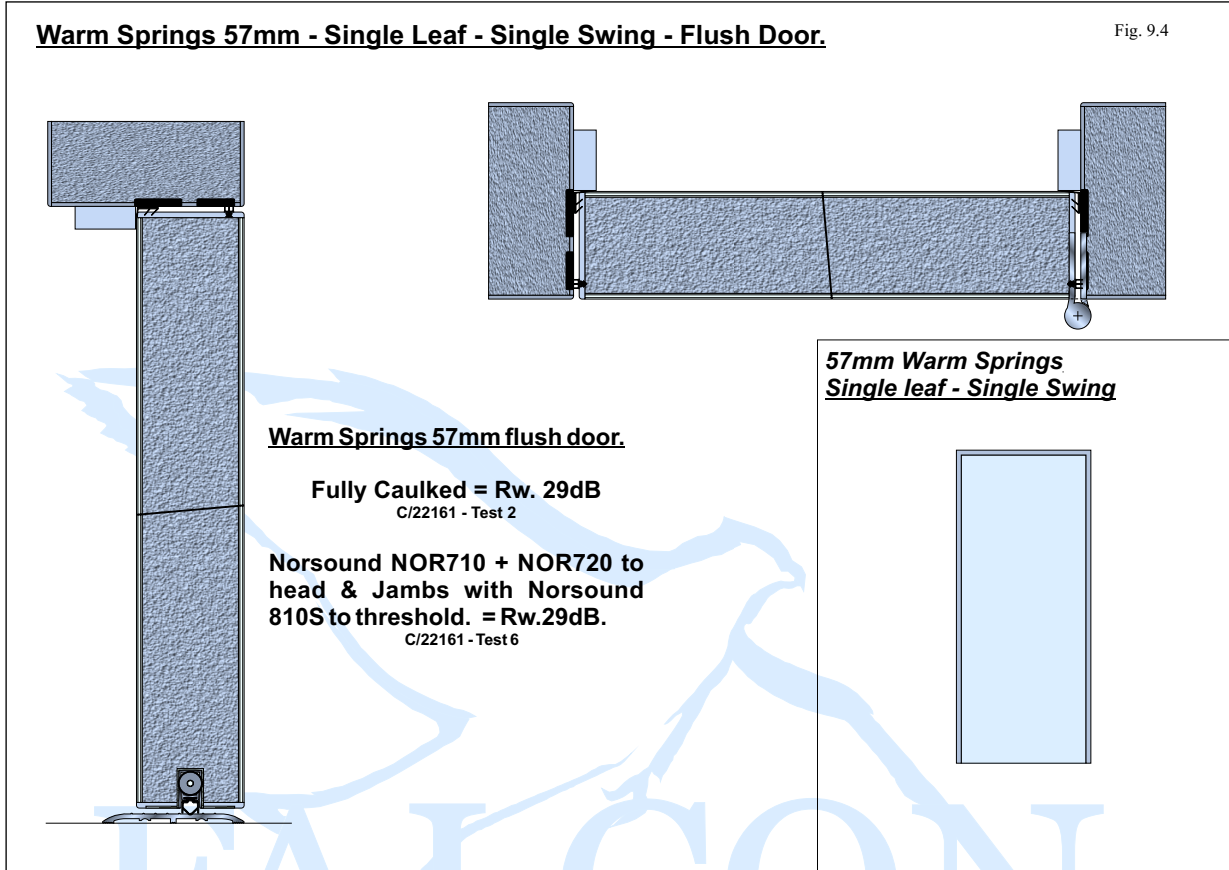
NOTE: It is important to carefully seal around the glass using suitable mastic to minimise the risk of sound leakage through the beading system.

The use of sealing systems is an essential requirement to provide for sound attenuating performances and these were carefully selected to provide for the following considerations:

- 1/ The sealing systems should have minimal influence on the operation of the door, with due regard to BS8300 and Building Regulations - (England & Wales) - Approved Document 'M'.**
- 2/ It should not be necessary to interrupt sound attenuating sealing systems to accommodate items of hardware. (i.e. provide for a minimal risk of conflict between seals and ironmongery).**
- 3/ Sealing systems used for sound attenuating purposes should also be able to provide for smoke sealing performances (BS476 : Section 31.1).**
- 4/ Sound attenuating sealing systems should not conflict with intumescent sealing systems.**

The following details show recommended fitting positions for Norsound acoustic sealing systems used for testing with Warm Springs material based doorsets. Sealing systems providing for similar performances are available from numerous sources.

Rw.29dB



NOTE: The 'fully caulked' performance relates to a door of the same construction and size as tested under operational condition but with all operating gaps between the door and the frame completely sealed using a heavy duty sealant with the door in an inoperable condition to determine the maximum potential performance of the particular door construction.

— PANEL PRODUCTS LTD —

Warm Springs 57mm - Flush Door - Single Leaf - Single Action.

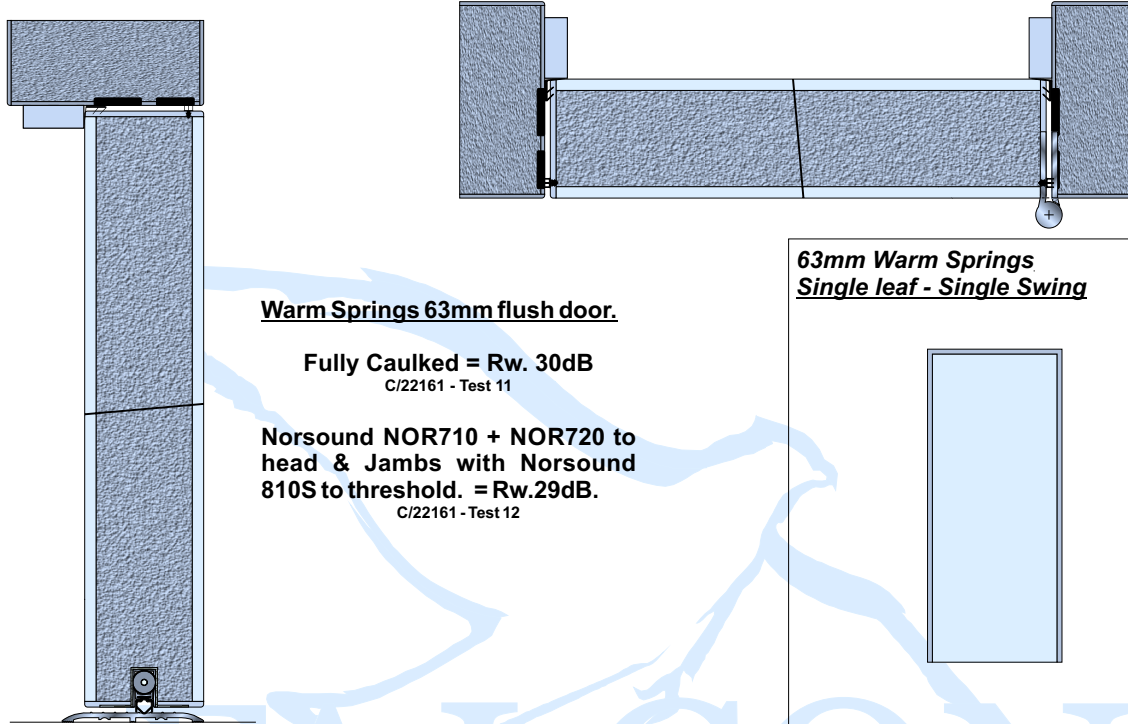
Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810S	N/A	N/A	C/22161 - Test 6	Rw.29dB

Acoustics

Rw.29dB ~ Rw.30dB

Warm Springs 63mm - Single Leaf - Single Swing - Flush Door.

Fig. 9.5



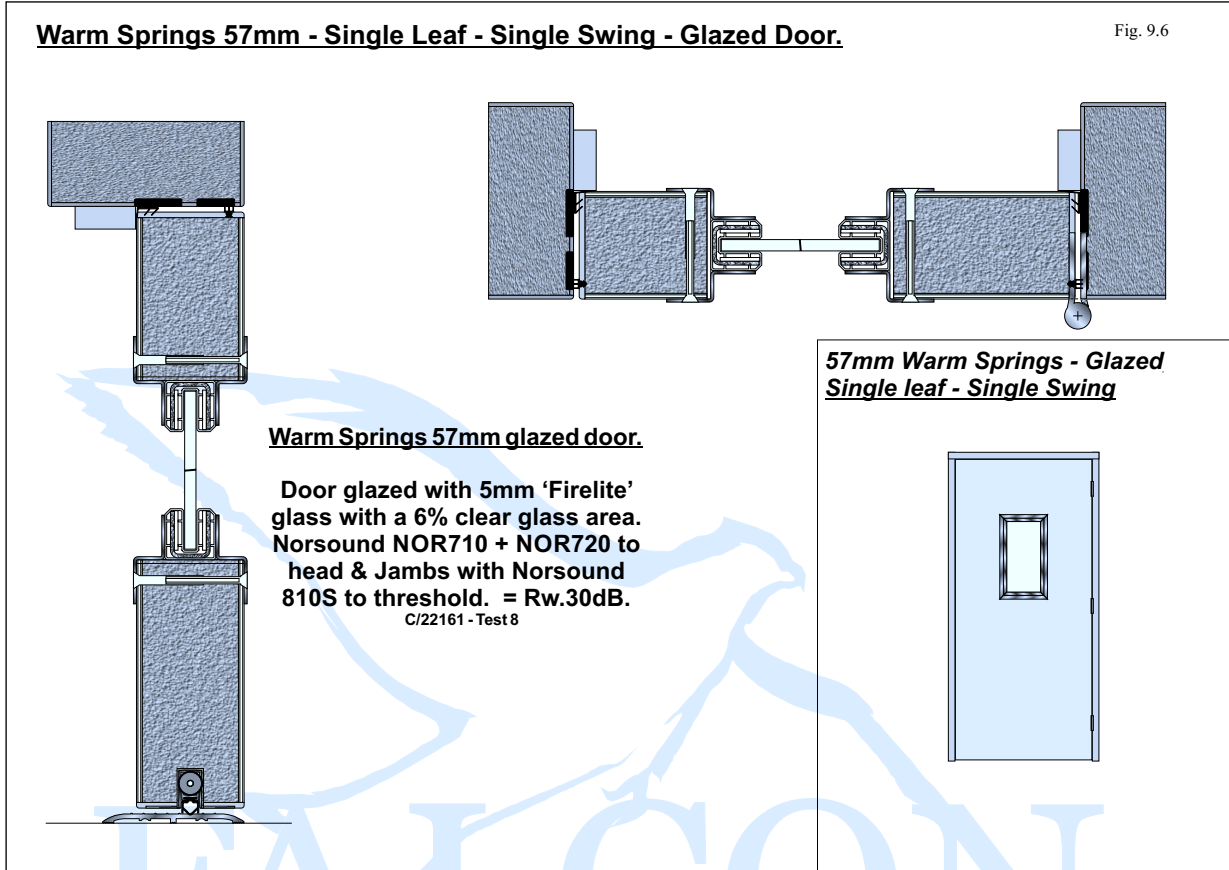
NOTE: The 'fully caulked' performance relates to a door of the same construction and size as tested under operational condition but with all operating gaps between the door and the frame completely sealed using a heavy duty sealant with the door in an inoperable condition to determine the maximum potential performance of the particular door construction.

— PANEL PRODUCTS LTD —

Warm Springs 64mm - Flush Door - Single Leaf - Single Action.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810S	N/A	N/A	C/22161 - Test 12	Rw.29dB

Rw.29dB ~ Rw.30dB



NOTE: The 'fully caulked' performance relates to a door of the same construction and size as tested under operational condition but with all operating gaps between the door and the frame completely sealed using a heavy duty sealant with the door in an inoperable condition to determine the maximum potential performance of the particular door construction.

— PANEL PRODUCTS LTD —

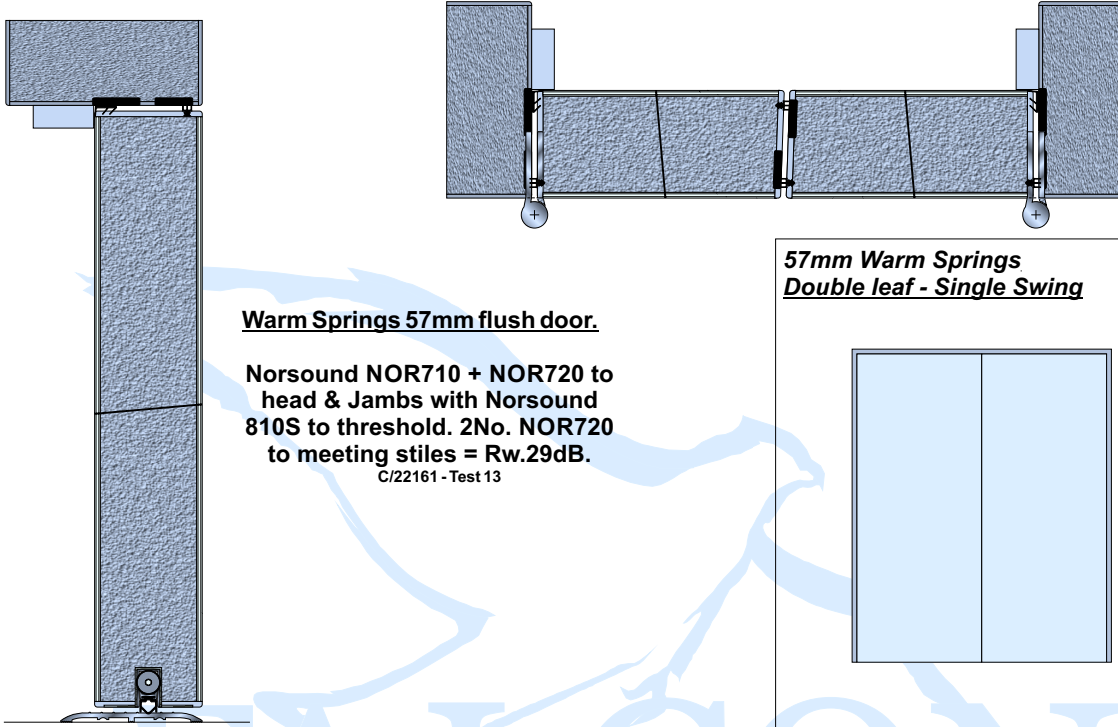
Warm Springs 57mm - Flush Door - Single Leaf - Single Action.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810S	N/A	5mm Firelite	C/22161 - Test 8	Rw.30dB

Rw.29dB

Warm Springs 57mm - Double Leaf - Single Swing - Flush Door.

Fig. 9.7



Warm Springs 57mm flush door.

Norsound NOR710 + NOR720 to head & Jams with Norsound 810S to threshold. 2No. NOR720 to meeting stiles = Rw.29dB.
C/22161 - Test 13

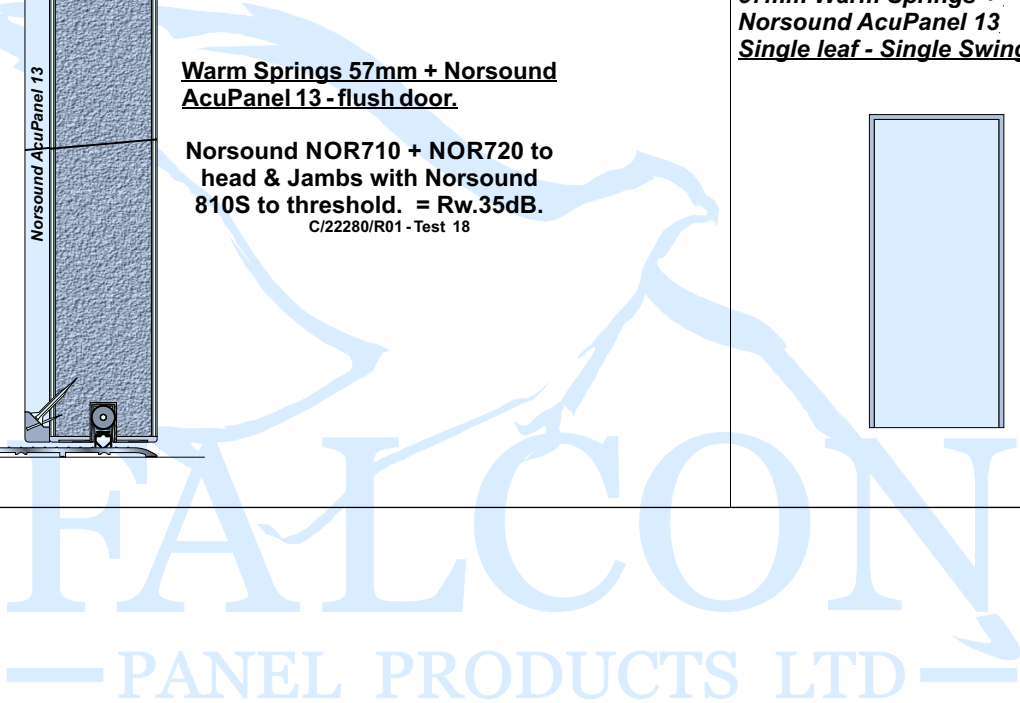
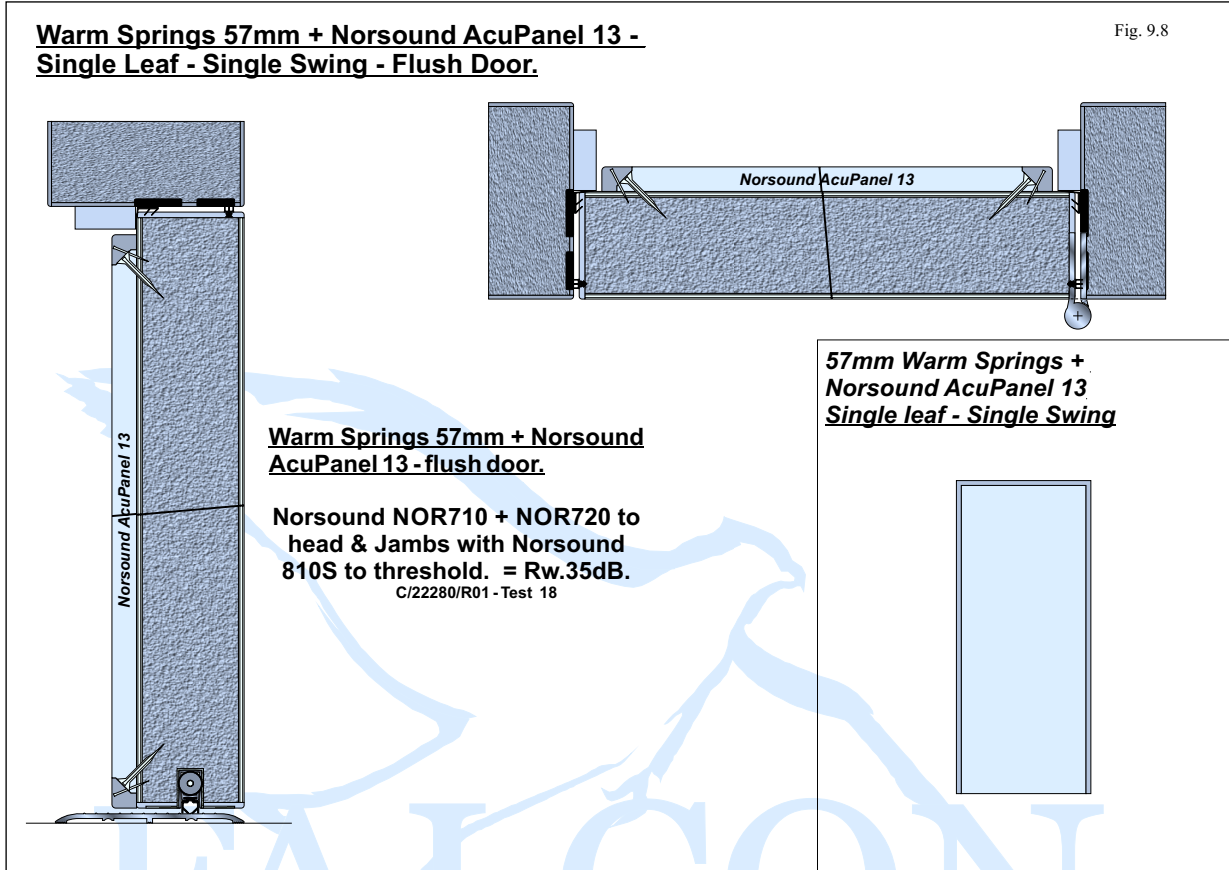
**57mm Warm Springs
Double leaf - Single Swing**

FALCON
— PANEL PRODUCTS LTD —

Warm Springs 57mm - Flush Door - Double Leaf - Single Action.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810S	2No. NOR720	N/A	C/22161 - Test 13	Rw.29dB

Rw.29dB ~ Rw.35dB



Warm Springs 57mm + Norsound AcuPanel 13 - Flush Door - Single Leaf - Single Action.

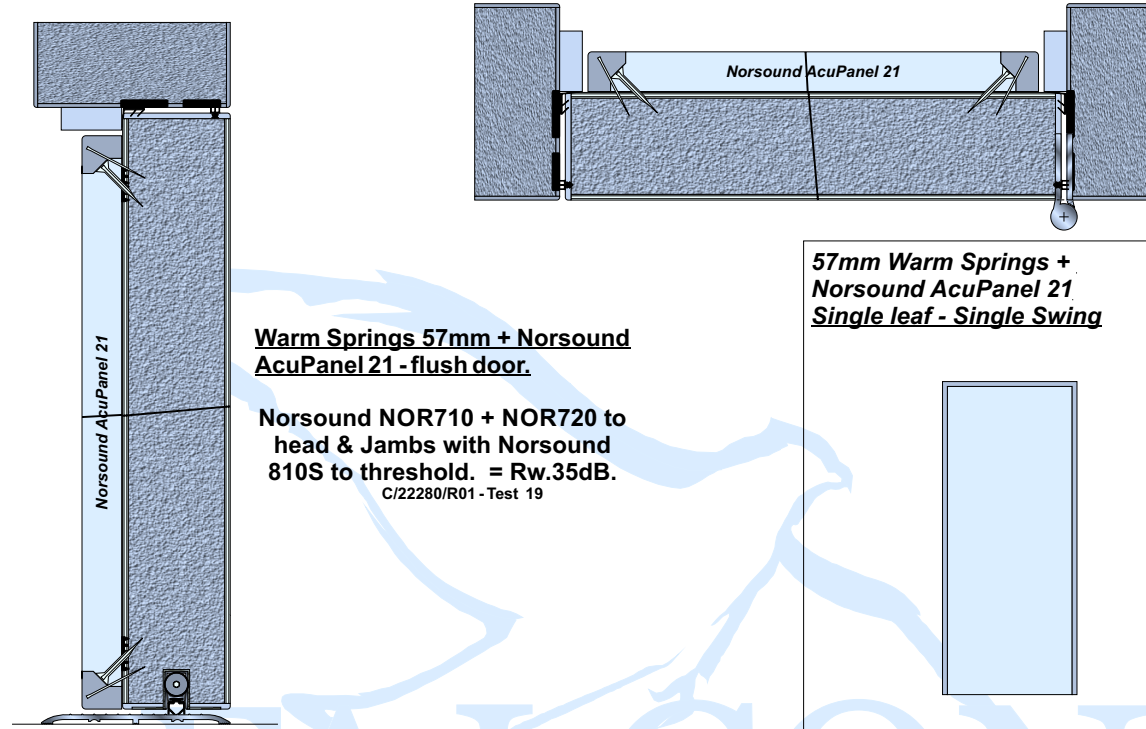
Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810S	N/A	N/A	C/22280/R01 Test 18	Rw.35dB

Acoustics

Rw.29dB ~ 35dB

Warm Springs 57mm + Norsound AcuPanel 21 - Single Leaf - Single Swing - Flush Door.

Fig. 9.9



Warm Springs 57mm + Norsound AcuPanel 21 - flush door.

Norsound NOR710 + NOR720 to head & Jamb with Norsound 810S to threshold. = Rw.35dB.
C/22280/R01 - Test 19

57mm Warm Springs + Norsound AcuPanel 21 Single leaf - Single Swing

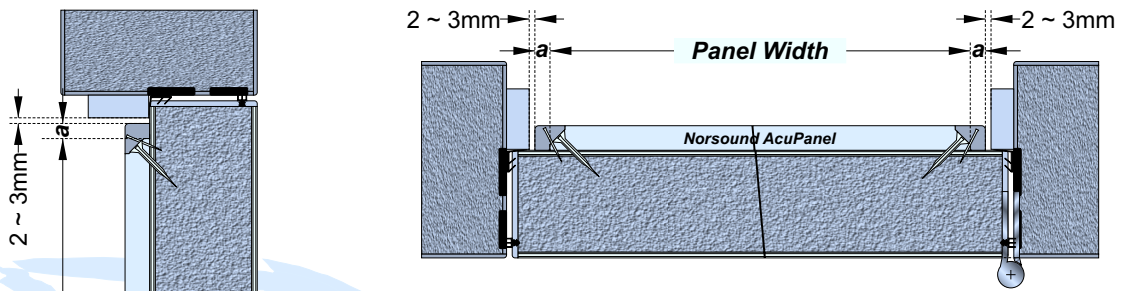
FALCON
— PANEL PRODUCTS LTD —

Warm Springs 57mm + Norsound AcuPanel 21 - Flush Door - Single Leaf - Single Action.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810S	N/A	N/A	C/22280/R01 Test 19	Rw.35dB

Norsound AcuPanel Recommended Sizing & Fixing:

Fig. 9.10



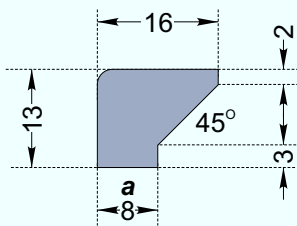
Sizing & Fitting Norsound AcuPanels:

1/Width:

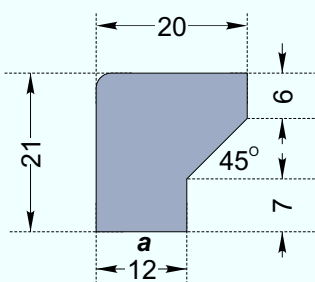
- a/ Measure dimension between the face of the door stops and deduct 2~3mm at each side for operating clearance.
- b/ Deduct 2x dim. 'a' (2x8mm for Acupanel 13 and 2x12mm for Acupanel 21).
- c/ Cut panel to width and profile vertical edges to suit hardwood trim profiles.

2/Height:

- a/ Measure dimension from the bottom edge of the door to the face of the head door stop and deduct 2~3mm for the head operating clearance.
- b/ Deduct 2x dim. 'a' (2x8mm for Acupanel 13 and 2x12mm for Acupanel 21).
- c/ Cut panel to height and profile horizontal edges to suit hardwood trim profiles.



**Hardwood Trim
AcuPanel 13**



**Hardwood Trim
AcuPanel 21**

Fixing:

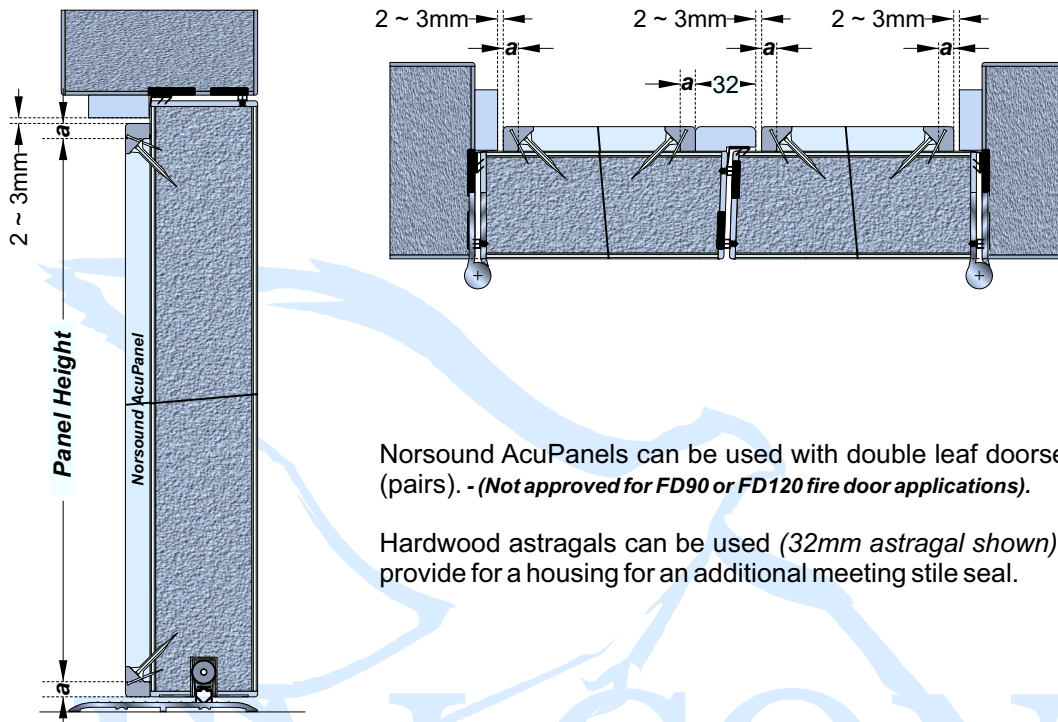
- a/ Position the panel allowing space for the hardwood trim.
- b/ Fix panels to the closing face of the door leaf using minimum number of 30mm No.8 or No.10 screws necessary to ensure stability (generally 3No. fixings top and bottom of the panel for doors up to 926mm wide and 4No. vertical fixings for doors up to 2050mm high).
- c/ Fixings should be angled at 45° with pilot holes prepared to receive fixings.
- d/ Ensure fixings are secured into the internal Tectonite framing of the door leaf.
- e/ Mitre corners of the hardwood trim and spot glue and pin trim into position avoiding conflicts between the pin fixings and the panel screw fixings.

NOTE 1: Acoustic damping: For some applications performance benefits from acoustic damping. This is achieved by using Norsound 'E' Seal pads at screw fixing positions with a Nom. 50mm square 'E' Seal fixed centrally in panel width / height resulting in a small Nom. 0.5mm gap between the panel and the face of the door leaf.

NOTE 2: Individual manufacturers may prefer to vary hardwood trim designs with consequential influences on the edge profiling of the AcuPanels.

Norsound AcuPanel with Double Leaf Doorsets:

Fig. 9.11



Norsound AcuPanels can be used with double leaf doorsets (pairs). - (Not approved for FD90 or FD120 fire door applications).

Hardwood astragals can be used (32mm astragal shown) to provide for a housing for an additional meeting stile seal.

NOTE: Not suitable for FD90 or FD120 Fire Door applications

Norsound AcuPanel & Hardware:

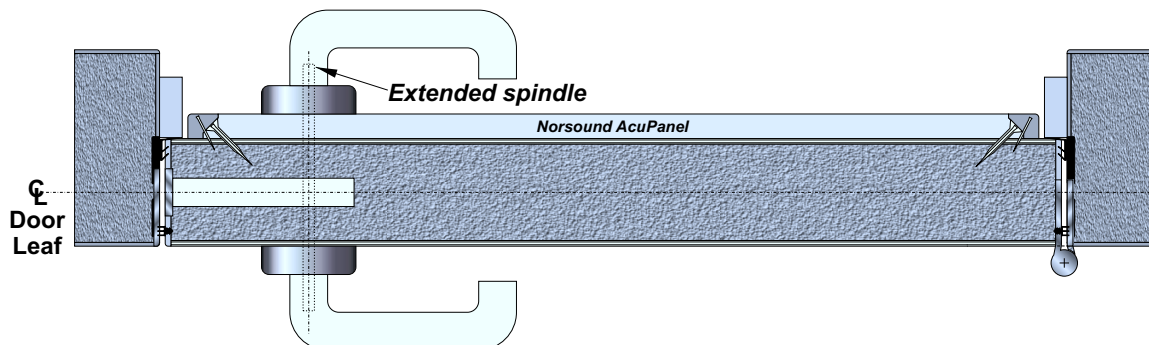
Fig. 9.12

Generally hardware is centred on the base door leaf with not special provisions to be made when used with Norsound AcuPanels excepting for items that pass through the thickness door leaf and panel

Latches can be fitted with extended spindles (as illustrated).

For cylinder locks, special 'off set' cylinders are required.

An alternative is to recess the AcuPanel at affected hardware positions i.e. around latches and locks with trim similar to the panel edge trim used to suit.



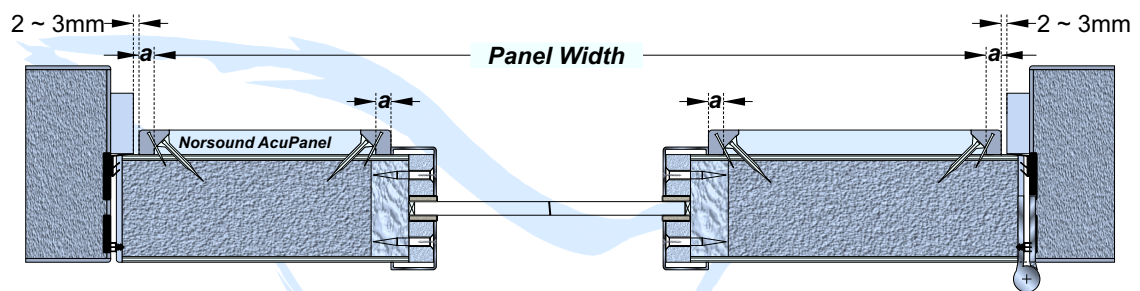
Norsound AcuPanel & Glazing:

Fig. 9.13

Norsound AcuPanels can be used with glazed doors.

An aperture is cut into the AcuPanel to suit the overall bead dimensions of the glazed aperture with a further adjustment (*dim. 'a'*) to receive the trim bead.

This detail shows the Norsound AcuPanel 13 used with the Norsound Universal 90 or Universal 120 glazing system. (See Section 7 - Glass & Glazing).



Norsound AcuPanel & Additional Sealing:

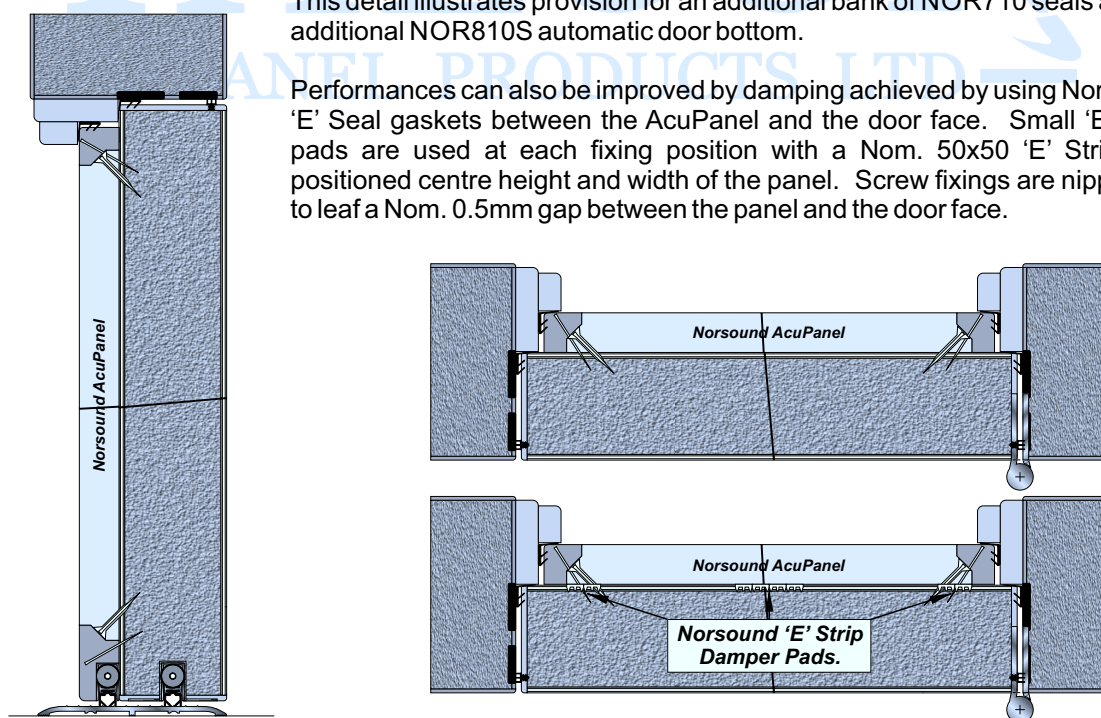
Fig. 9.14

The sound attenuation performance of a doorset is achieved in part by the restriction of air flow (*and consequently the movement of airborne sound*) through the doorset.

Use of the Norsound AcuPanel provides for opportunities for increased sealing with minimal influence on the operation of the doorset.

This detail illustrates provision for an additional bank of NOR710 seals and an additional NOR810S automatic door bottom.

Performances can also be improved by damping achieved by using Norsound 'E' Seal gaskets between the AcuPanel and the door face. Small 'E' Strip pads are used at each fixing position with a Nom. 50x50 'E' Strip pad positioned centre height and width of the panel. Screw fixings are nipped up to leave a Nom. 0.5mm gap between the panel and the door face.



Acoustics

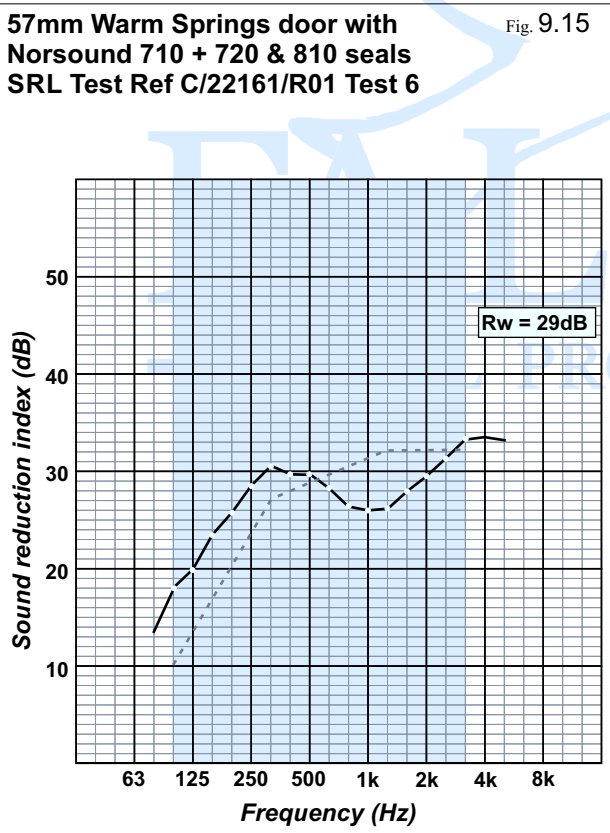
Acoustic Enhancement:

Most solid core 'general purpose' door constructions suffer from a 'coincidence gap' problem. The 'coincidence gap' is the difference between the plotted curve, measured by reference to BS EN ISO 10140-2 : 2010 (previously BS EN ISO 140-3) and the reference curve that is calculated by reference to BS EN ISO 717-1 : 1997.

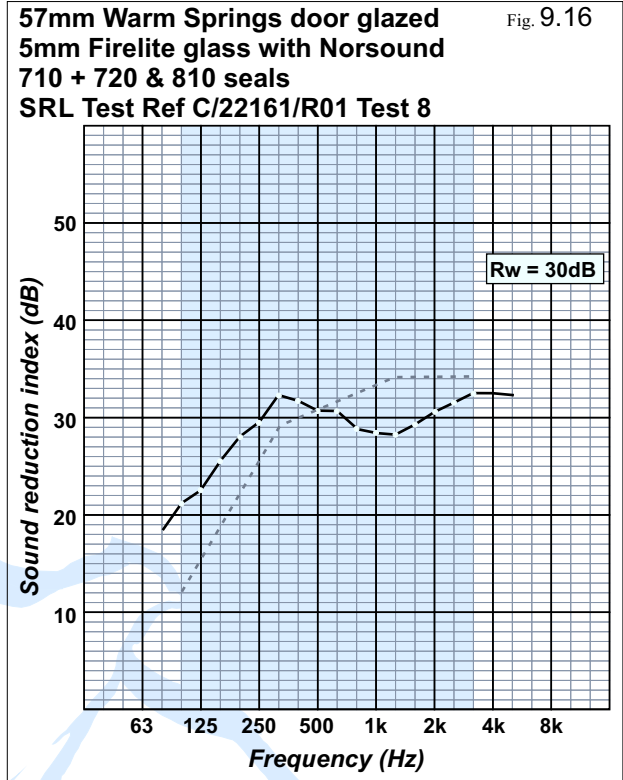
Where the plotted measurement falls above the reference curve, this indicates a surplus of performance at the particular frequencies relative to the weighted index (Rw.).

Where the plotted measurement falls below the reference curve, this indicates a deficiency in performance at the particular frequencies relative to the weighted index (Rw.).

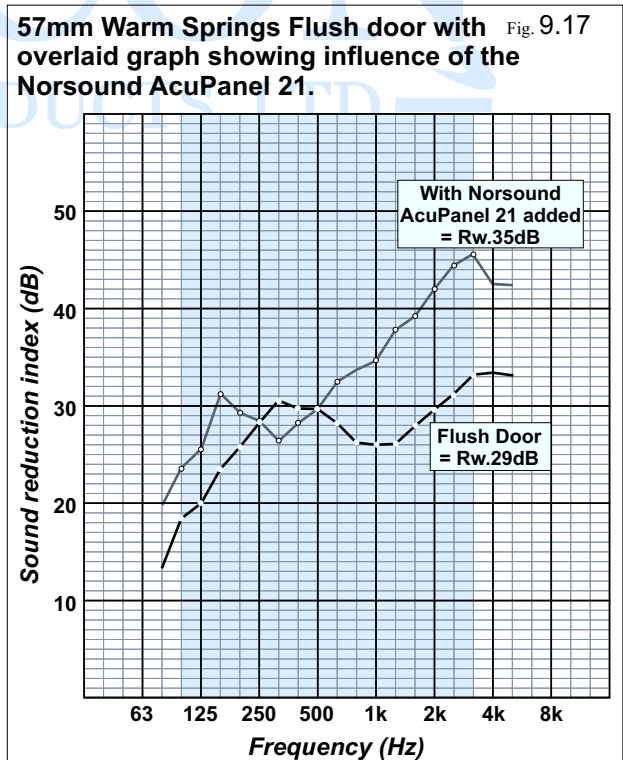
The test data for a Nom. 57mm Warm Springs door fitted with Norsound 710 & 720 perimeter seals and a Norsound 810 threshold seal is illustrated as follows:



The maximum deviation for the 57mm Warm Springs door occurred at about 1,000Hz. Tests were then carried out using the same arrangement but with the door glazed using the 5mm Firelite glass approved for FD120 applications.



Whereas glazing had some beneficial influence on coincidence gaps, the overall performance of a flush door was significantly improved by adding a Norsound AcuPanel



The influence of hardware:

Provided that care is taken to select and position hardware to avoid the need to interrupt sealing systems, the choice of hardware will have little effect on sound attenuating performances.

Hardware items that require the removal of any of the door core should be kept as small as possible.

The main risk to the performance of a sound attenuating doorset results from the creation of flanking routes through the door that may be created by providing for hardware items that essentially pass through the thickness of the door. e.g. lever handles, cylinders / keyholes. The use of lever sets with back plates will generally allow for the use of mastic (or other sealants) to prevent the passage of airborne sound. Similar action can be taken with cylinders. For key ways, the use of escutcheons with escutcheon plates will generally provide for a sufficient barrier.

NOTE: Letter plates passing through the door have been successfully tested for performances up to Rw.40dB.

Flanking:

Flanking is the leakage of airborne sound through or around the door leaf and / or the doorset.

The main causes of flanking are:

- Insufficient care and adjustment when fitting seals.
- Worn seals.
- Interruption of seals to receive hardware.
- Inadequate sealing around hardware items that pass through the door.
- Inadequate sealing around glazed apertures.
- Inadequate sealing between the frame and the surrounding structure.

When fitting seals, the main areas of weakness are at the junctions between horizontal and vertical seals i.e. at the four corners of a single leaf doorset. Seals should extend to the full shoulder height and width of the frame with the head seal carefully mitre jointed to the jambs seals where possible.

The operating gap at the seal position should suit the dimensions of the seal. In the case of the Norseal 710 seal, the operating gap at the seal position can be adjusted by the use of backing tape to provide for an optimum seal operating gap.

Seals such as the Norsound 720 should be positioned to provide for the optimum overlap with the frame or adjacent door. If sealing gaps are too small or seals are over compressed there is the risk of seal distortion with consequential failures.

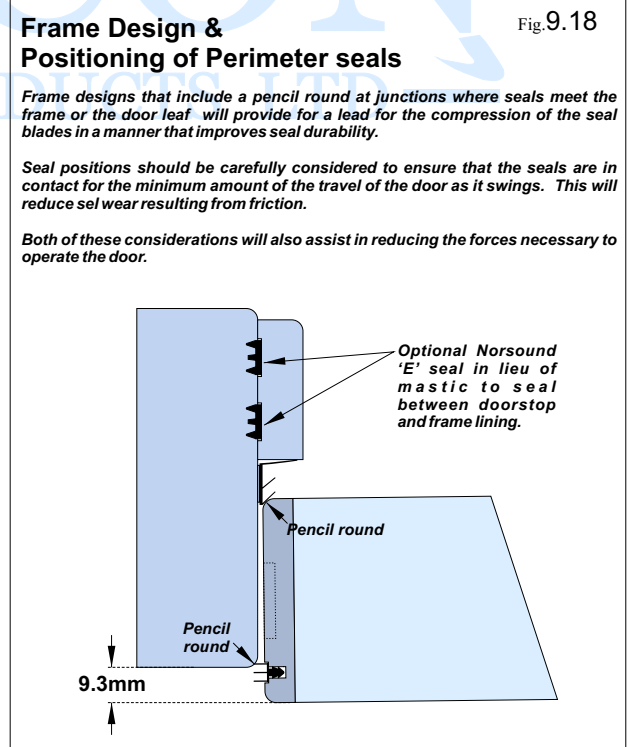
NOTE: The optimum setting usually provides for seal gaskets to compress by about 40 ~ 50%.

The gaskets for automatic door bottoms should be cut to suit the full width of the door to provide for a close fit with the end plates. The automatic door bottoms should be carefully adjusted to ensure that they seal across the full width of the door onto the floor or threshold strip.

Carefully locating seals to suit the action of the door can ensure that the seals are in contact with the door / frame for the minimum amount of the swing of the door thus reducing the influence on operating forces and reducing wear resulting from friction.

Threshold strips or stepped thresholds with seals should be carefully scribed to the frame with mastic (or other suitable sealant) used to fill any gaps that might provide a route for flanking.

The use of frame and door leaf designs that provide for a pencil round at junctions where the seals meet the door leaf or the frame are recommended. This will act as a lead to the compression of the seal and improve seal durability.



Acoustics

Flanking contd:

The doorset should be installed plumb and square. Any distortion may give rise to difficulties when fitting seals.

The gap between the frame and the surrounding structure should be carefully packed with mineral wool between fixings to prevent flanking around the frame. A mastic sealant should be applied to both sides of the frame before fixing architrave (if used).

Because doorsets are essentially operational products they must provide for ease of operation. This requires a careful balance when fitting (*and adjusting*) seals. The effect of the seals can usually be felt in the last part of closing but more particularly when opening. For well fitted seals there should be a 'bath plug' effect resistance to opening. (*Air is trapped between seals as the door opens resulting in a lowering of air pressure*). The pressure is equalised by the slow feed of air into the space. This effect will result in difficulty if an attempt is made to snatch open the doors. i.e. for normal operation the doors should be opened more gradually.

One part of the doorset that is difficult to seal is at the bottom of the doors at the hanging, closing and meeting stiles. This results from an essential gap between the end plates of automatic door bottoms.

When using the twin NOR720 seals (*or other fixed bottom of door seals*) with a threshold plate, it is possible to extend the 720 seal into the operating gap at the hanging jambs thus reducing flanking in this area.

For pairs of doors a flanking gap also occurs at the bottom of the meeting stiles. The NOR650 stepped threshold with seal (currently) provides for the only effective way for sealing this gap.

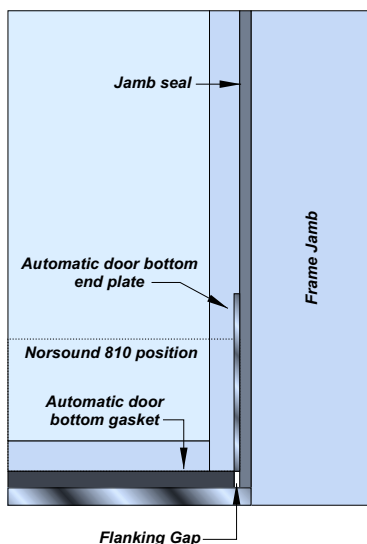
Flanking Gaps - Single leaf doorsets.

Fig. 9.19

For single leaf doorsets there will generally be a flanking route at the threshold position caused by the essential need to provide for operating gaps.

Flanking can be minimised by ensuring that operating gaps, particularly at the threshold are kept as small as possible (4 +/- 1mm) and that threshold sealing gaskets extend as far as possible to the full width of the door. This is usually up to the automatic door bottom end plates.

For single leaf doorsets these flanking routes fall outside to the normal pedestrian used space. It is therefore possible add small additional sealing devices to address this problem. See Flanking seals.



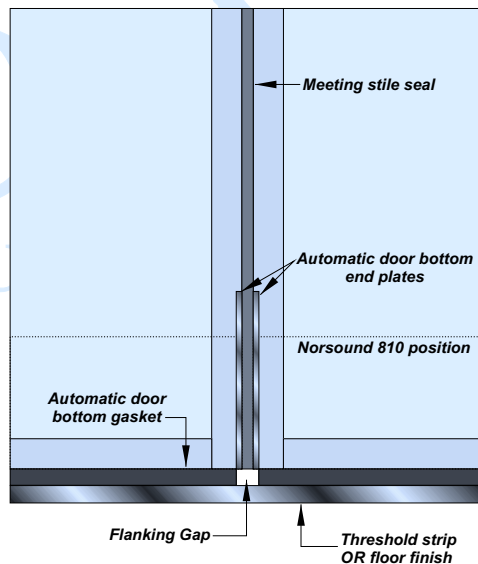
Flanking Gaps - Pairs.

Fig. 9.20

When using automatic door bottoms or fixed bottom edge seals at the threshold there will be a gap at the bottom of the meeting stiles which will be exploited by airborne sound.

This leakage is unavoidable for an operational door but can be minimised by ensuring that under door gaps are kept as small as possible (4 +/- 1mm) and that threshold sealing gaskets extend as far as possible to the full width of the door. This is usually up to the automatic door bottom end plates.

Flanking at the bottom of meeting stiles can be significantly reduced by use of the Norsound 650 stepped threshold with seal where the NOR650 sealing gasket bridges this gap.



Flanking contd:

To reduce flanking at the hanging and closing stiles of single leaf doorsets and the hanging stile for pairs of doors, flanking protectors can be added to the doorset sealing system.

These devices (*Norsound 'AcuPad'* and *Norsound DT1*) can form part of the original doorset design or added as upgrade items where they are needed.

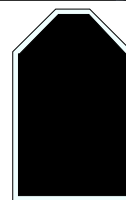
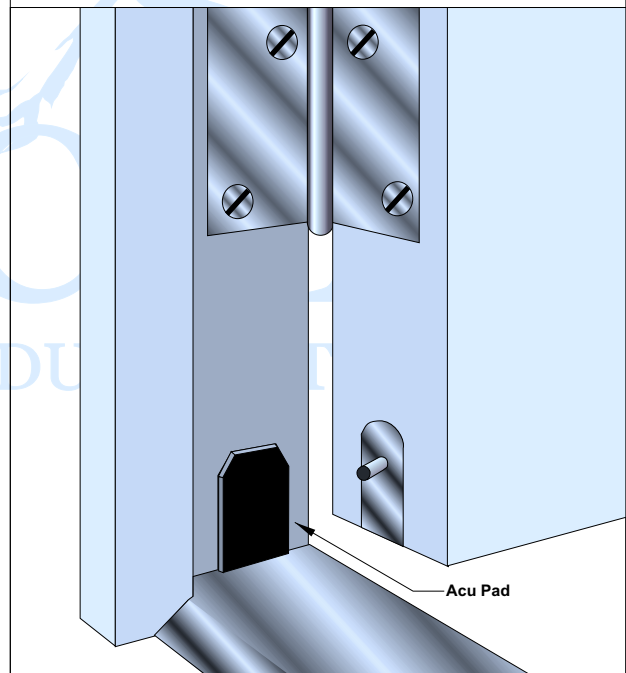
Norsound Flanking Seals.

Fig. 9.21

The Norsound 'AcuPad' is a small self adhesive device with a nylon brush seal that can be adhered to the frame jambs at the hanging and closing stiles of single action single leaf doors and at the hanging stiles for pairs. This device provides for a sealing function at a position where flanking is otherwise unavoidable.

The alternative Norsound DT1 provides for a similar function but this device is recessed into the bottom of the frame which is screw fixed into position.

Both devices provide for the same performance with the NOR DT1 being (perhaps) aesthetically more acceptable and less prone to casual removal.



Norsound 'AcuPad'



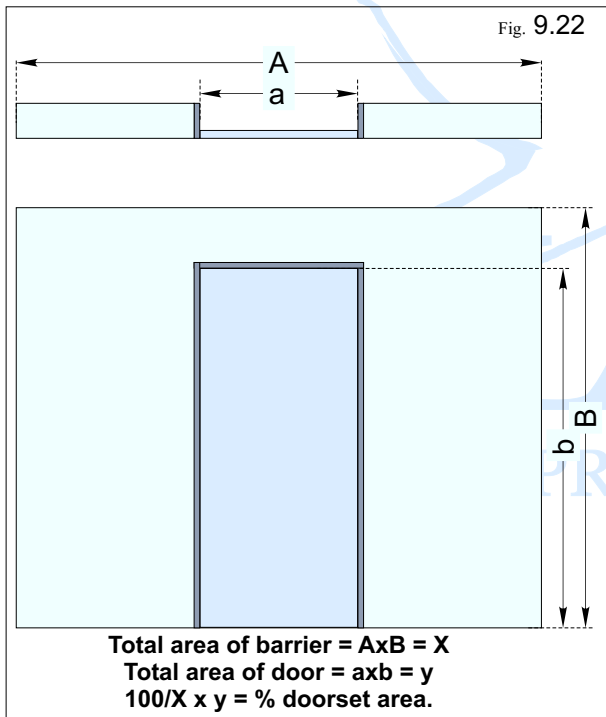
Norsound 'DT1'

Acoustics

Site Measurements:

When measuring sound attenuating performance on site, it is the performance of the complete barrier between the sound source and the protected area that is important. i.e. the combined performance of the wall, doorset, window etc. This performance is measured in accordance with BS EN ISO 140-4: 1998.

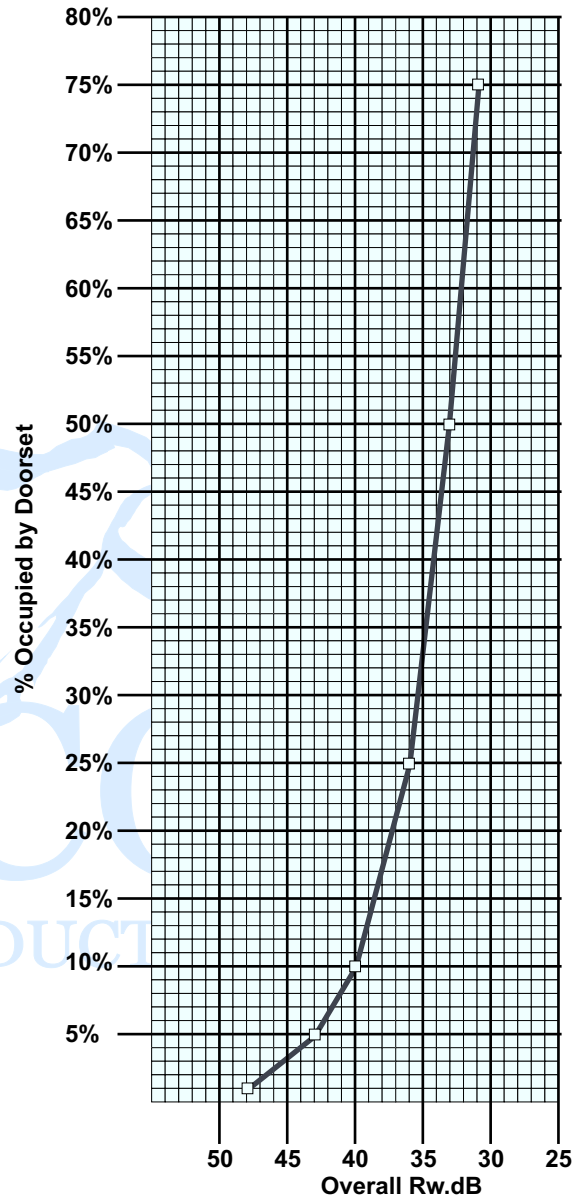
The performance of a doorset (*an operational product*) is likely to be less than the surrounding wall and the perceived performance of the total barrier (*wall & doorset*) will be less than the performance of the wall and better than the performance of the doorset. The total effect will vary, among other things, according to the percentage area that is occupied by the doorset.



Acoustic Engineers will need to know the sound attenuating performance of doorsets determined by laboratory testing to BS EN ISO 140-3 for the purpose of calculating acoustic designs for particular projects.

Falcon Panel Products Ltd. will supply base test evidence to Architects and Acoustic Engineers for this purpose, on request.

Fig. 9.23



This graph illustrates the total sound attenuating performance when using an Rw.30dB doorset in an Rw.53dB wall.

Example: The overall sound attenuating performance of a barrier where an Rw.30dB doorset occupies 25% of an Rw.53dB wall, the overall performance would be about Rw.36dB.

Further assistance in the calculation of total barrier performances is provided by reference to www.norsound.co.uk 'Acoustic Calculator'

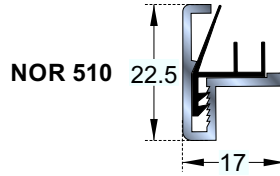
NOTE: Some of these products may not be suitable for FD90 & FD120 fire door applications

Acoustics

Norsound Ltd. tested Acoustic Products.

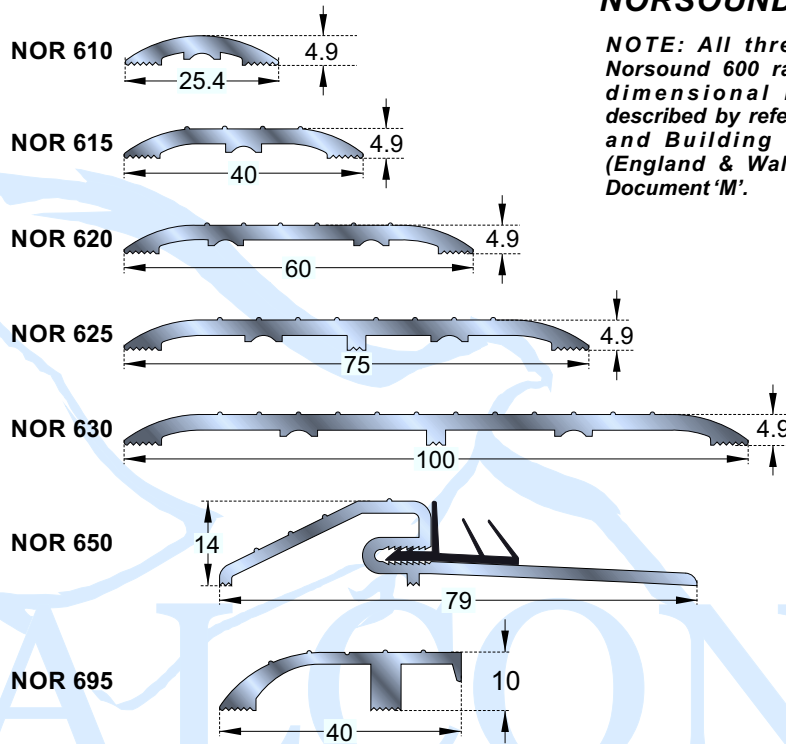
Fig. 9.24

Meeting stile Astragal with seal



NORSOUND 500 Series

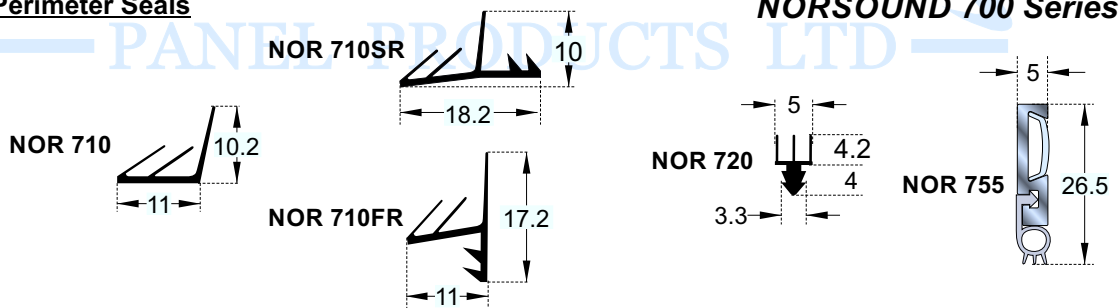
Thresholds



NORSOUND 600 Series

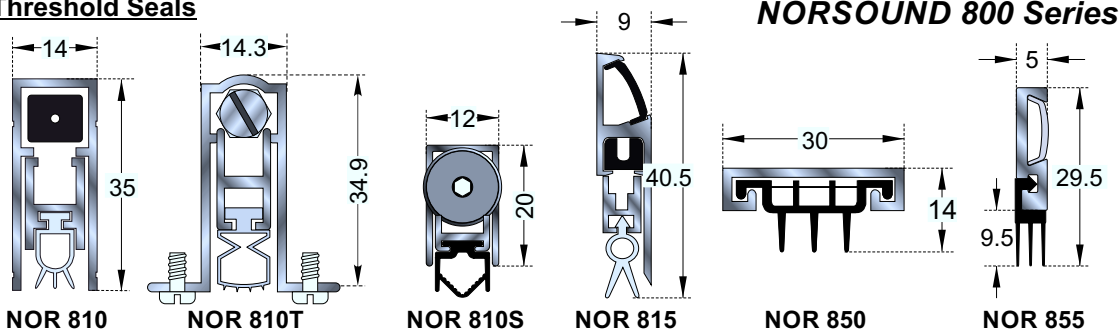
NOTE: All thresholds in the Norsound 600 range satisfy the dimensional requirements described by reference to BS8300 and Building Regulations - (England & Wales) - Approved Document 'M'.

Perimeter Seals



NORSOUND 700 Series

Threshold Seals



NORSOUND 800 Series

Acoustics

Recommended locations for Norsound Seals:

For manufacturers recommendations see:
www.norsound.co.uk

The sound attenuating performance of a doorset is directly related to the ability of the sealing system to prevent the flow of air (and consequently airborne sound) through the doorset.

Generally the maximum potential performance of a doorset design can be determined by 'fully caulked' testing. For this purpose the door is sealed in an inoperable condition using a heavy duty sealant to prevent airborne sound passing through any gaps around the door.

Doorsets require operating gaps around the door to permit the door to be operated. The sealing systems are required to fill these gaps to prevent (or significantly reduce) the flow of air through the doorset while still allowing the door to be operated. Consideration must also be given to the selection and location of hardware.

When developing the Norsound range of acoustic seals care was taken with regard to the location of seals to minimise the risk of conflicts between sealing systems and hardware, while providing for minimal influences on operating forces.

There are two methods for achieving a design performance requirements for a doorset:

Method 1: Use a door construction with a very high fully caulked performance in conjunction with minimal sealing efficiency.

Method 2: Use a door construction with a lower fully caulked performance with a more efficient sealing system.

Example: If (say) an Rw.30dB performance is required for a particular location:

A door construction providing for a (say) Rw.38dB fully caulked performance could be used in conjunction with seals providing for 79% efficiency (with the same door construction). i.e. allowing for 21% leakage.

Alternatively a lower rated door construction providing for a (say) Rw.33dB fully caulked performance with a sealing system providing for 91% sealing efficiency (when used with the same door construction). i.e. allowing for just 9% leakage.

General purpose door constructions can provide for performances up to Rw.35dB. as operational doorsets. For performances in excess of Rw.35dB. consideration should be given to the use of 'dedicated' acoustic door constructions such as the Falcon Tri-Sound® - Series 3 construction or, to the construction of 'acoustic lobbies'.

Some improvement to sound attenuating performances can be achieved by glazing using suitable glass types and methods of beading.

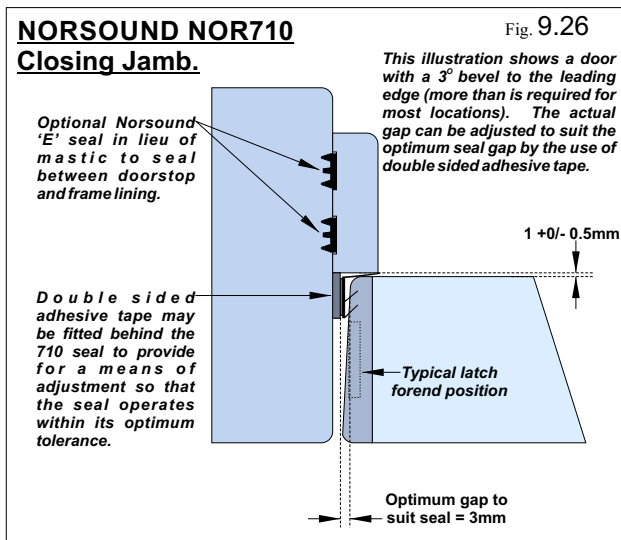
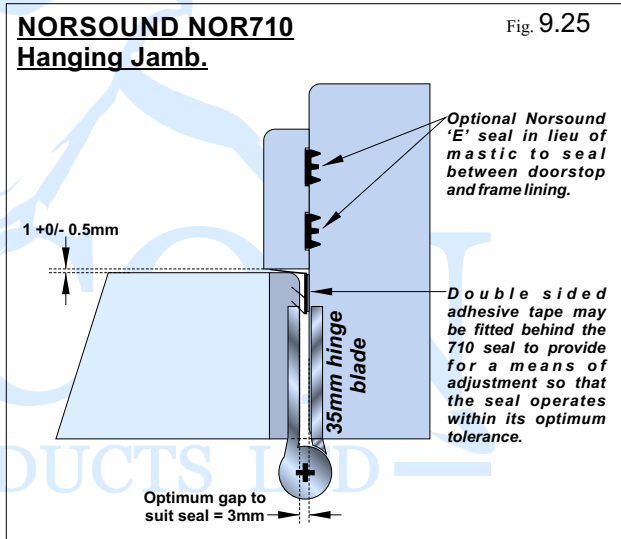
The following details show recommended fitting positions for Norsound acoustic sealing systems based upon extensive testing experience. Sealing systems providing for similar performances are available from numerous sources.

Norsound 710 seal:

This flexible seal fits in the rebate of the frame in a position that is unlikely to result in conflicts with hardware or other sealing systems and in a position that results in minimal influence on operating forces.

Variants to the basic NOR 710 design to allow for alternative methods of fixing.

NOTE: The Norsound 710 seal together with other seals in the Norsound range are intended to provide for optimum performances when used with operating gaps as defined by reference to BS4787 Pt.1 : 1980.

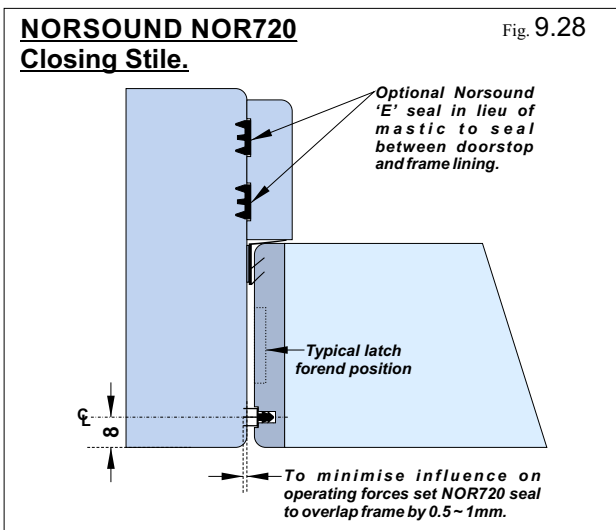
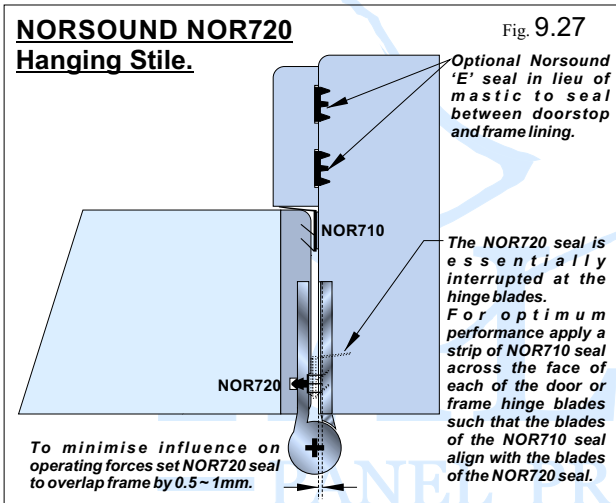


Norsound 720 seal:

This versatile small three bladed seal can be used for a number of applications including:

- Supplementary perimeter seal to improve sealing efficiency with minimal influence on operating forces.
- Meeting stile sealing option.
- Threshold sealing option.

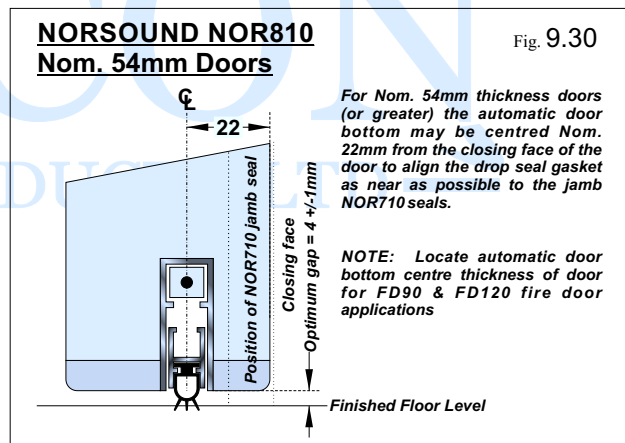
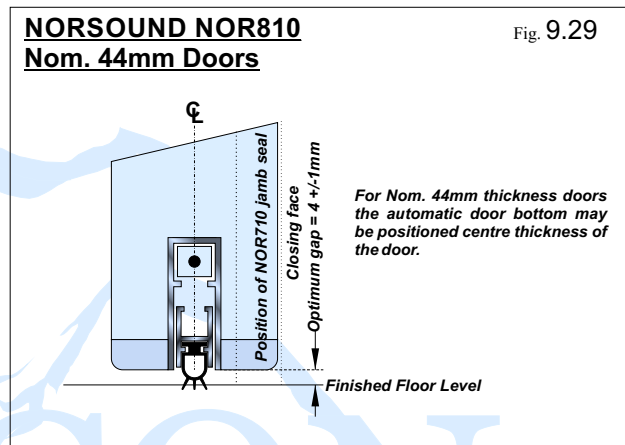
The NOR720 perimeter seal application is illustrated below:



Threshold sealing Norsound 810, 810T, 810S, 815, 850, 855, & 720:

Norsound provide for a number of threshold sealing options including three types of automatic door bottoms, door shoes, threshold strips and a stepped threshold plate with seal that has been successfully tested to provide for in excess of 95% sealing efficiency even when used with doorsets in the Rw.40dB+ class.

The following details illustrate various threshold sealing options:

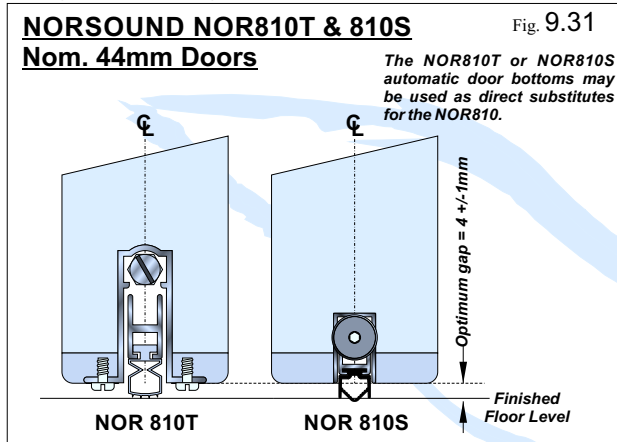


Acoustics

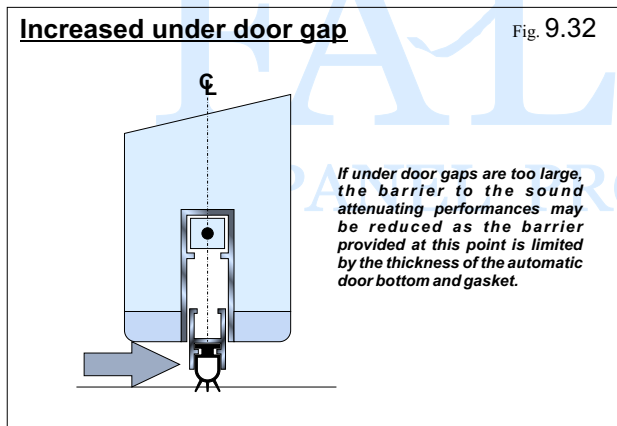
Threshold sealing contd.

The Norsound 810T and 810S automatic door bottoms have matched the performance of the 810 under test and provides users with an alternative method of fixing and a smaller seal carrier.

NOTE: The NOR810S automatic door bottom is 'Q' Mark approved when used with a dedicated intumescent gasket for FD90 & FD120 applications using Warm Springs door constructions.



NOTE: For sound attenuating applications it is necessary to keep the operating gaps to the minimum necessary to ensure correct operation. Particular care should be taken at the thresholds.



It is generally easier to control under door gaps where a threshold strip is used.

Whereas all of the Norsound 810 series automatic door bottoms will seal effectively onto carpet or hard floor finishes such as vinyl the use of a threshold strip is strongly recommended when using these devices with carpet or soft floor finishes.

NOTE: Use direct onto carpet may adversely effect durability.

When used with tiled floor finishes the grout between the tiles might provide a route for flanking.

NORSOUND 600 series threshold strips.

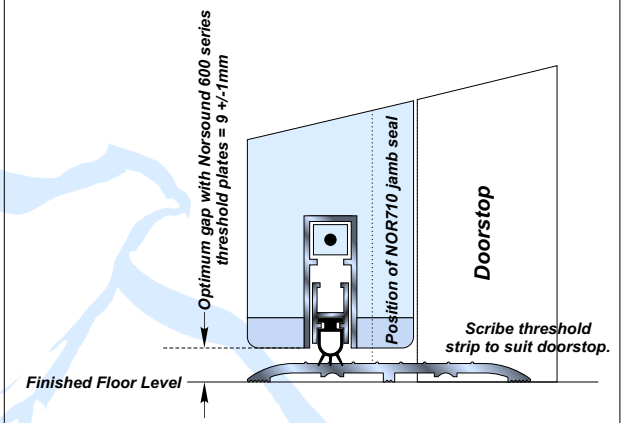
NORSOUND NOR600 series Threshold Strips.

Fig. 9.33

Whereas Norsound 810 series automatic door bottoms may be used without a threshold strip for locations with both soft (carpeted) and hard floor (vinyl) finishes, the use of a threshold strip is recommended, particularly in conjunction with soft floor finishes, to improve seal gasket durability.

Tests have been carried out using a range of NOR600 series threshold strips with no variation to performances under test. The threshold should be aligned with the opening face of the door and carefully scribed to suit the doorstop on the closing face.

Threshold strips may be drilled / countersunk and screw fixed or secured with Norsound threshold adhesive.



NORSOUND 650 stepped threshold with seal:

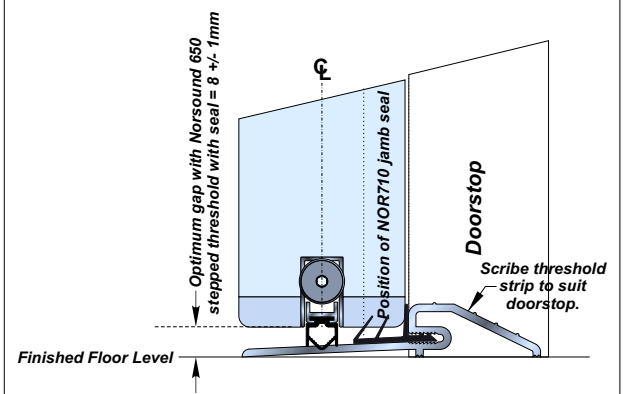
NORSOUND NOR650 stepped Threshold with Seal.

Fig. 9.34

The Norsound 650 stepped threshold with seal provides for optimum sound attenuating performances. The sealing gasket in the NOR650 aligns in section with the NOR710 perimeter seals to the head and the jambs thus considerably reducing flanking risks.

For doorsets required to provide for performances up to Rw.35dB, the NOR650 can be used without any additional threshold sealing. For doorsets in the Rw.35+dB class additional sealing may be required. Any of the bottom of door sealing options illustrated in this section may be used for this purpose. In this case use of the NOR810S is illustrated used with a nom. 44mm thickness door.

The dimensions of the NOR650 stepped threshold with seal are within the requirements described by reference to Building Regulations - (England & Wales) - Approved Document 'M' and BS8300 requirements.



Threshold sealing contd.

NORSOUND NOR850 Door Shoe Fig. 9.35
Threshold Sealing.

The Norsound 850 triple bladed door shoe provides for a simple yet effective method for threshold sealing without the use of mechanically operated devices.

Fixed bottom of door seals must essentially be used with a threshold strip (NOR625 illustrated below) to ensure that the seal gasket clears the floor during the swing of the door.

It is recommended that the NOR850 carrier is recessed into the bottom edge of to a depth that is necessary to provide for the gasket blades to overlap the threshold strip by Nom.2 +/- 0.5mm.

Comparative base test data demonstrates that the NOR850 door shoe can be used as a direct substitute threshold sealing option to the NOR810 series without detriment to acoustic performances.

Threshold sealing can also be effectively achieved without the use of automatic door bottoms.

The Norsound 850 door shoe is fitted to the bottom edge of the door. This multi bladed seal provides for excellent sound attenuating performances.

A simpler low cost alternative can be achieved by using 2No. Norsound 720 seals at the threshold.

A threshold strip (or the Norsound 650 stepped threshold with seal) should be used with any fixed seals that are fitted to the bottom edge of the door to ensure that the seal blades will clear the floor during the swing of the door.

NORSOUND Twin NOR720 Fig. 9.36
Threshold Sealing.

The versatile Norsound 720 triple bladed seal provides for a low cost yet effective threshold sealing system.

Fixed bottom of door seals must essentially be used with a threshold strip (NOR625 illustrated below) to ensure that the NOR720 seals clear the floor during the swing of the door.

More demanding tolerances apply when using the twin NOR720 threshold sealing system.

Comparative base test data demonstrates that the twin NOR720 option can be used as a direct substitute to the NOR810 series without detriment to acoustic performances.

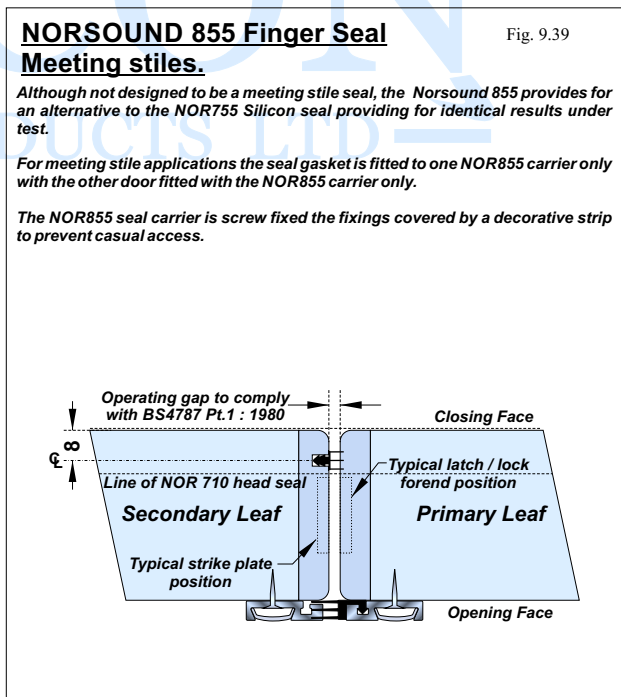
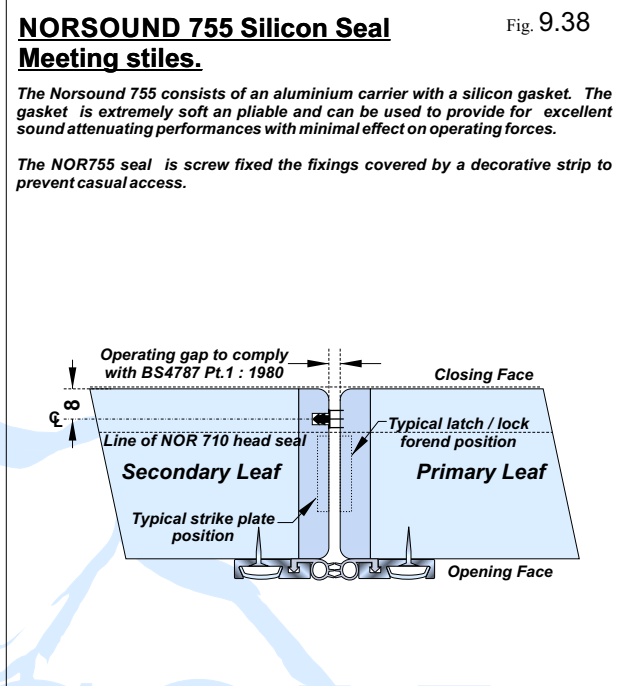
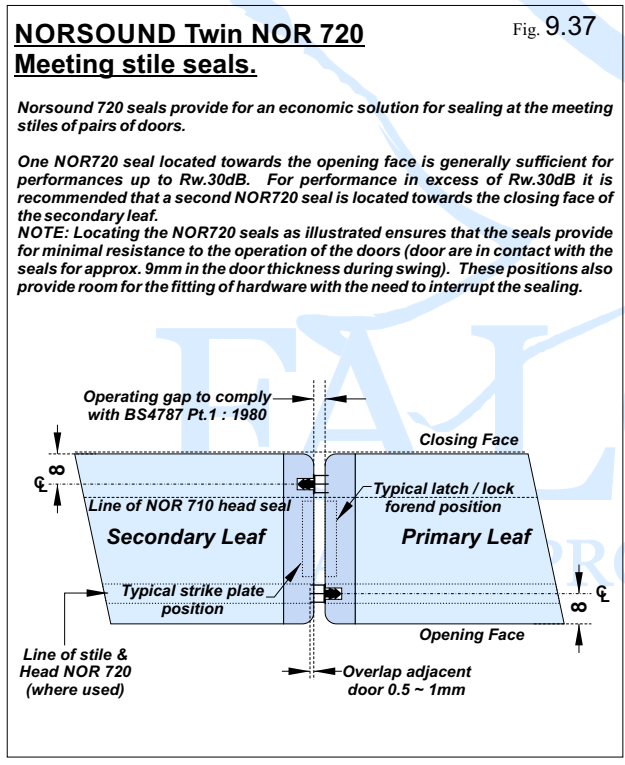
Acoustics

Meeting stile sealing:

Norsound provide for a number of meeting stile sealing options.

The fundamental problem with pairs of doors is that there is an additional gap to be sealed with a consequent increase of flanking risks. However, testing has demonstrated that performances achieved for single leaf doorsets can be maintained for pairs of doors.

Where possible, meeting stile seals should be positioned to align with jamb and head perimeter seals.

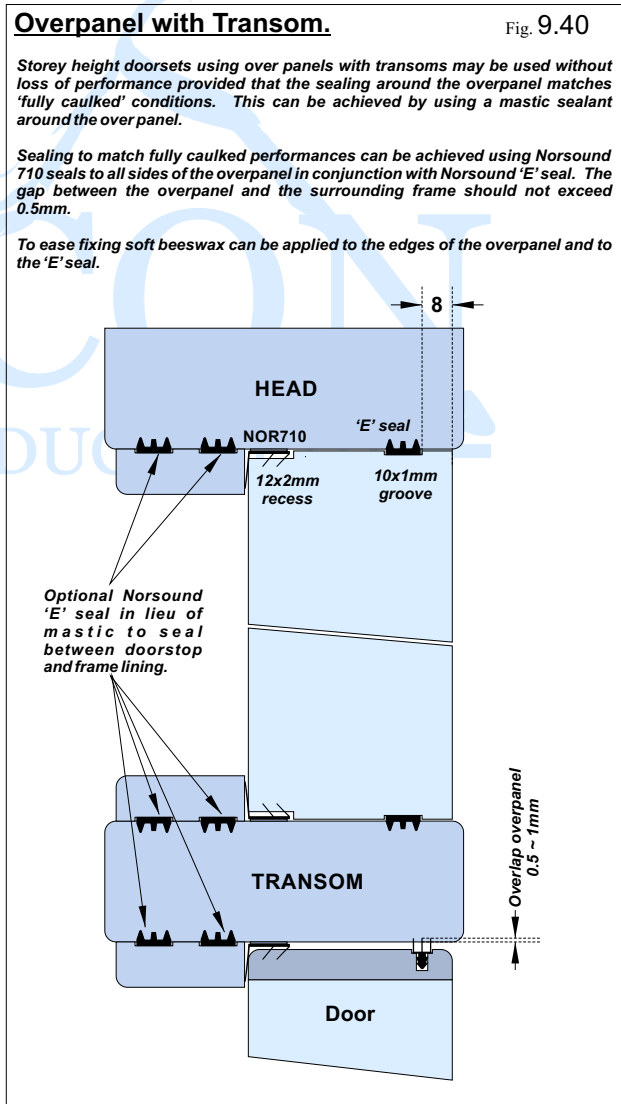


Storey Height doorsets:

There is limited base test evidence with regard to the influence on sound attenuating performances resulting from the use of storey height doorsets. However, for storey height doorsets with transoms, the overpanel is a fixed (*non operable*) element that can be completely sealed to the surrounding frame.

For the purpose of assessments it is anticipated that a transomed overpanel will provide for 'fully caulked' performances and that the transom will act as the head of the frame thus providing for the same performances as door height assemblies.

As fixed elements, the overpanels can be completely sealed at all frame interface junctions using a suitable mastic. However, the same results can be achieved using a dry sealing option using Norsound seals. This latter option is illustrated in the following details:



WARM  SPRINGS
DOOR CORE PRODUCTS

Section 10

10

Doorset Installation



Fire Door Installation:

Doorsets are not free standing products and they will not provide for any design performance until they have been competently installed into a suitable structure.

The primary purpose of any doorset is to provide a means for 'traffic' to pass from one side of a wall to the other. To achieve this objective the doorset should be easy to use. If the installed doorset is difficult to operate the users of the building may disable elements of the doorset on the basis of user convenience with consequential safety risks. e.g. by wedging fire doors in an open position.

It is vital that performance doorset are installed by competent tradesmen and It is strongly recommended that the installer is a member of a recognised quality assurance scheme, such as the 'Q' Mark Fire Door Installers scheme to ensure that best practice is used.

Installers should be familiar with the content of BS8214 : 2008 - Code of practice for fire door assemblies. Fur further guidance can be found by reference to the Architectural and Specialist Door Manufacturers (ASDMA) published Installation Guide.

This section provides for further guidance but does not include for details with regard to any particular brand or type of fixing or for any particular method of packing doorsets at fixing positions. Most installers have there preferred methods but these should generally comply with the following advice.

Warm Springs based doorsets are 'Q' Mark approved for installation into most structures that provide for the required level of fire performance including:

- Cast dense concrete
- Dense concrete blocks or brickwork.
- Lightweight concrete
- Lightweight aerated concrete.
- Timber stud partition.
- Steel stud partition.

NOTE 1: All structures must provide for secure fixings and in the case of Steel stud partitions, the jamb fixing studs should be generally be back filled with a suitable material (e.g. Hardwood) to receive fixings.

NOTE 2: Doorsets may be fixed to some propriety steel stud partitions where the particular partition system has been successfully tested to the required performance with doorsets of a similar construction. In this event fixings must comply with the partition suppliers (manufacturers) specifications.

Installation Fixings:

Fasteners used for the installation of doorsets must be in steel and of a size and type suitable for securing into the medium into which the doorset is to be installed.

Fixings must penetrate the structure to a minimum depth of 50mm.

NOTE: Where grounds are used, the fixings must pass through the grounds to a minimum depth of 50mm into the surrounding structure.

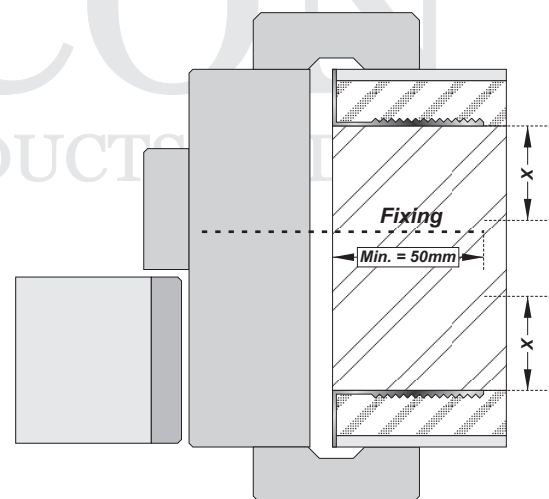
When installing doorsets into masonry walls it is recommended that fixings should be located at least 25mm from the face of the base block work or brick work wall.

Steel wood screws are approved for use with timber stud partitions and for use with steel stud partitions that incorporate a timber infill.

When fixing to propriety metal stud partitions without timber infill the fixings must be of the size and type approved by reference to the partition manufacturers fire test / assessment data.

Installation Fixings

Fig. 10.1



a/ Steel fixings to penetrate structure to a minimum depth of 50mm.

b/ For masonry walls it is recommended that fixings are located a minimum of 25mm (dim. x) from the face of the base block / brick structure.

c/ Fixings may be covered by use of the door stop, pellets or by the intumescent seals.

Fire Door Installation

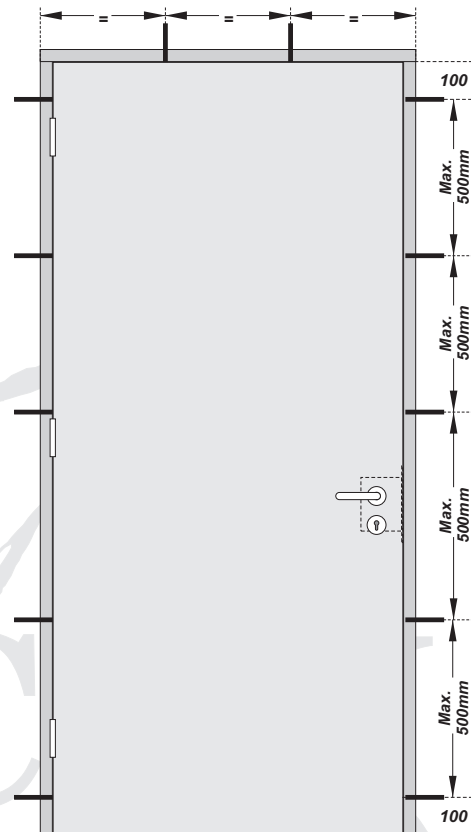
Installation Fixings contd.:

The positioning of installation fixings in height should be planned to avoid conflicts with hardware, sealing systems and other building elements.

- **A top fixing must be located Nom. 100mm from the underside of the frame head.**
- **A bottom fixing must be located Nom. 100mm from the bottom of the jamb.**
- **Intermediate fixings must be located at centres of not more than 500mm.**
- **The minimum number of fixings in height must be:**
 - a/ Doorset height up to 2000mm = 4No.
 - b/ Doorset height 2000 ~ 2500mm = 5No.
 - c/ Add 1No. fixing for each further 500mm increase in doorset height.
- **For storey height doorsets a top jamb fixing must be provided Nom. 100mm from the underside of the frame head with a further top fixing positioned Nom. 100mm from the under side of the transom rail (or bottom edge of the over panel if a flush overpanel design is used).**
- **A minimum 2No. equi-spaced frame head fixings must be provided. For doorset widths in excess of 1100mm the use of an additional fixing centre width of the doorset at the head position is recommended.**

Installation Fixings contd.:

Fig. 10.2



Fire Performance Walls and Partitions:

The wall and partition constructions shown in this section are for illustration purposes only.

There are numerous wall and partition constructions and Designers must ensure that the designs used for any particular project are suitable to receive fire doors to the required performance.

The wall / partition designs must also provide for the secure fixing of doorsets.

Locating Doorsets:

For 2nd. fix Fire Door installation, doorsets must be positioned centrally in the opening width with equal packing to both sides.

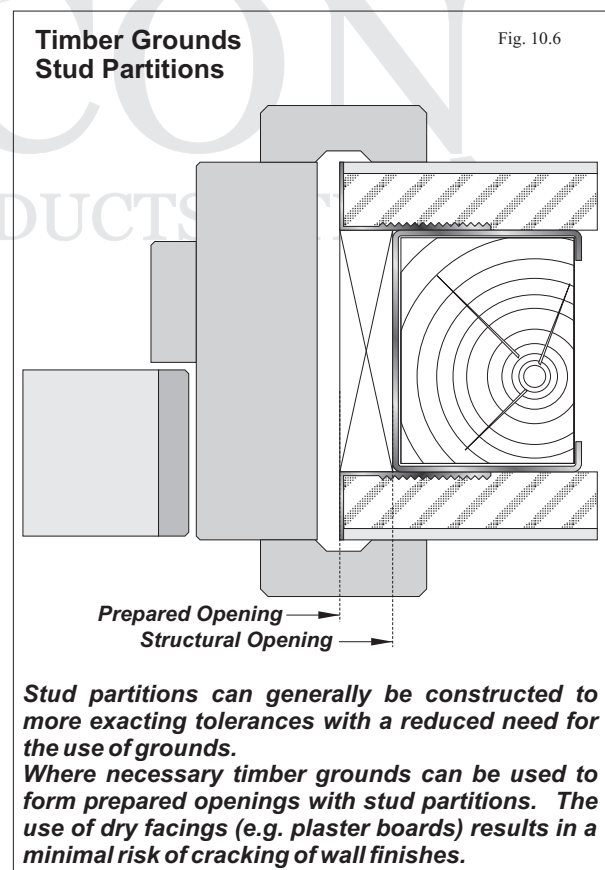
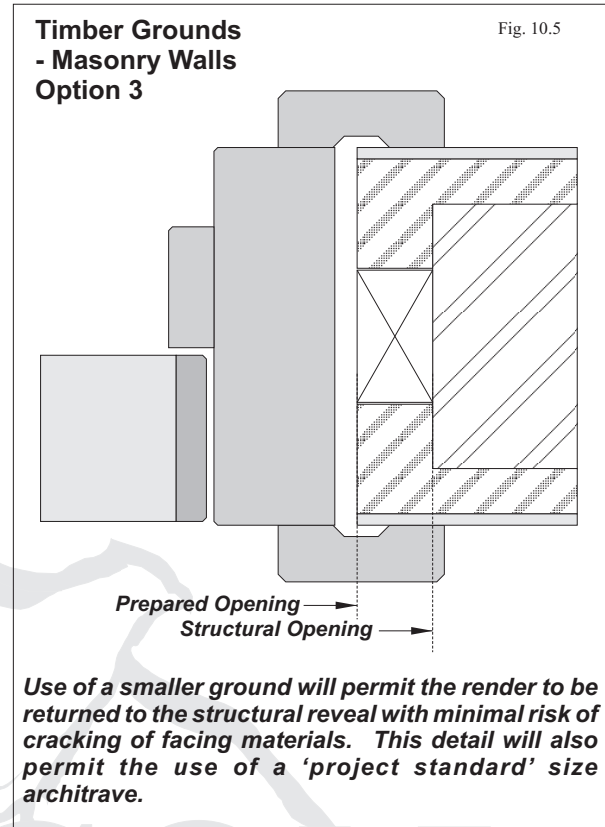
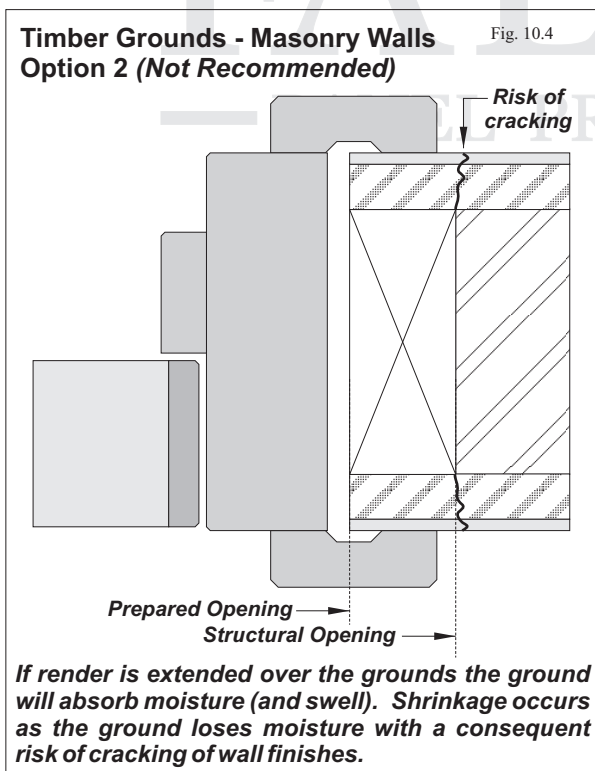
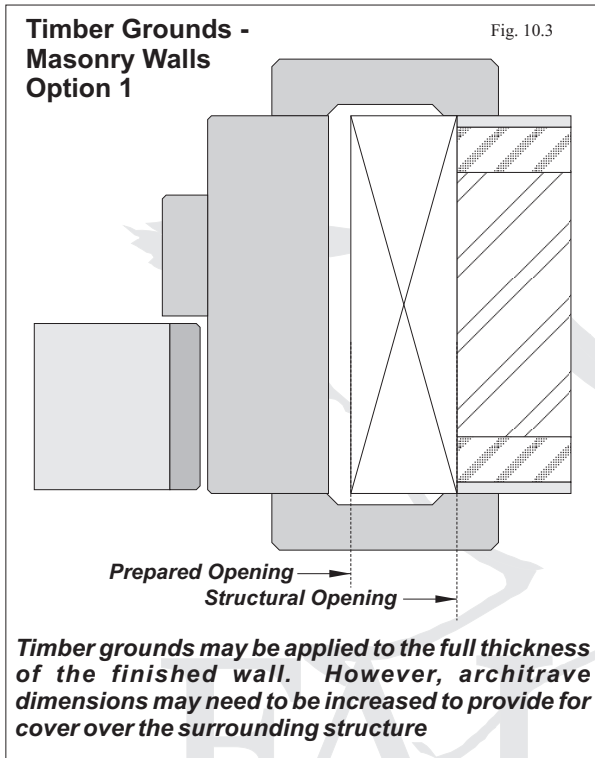
For single action doors it is recommended that doorsets are aligned with the wall / partition faces towards the opening face of the door. For double action doorsets doorsets should be aligned relative to a single selected face.

Doorsets must be installed plumb and square and the use of the door leaf as an installation template is recommended to reduce the need for subsequent adjustments.

Timber Grounds:

Timber grounds may be used to adjust opening dimensions to receive fire rated doorsets **up to FD60 (BS476 Pt.22)**.

The use of timber grounds is recommended to provide for 'prepared openings' to receive doorsets.

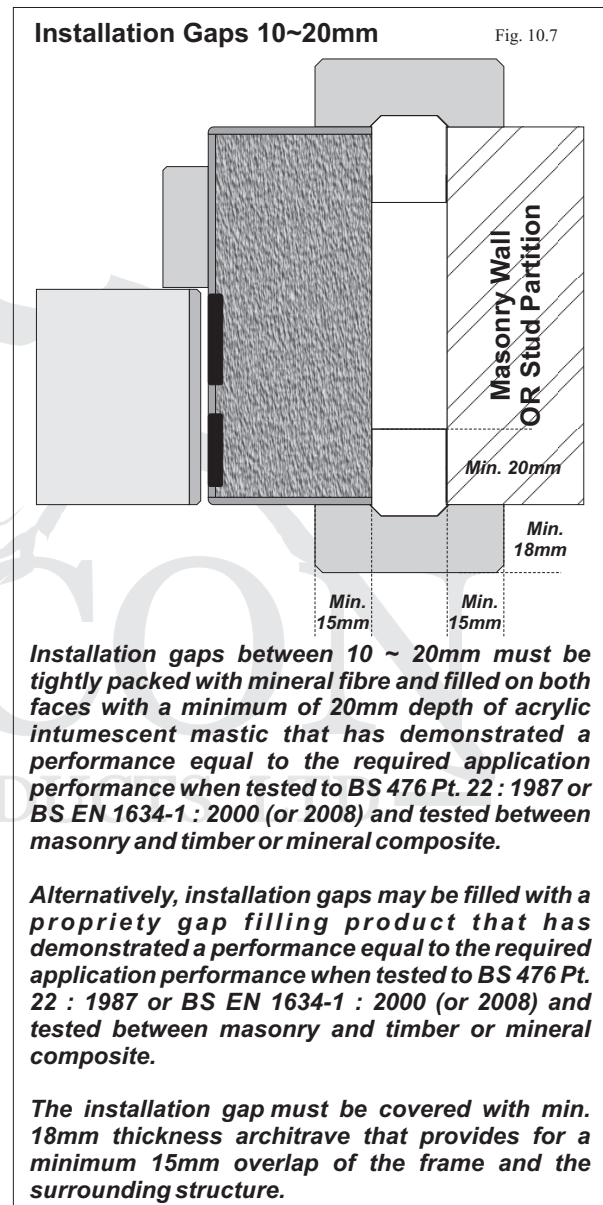
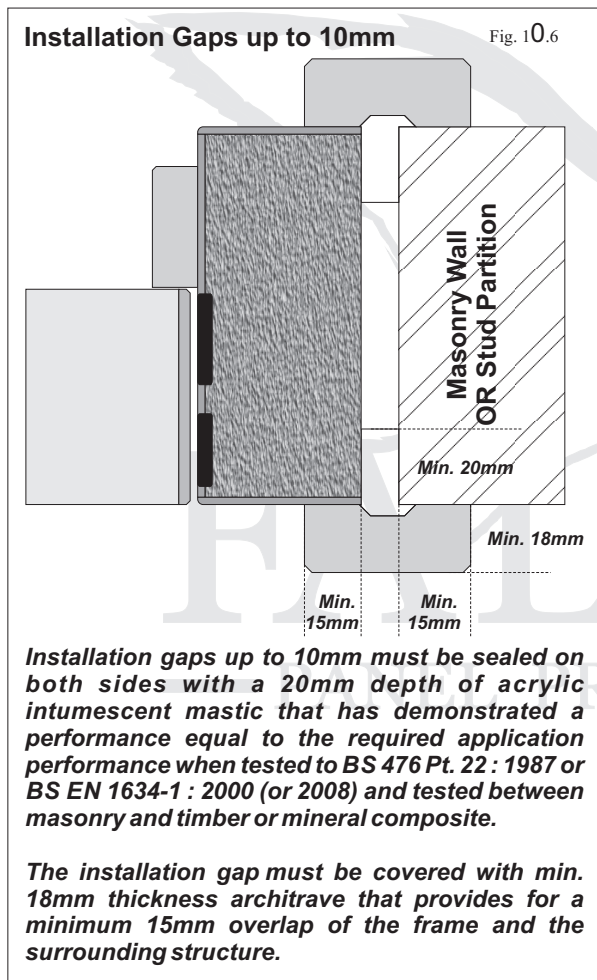


Fire Door Installation

Installation Gaps:

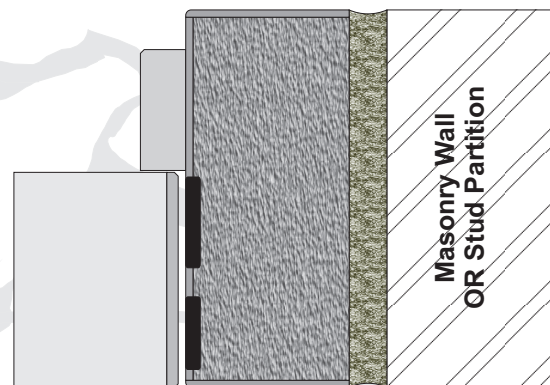
Advice: BS8214 : 2008 does not apply to FD90 & FD120 fire rated doorsets.

The following details illustrate 'Q' Mark approved methods for the treatment of installation gaps for Warm Springs material based doorsets for FD90 & FD120 applications.



Installation Gaps contd.:

**Designs without Architrave
or with reduced dimension Architrave:** Fig. 10.8



Frame designs either used without architrave or with reduced dimension architrave may be used provided that the installation gaps are suitably sealed with a proven linear gap seal that meets the following criteria:

1/ The sealing medium must have been tested at the required thickness and depth and must have demonstrated a performance equal to the required application performance when tested to BS 476 Pt. 22 : 1987 or BS EN 1634-1 : 2000 (or 2008) and tested between masonry and timber or mineral composite.

2/ The sealing medium must have been tested without architrave or any other capping material.

Fire Door Installation

Adjusting Door Leaves:

The extent to which door leaves need to be adjusted will be influenced by a number of factors including:

- *Provisions made at the time of manufacture.*
- *Environmental conditions affecting moisture contents during transport and storage.*
- *Quality of installation.*

When installed, the operating gaps between the door and the frame and at the meeting stiles of pairs should comply with BS4787 Pt.1 : 1980 when measured from the opening face of the door leaf.

It is recommended that the moisture content of the door leaf is checked before attempting to adjust door leaves.

NOTE: *Timber can grow or shrink across the grain, on average by 1% for each 4% variation in moisture content. Adjusting door leaves that have absorbed excessive moisture during transport, storage or during installation while wet trades are in attendance, may give rise to subsequent operating gap issues following the commissioning of the building heating and ventilation systems.*

The site adjustment of door leaves may be required to suit individual location requirements. The need for adjustments will be reduced if the doorsets are installed plumb and square and where the door leaf (rather than the surrounding structure) is used as the installation template.

The application of a 'leading edge' may be required for some locations.

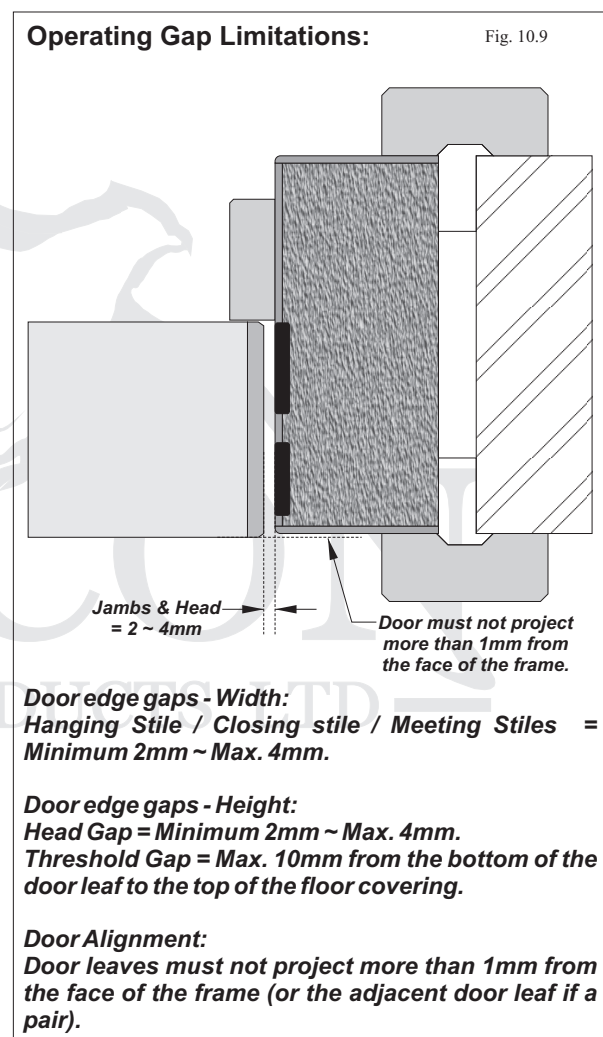
NOTE: *Some door manufacturers offer a 'leading edge' service as a factory applied optional extra. This will usually provide for a fixed chamfer of 2° applied to the closing stiles of doors.*

Warm Springs material based fire doors may be reduced on site by planing or sanding lippings. The extent of the reduction should be the minimum necessary to provide for the correct operation of the door but must not exceed 20% of the original lipping thickness.

For adjustments in widths lippings must be reduced equally on both vertical edges of the door.

For reductions in height, adjustments may be limited to the bottom edge only unless otherwise required by reference to specific project specifications.

Installed Doorset Operating gaps & Alignment.



‘Q’ Mark Approval:

To maintain ‘Q’ Mark approval, an installed fire rated doorset must satisfy the following requirements:

a/ Lippings must not be reduced by more than 20% of the original sectional thickness.

b/ Leading edges may be applied but the chamfer must not exceed 2°.

c/ Edge profiling (e.g. pencil rounds) to be Max. 1.5mm radius.

d/ The maximum permissible operating gaps must not exceed 4mm at all stiles and at the head and must not exceed 10mm at the threshold.

e/ The door leaf must not project more than 1mm from the face of the adjacent door leaf (if a pair) or the frame lining (before the application of architrave).

f/ The packing of installation gaps must comply with approved details illustrated in *Section 10 - Fire Door Installation*.

g/ Frame materials and sectional details must comply with the requirements of *Section 3 - Frames*.

h/ Fire doors must be lipped to comply with approved details described by reference to *Section 3 - Lippings & Facings*.

j/ Door facings must comply with details described by reference to *Section 2 - Door Construction*.

k/ Intumescent seals must be of the size and type suitable for the particular doorset design by reference to *Section 4 - Fire Door Applications*.

m/ Intumescent seals must be located as described by reference to *Section 5 - Intumescent Sealing*.

n/ Glazing in fire doors must comply with details described by reference to *Section 7 - Glass & Glazing*, including glass type, glazed area and intumescent glazing / beading system.

p/ Hardware used with fire rated doorsets must comply with details provided by reference to *Section 8 - Hardware*, including all intumescent gaskets, sealing and the like.

It would be an impossible task to attempt to anticipate every possible doorset design or design variant.

The content of this manual will cover most application requirements.

Where particular project designs require applications that fall outside of the scope of this manual it may be possible to provide for a ‘Project Assessment’ based upon specific details.

Requests for ‘Project Assessments’ under the ‘Q’ Mark scheme may be forwarded by any ‘Q’ Mark member to

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Fire Door
Manufacture



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