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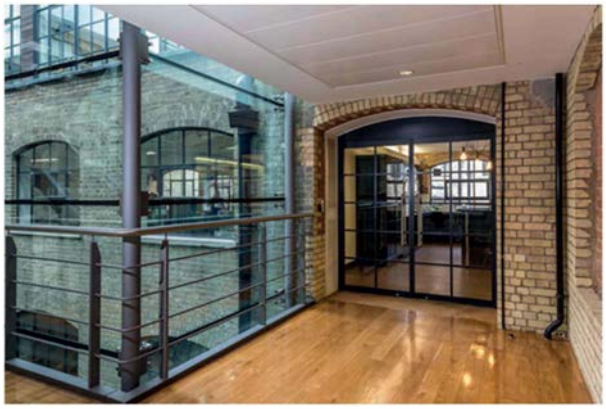
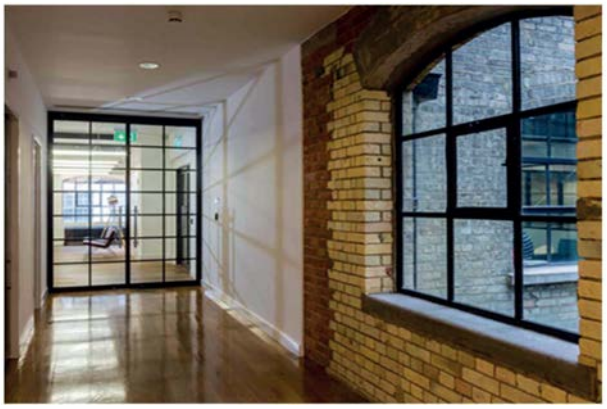
CPD GUIDE: Glass Fire Doors





THE PYROSTYLE FAMILY

FIRE RATED DOORS & SCREENS

CPD Guide: Glass Fire Doors

This CPD covers the design options for glass fire doors and screens. Timber fire doors are not designed to be appealing to the eye - their purpose is simply fire safety. Glass fire doors fulfil the same purpose whilst enhancing the built environment and allowing light in. Although in most locations there is no need to choose between fire safety and architectural appeal, there are still many design factors to consider for the installation to go in on time, on budget and in compliance with fire safety guidelines and Building Regulations as well as providing security, accessibility and longevity.

Contents

1. Specification, Design and Detailing

THE ROLE OF A FIRE DOOR

A fire door has three key purposes:

1. **Fire Safety -** save lives & property by compartmentalising the building, restricting a fire & protecting escape routes.
2. **Security -** provide security for the occupants and property.
3. **Access -** facilitate everyday activity, allowing easy passage into and through the building.

A glazed fire door also enhances the prestige impression of a building and adds extra light and openness. Glass fire doors can be installed in most of the same locations as any other fire door. However, they may not be appropriate in areas where they may be subjected to high levels of abuse, such as being hit by vehicles or trolleys etc. For example, industrial areas, certain basements, loading bays etc.

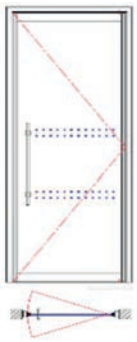
A poorly maintained glass fire door will not only cost more over its life but will fail on its key purposes, inconveniencing employees and visitors whilst risking lives, property, security and the image of the company and building. A preventative maintenance contract for fire doors is not just a sensible economic choice, it's fundamental to the management of a successful facility and business. It is important at the design stage to consider the factors that might hinder or facilitate ongoing maintenance. For example, covering floor springs with the finished floor rather than metal cover plates will mean the floor will need to be lifted to service the floor springs.

DESIGN CONSIDERATIONS

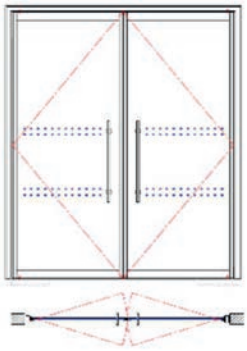
Door Configurations

There are broadly 6 door configurations, which are a single or a double door with or without fixed or framed sidelights.

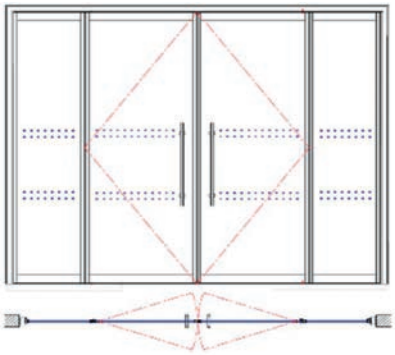
Type A – Single Door



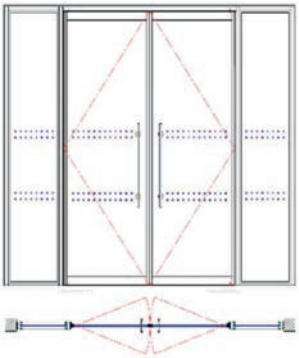
Type B – Pair of Doors



Type C – Pair of Doors with Fixed Sidelight Panels

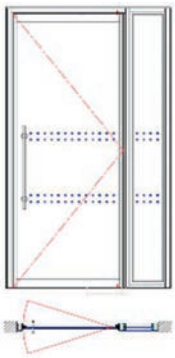


Type D – Pair of Doors with Framed Glazed Sidelights



Type E – Single Door with 2 Glazed Sidelights

Type F – Single Door with Glazed Sidelight



Installation Issues

To avoid extra costs and delays to a project it is important at the design stage to consider any factors that might hinder the installation of a fire door as well as its ongoing maintenance.

- **Doors are not designed with the building facilities in mind.** Doors are often designed slightly too large to be able to fit them into goods lifts. Sometimes less than 100mm makes a big difference. Glass fire doors usually require at least 4 men to lift them so carrying them up multiple floor levels in narrow stairwells is extremely difficult, time consuming and costly and risks damaging them.

- **Post-contract design revisions.** Revisions regularly cause delays to manufacture and installation. They are often due to uncertainty over the fire strategy of the building at the design stage. The fire strategy of the building should be thoroughly ascertained before a fire door manufacturer is first contacted for a quote. The fire strategy requirements should then be discussed with the fire door manufacturer to ensure the correct solution is quoted first time and, critically, that the solution doesn't change after it has been ordered. A change to the fire rating means making different glass and possibly a different frame design. If this happens after the contract is signed, then it will inevitably lead to delays and additional costs.

- **Inadequate site distribution:**
  - Hoist availability
  - Lift size
  - Distance and clear route from the point of unloading to each door location
- **Incorrect floor cavity size –** the floor springs sit on 'top hat' sections under the floor. We need the exact measurement from Structural Slab Level to Finished Floor Level. Changes to this dimension causes delays and extra costs.

- **Finished floor height not rigidly adhered to.** Floor contractors are often not made aware of how small the tolerances are for the gaps around fire doors, nor that the size of a metal-framed door can't be changed as easily as it can with a timber door. Often the finished floor is installed after the fire doors. Pyrostyle fire doors need a gap of 3-7mm at the top and 7-10mm at the threshold. So, the tolerance for error is a matter of a few mm. The finished floor must go in at the correct height or the doors will scrape. The only remedy is then to lower the floor (e.g. by scabbling concrete or polishing marble) or replace the doors – both at a significant cost and delay to the project.

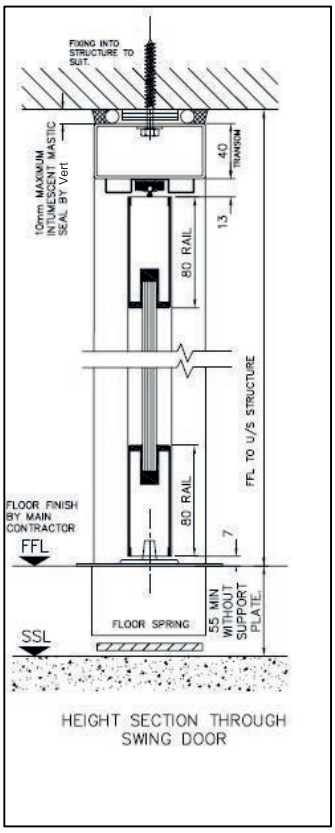
- **Wall material for fixing.** If a suitable solid fixing is not available then the wall needs to be changed e.g. dry wall removed, timber added then dry wall replaced. This can be avoided at the design stage.

Floor and Ceiling Fixings

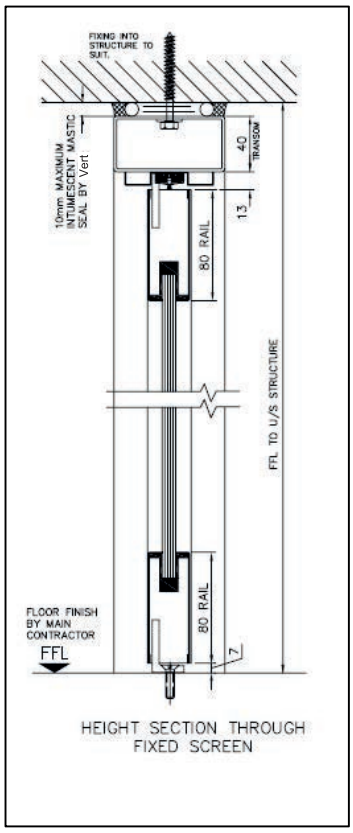
The following drawings show the sections through a swing door using a floor spring and top pivot (as opposed to hinges) and also a fixed screen.

Some important things to point out here are:

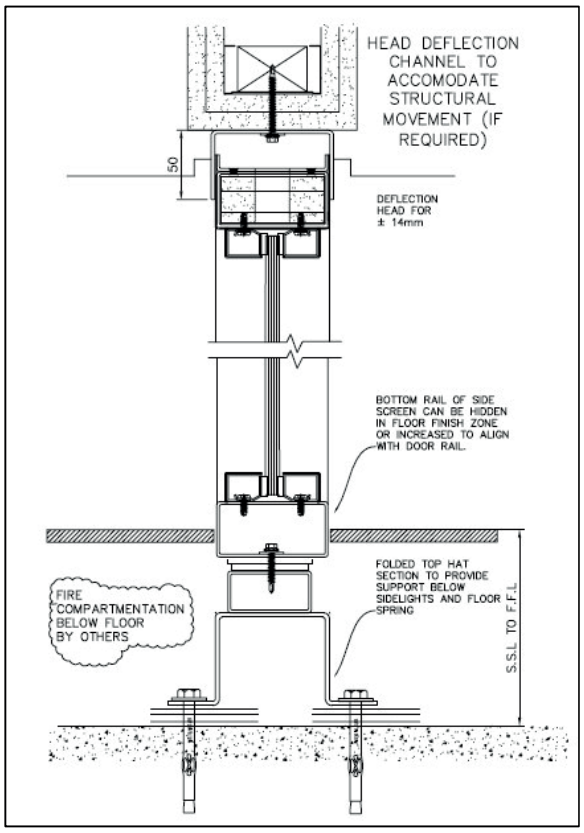
1. The floor spring takes all the weight of the door and it is supported by a top hat section, which must be installed on a flat, solid slab.
2. It is critical to know the exact measurement from Structural Slab Level to Finished Floor Level.
3. Establish who is responsible for the fire compartmentation under the floor.
4. A head deflection channel can be provided to accommodate structural movement.



HEIGHT SECTION THROUGH SWING DOOR



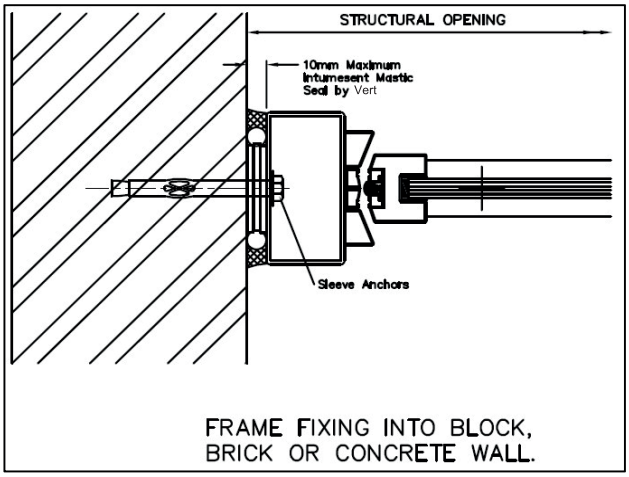
HEIGHT SECTION THROUGH FIXED SCREEN



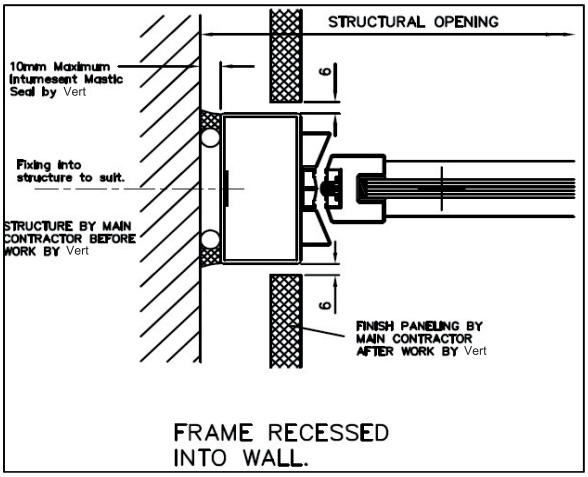
Wall Fixings

It's critical to consider what material the door frame is going to fix in to and how this will be achieved. This is often a factor that is overlooked at the building design stage, which can cause major issues for everyone at the point of installation. For example, it is not uncommon for a building contractor to have to remove newly installed plasterboard and refit it with suitable timber behind, to provide a suitable solid fixing point.

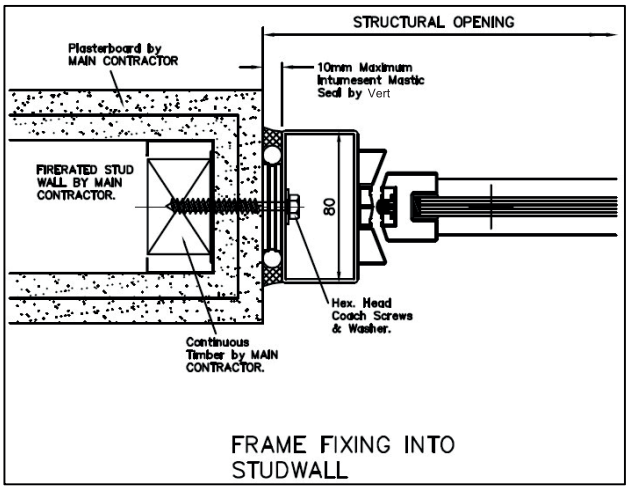
Here you can see 4 typical fixing types:

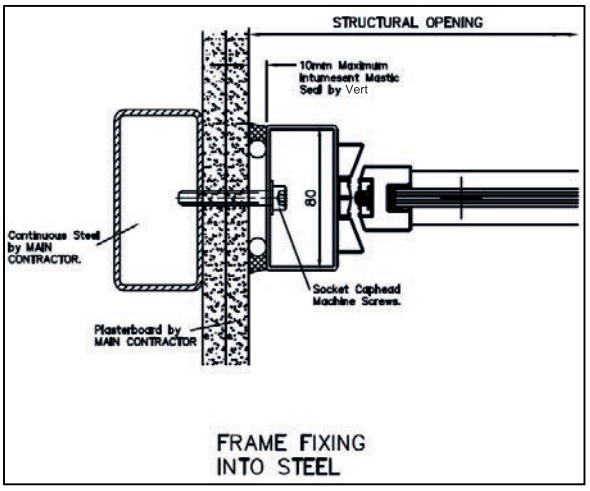


FRAME FIXING INTO BLOCK, BRICK OR CONCRETE WALL.



FRAME RECESSED INTO WALL.





Component Selection

Every component affects the fire performance, appearance, functionality and security of a door.

- **Frames:** the rigidity of the door stiles is important as fire glass is very heavy. This makes a noticeable difference to the 'whip' of the door i.e. the quality feel of the operation and the surety of the close. A cheap lightweight frame will flex and bow, providing less support for the glass.
- **Glass type:** critical to the fire strategy of the building - discuss later.
- **Handles:** choice limited by glass type.
- **Surface Finish:** range of options available - more limited for fire doors than standard doors.

- **Manifestations:** need to be applied to the fire attack side of the glass.

The glass Kitemark will affect the appearance of the door and, unless specified, some manufacturers may not be consistent about its positioning. For example, on some doors it may be top left and on others it may be bottom right.

Door Operators:

- **Floor Springs and Top Pivots** (discreet and with the option of being double action).
- **OR Hinges with door closers** (basic, less attractive and single action only)**.**

Double-action doors can be more convenient but can have issues for security as drafts can lead to certain lock types with less tolerance not always engaging.

Physical Access Control Components:

- **Standard Maglock** (for single action doors)
- **Electromagnetic shearlock: same as a** maglock but concealed and double action. A small contact magnet tells the lock when the leaves are closed and then the main magnet engages. Vulnerable to security breaches as there is a limit to the force they can withstand.
- **Solenoid drop bolt:** concealed & Double action. No longer advisable on fire escape. Solenoid drop bolts are discreet but have little tolerance for misaligned doors, which can be caused by through-drafts.
- **"V-Lock"** – concealed/Double action, safe for escape doors (fail safe under pressure).

Less Visible Components:

- Fire Rope
- Fire Sealants
- Intumescent Strips
- Fire and Smoke Seals

Maintenance Considerations

The Regulatory Reform (Fire Safety) Order 2005 applies to all buildings other than domestic housing, and replaces 118 pieces of previous fire legislation, including the old fire certificate. The law now shifts responsibility from the fire authorities for fire safety to whoever has day-to-day control of premises. Each business must appoint a 'Responsible Person', whether it be the owner, manager, facilities manager or an expert consultant to manage the fire risk to the building, including those using the premises and its immediate surroundings.

All stakeholders bear some responsibility for the fire integrity of the building and the safety of the fire escape route. Everyone in the building has a responsibility to report any fire or safety risk such as damage to fire doors.

Although the owner or landlord has responsibility to ensure a safe fire escape route for the entire building they often assign responsibility to tenants for maintenance of the fire doors in their demise - including fire doors on the fire escape route! However, staircases often pass fire doors at the boundary of each tenant's demise on each level.

If tenants are held entirely responsible for maintaining the fire doors at the entrance to their demise, then there is a significant risk that the quality of this will vary throughout the building. If a tenant doesn't properly maintain their fire doors this could affect the fire escape route for other tenants. Just one poorly maintained fire door could be the weak link affecting the safety of the entire building. Fire doors are designed to hold back the fire for a specific amount of time to give everyone enough time to exit. Poor maintenance could reduce this time.

Therefore, to ensure the overall safety of the entire building, it is advisable that a single party such as the owner or landlord takes on responsibility for a maintenance agreement that covers regular inspections of all fire doors (generally 6-monthly). The cost to rectify any reported damage or adjustments can then be passed to individual tenants.

Basic Fire Door Inspections – What to Look For

Fire and Smoke Seals

- Are the seals free from damage?
- If combined fire and smoke seals, are the fins or brushes free from damage?
- Are the seals continuous around the door leaf's perimeter?

Permissible Gaps

- **Frame to door leaf** at the sides and the top should be 6mm.
- **Threshold gap** should be 10mm for a Fire Door or 3-4mm for a Fire and Smoke Door.

You should always check manufacturers' instructions and evidence regarding gap sizes. For Pyrostyle fire doors you should allow 3-4mm at the sides, 3-7mm at the top and 7-10mm at the threshold.

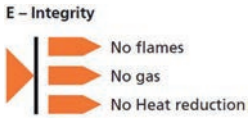
Door Leaf and Frame

- SMALL gaps should be filled with fire-rated material.
- Is the door frame firmly attached to the wall?
- Does the door close evenly into the frame and swing freely, without binding?
- If glass has been replaced incorrectly the certificate will be void.

FIRE-RATED GLASS TYPES

In 2001, the UK adopted the Euro Norm BS EN1363 Fire Testing Standards and all fire glass manufacturers should test their glass to these levels to comply with CE Marking.

Methods of Manufacture

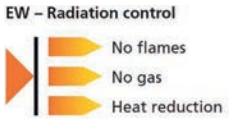


Provides a physical barrier against flames, hot toxic gases and smoke

Integrity Glass has 3 methods of manufacture:

1. **Georgian Wired Glass** is where float glass has wire embedded into it, whilst the glass is in a molten state. 6-7mm thick depending upon the manufacturer.
2. **Modified Toughened** is where a toughening (or tempering) process on a single pane of glass strengthens the glass. 5-12mm thick.
3. **Laminated** is where 2 or more layers of glass are bonded together. 7-13mm thick.

Toughened glass is made to order as it cannot be cut once put through the process. The other 2 are made in sheet form and cut to size

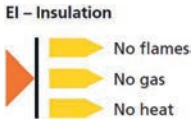


Control of the transmission of radiated heat below a specific level

Radiant Heat Control Glass has 3 methods of manufacture:

1. **Coated Modified Toughened** where a special coating is applied to the outer layer of the toughened glass to reflect some of the heat and in turn reduce the heat transferred through the glass.
2. **Laminated** is using 2 or more layers of glass with a resin or intumescent layer. 7mm-20mm depending on the manufacturer.
3. **Gel Filled** is using 2 or more layers of glass with a fire-resistant gel. 13mm-20mm thick.

Toughened glass and Gel Filled glass are both made to order as they cannot be cut once put through the process. Laminated is made in sheet form and cut to size.



Highest performance limitation of surface temperature on the unexposed side

Integrity and Full Insulated Glass has 2 methods of manufacture:

1. **Laminated** has multiple layers of glass and silicate. 15mm-50mm thick depending upon the manufacturer. There are 2 versions - internal use or external use (or for use within 2.5 metres of direct sunlight). This is due to the silicate layer being reactive to UV light and to overcome this a PVB layer (Polyvinyl Butyl), which prevents UV reaction, forms 1 of the interlayers within the external glass version.
2. **Gel Filled** is using 2 or more panes of either float or toughened glass and a clear fire-resisting gel interlayer. A spacer is installed around the perimeter edge of the glass with an edge seal capping to prevent leakage of the gel. 18mm-55mm thick. This glass is UV stable and doesn't have an internal/external type.

The Gel Filled glass is made to order as it can't be cut once put through the process. Generally, the thicker the glass the longer the performance of the glass i.e. 30/60/90 minutes and so on.

Fire Door Ratings

These ratings are for the entire doorset as a complete unit, as set out in BS EN 16034:2014. This includes the frame and the glass, which may have their own individual component ratings. The glass classification is dictated by BS EN 13501-2. It is worth noting that the fire rating is not specified in the Kitemark on the glass.

Just the metal frames on their own can go up to EI 120 (Integrity and Insulation for 2 hours). However, the weight of the frames combined with the glass limits the rating that can be achieved.

Building Regulations and Fire Strategy will determine the glass types required and where they are needed. We and other manufacturers can help with advice.

Intumescent & Smoke Seals

Intumescent fire seals save lives and property by expanding in the event of a fire to seal off the gap between the door and the frame, preventing the spread of fire and cold or hot smoke. Seals must be tested to BS 476: Pt 22 or BS EN 1634-1:2014 with a separate test for smoke leakage under BS 476: Pt 31.1. Many doorsets now need to provide fire, smoke & acoustic containment.

It is important to consider maintenance at the design stage. Although beyond the design stage, it's also worth stating the importance of ensuring that any parts replaced on a fire door are equal to the original item that was tested as part of the complete door assembly. The best way to ensure this is for the original manufacturer to supply and fit them.

Intumescent seals should be fitted along the two vertical sections and the top edge, but not the threshold. Typically, they are fitted into a groove in the door leaf and/or the frame.

Impact Protection

EN12600 is the Standard for glass impact protection and the rating has a 3-digit format. For example**,** 1B1, 2B2 or 3B3**.**

The first digit (a number) is the height at which the weight was dropped from when the glass passed the impact test. It is measured at three heights: 3 = 190mm, 2 = 450mm, 1 = 1200mm

The second digit (a letter) signifies how the glass breaks when it eventually breaks: A = as annealed glass, B = as laminated glass, C = as toughened glass

The third digit (a number again) indicates the height at which the glass does not break.

- For annealed and laminated glasses this will always be the same as the first number.
- Toughened glass is deemed to have passed the test having shattered into small particles.

Batch testing is required for CE Marking to ensure all products meet the required standard.

Acoustic Properties

Acoustic properties of fire glass are very good, reaching as high as 47 decibels with fire glass on its own. With additional panes, laminated or in a unit construction, you can hugely improve sound reduction to over 50 decibels.

Good sound reduction and acoustic performance will of course help you meet the guidelines in Document E - Resistance to the Passage of Sound. An example of fire glass and sound reduction is Building Bulletin 93 (BB93), which was written to ensure educational buildings meet a minimum requirement for acoustics. Requirements such as BB93 are comfortably met with the use of fire glass.

2. Testing Certification

Two types of fire door Installation

1. **Door Assembly** - door leaf, frame, seals, glazing, closers, hinges, locks and other essential ironmongery and additional components supplied and fitted separately.

   If you install separate fire-rated components together as a Door Assembly but don't test everything together as a complete unit then you won't know how that door will perform in a fire as the components may affect each other.

2. **Doorset** - frame, a pre-hung door leaf and essential ironmongery, all matched and pre-assembled in the factory. Critically a doorset is tested and certified with all the components together as a complete system.

Doors Should be Tested and Certified

Any single component can greatly affect what will happen in a fire. Small differences in glazing apertures, intumescent strips, door frames and ironmongery may significantly affect the rating, which is why it is so important to opt for Doorsets, which have been independently tested as complete units.

It is important to ensure a doorset has been installed in accordance with the manufacturers' instructions, so you know it will behave the same as it did in the certification tests. Test evidence used to substantiate the fire resistance rating applies to the complete doorset, which must be installed as it was tested. Proof of performance is necessary to comply with building regulations. A test certificate indicates the complete installation can withhold fire for a defined period.

3. Standards and Legislation

BUILDING REGULATIONS

The Building Act 1984 – a broad framework under which Building Regulations and secondary legislation are made.

Building Regulations – the minimum legal requirements for design, construction and alterations to buildings.

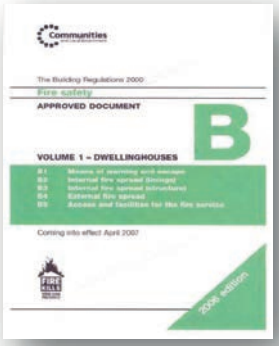
The principal pieces of Statutory legislation that affect specification and design works are **The Building Regulations** and Construction (Design & Management) Regulations – or **CDM.**

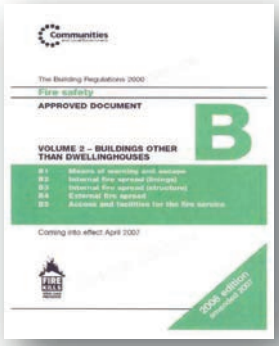
There are 23 **Approved Documents** that provide guidance that can be followed to ensure compliance with the Building Regulations. They detail the performance expected of materials and building work and give practical examples and solutions to achieve compliance in common building situations.

Performance	Notes	England & Wales: Approved Documents	Scotland: Technical Handbook (sections)	Northern Ireland: Technical Booklets
Fire Safety	• Where a fire door is required • Expected fire resistance period • Specific requirements e.g. smoke seals & signage	B	2	E
Acoustics	Minimum sound resistance performance of the door	E	5	G
Ventilation	Minimum air transfer gap required under the door	F	3	K
Thermal	Minimum thermal performance of the door if required	L	6	F
Accessibility	Access to buildings for disabled people, including door width, hardware locations, opening forces, provision of vision panels and light reflectance values required	M	3	R
Safety Glazing	Where safety glass is required	N	4	V

Although there is no obligation to adopt any solution contained in an approved document, you do still need to make sure you comply with the overriding Building Regulations one way or another.

APPROVED DOCUMENT B





Approved Document B gives guidelines for complying with Fire Safety regulations to assist specifiers, architects and building contractors in England and Wales.

This document is the building regulations for where and at which levels of fire resistance product should be used throughout a building, be it for houses (Volume 1) or commercial buildings (Volume 2). It only provides a guideline and is open to interpretation in a lot or areas.

FACTORS AFFECTING FIRE STRATEGY

The function of a building will impact greatly on what is required for fire safety.

2 examples that may have very different fire strategies would be:

- An industrial site with plant and machinery moving about, making escape routes potentially hazardous. Occupants are more likely to be regular employees who have had training and been made aware of the fire escape strategy.
- A healthcare site is likely to have many infrequent occupants who have had no training and no awareness of the fire strategy beyond following signs.

Other factors that will affect the fire strategy would be the height of the building and the depth of the basement. Also, if there are water sprinklers operating in a fire, this can influence how fire-resistant glass will perform in that event. The glass manufacturer will be able to advise on how the rating is affected by sprinklers.

CODES OF PRACTICE AND BRITISH STANDARDS

- **BS EN 9999 -** *Fire safety in the design, management and use of buildings.*
  This gives guidance for fire safety in buildings. It covers the design and specification stages right through to the maintenance of fire doors.
- **BS EN 16034 -** *Pedestrian doorsets – Fire resisting and/or smoke control characteristics.*
  This covers complete Doorsets.
  BS EN 1634 - the test standard under BS EN 16034, detailing fire resistance and smoke control tests for doors.
  Part 1: *Fire resistance test for door and shutter assemblies and openable windows.*
  Part 3: *Smoke control test for door and shutter assemblies.*
- **BS 476 -** *Fire tests on building materials and structures*
  Part 22: *Method for determination of the fire resistance of non-loadbearing elements of construc*tion
  16034 doesn't cover glazed side panels or over panels if they are not an integral part of a doorset. BS 476 covers separate glazed panels as "non-loadbearing elements of construction".
- **EN 13501-2 -** defines the classifications of Fire Glass: Integrity (E), Integrity & Radiation (EW), Integrity and Full Insulation (EI). Whereas some European countries see Radiant Heat Control Glass (EW) as a minimum standard for fire protection glass, as yet the UK Building Regulations don't acknowledge EW glass, although for relevant applications it is acceptable. In some European countries the use of Integrity-only (E) glass types is restricted.
- **BS EN1363 –** the common Testing Standard for fire glass, adopted by the UK in 2001. All fire glass manufacturers should test their glass to these levels to comply with CE Marking.

- **BS 8214 -** Covers timber-based fire Door Assemblies or Door Leaves fitted into any frame material.
- **BS EN 1154** isn't aimed specifically at fire doors but it states the minimum closing force for fire doors is 18Nm.

CDM – The Role of the Designer

CDM is the main set of regulations for managing the health, safety and welfare of all construction projects.

It applies to all building and construction work including new build, demolition, refurbishment, extensions, conversions, repair and maintenance.

HSE Construction (Design & Management) Regulations 2007

CDM 2015


STATUTORY INSTRUMENTS

2007 No. 320

HEALTH AND SAFETY

The Construction (Design and Management) Regulations 2007

It is important to note that everyone has responsibilities under the CDM.

- **Clients -** e.g. other duty holders are appointed, welfare facilities are provided
- **Principal Designers -** e.g. identify, eliminate or control foreseeable risks, prepare and provide relevant information to other duty holders
- **Designers -** e.g. eliminate, reduce or control foreseeable risks that may arise during construction and the maintenance and use of a building once it is built
- **Principal Contractors -** e.g. prepare construction phase plan, organise co-operation between contractors and co-ordinate their work, provide site inductions, prevent unauthorised access
- **Contractors -** e.g. plan, manage and monitor construction work under their control so that it is carried out without risks to health and safety, co-ordinate activities with others
- **Workers -** e.g. take care of their own health and safety and that of others who may be affected by their actions, report H&S issues, co-operate with their employer and other duty holders

BREEAM

BREEAM is the World's most widely used environmental assessment method for buildings. It is a sustainability assessment method for master planning projects, infrastructure and buildings and it assesses the building's performance and rates it under a selection of categories or lifecycle stages from Energy Consumption to Building Materials. By specifying the best glass combination for the project, you can gain credits in some of the main BREEAM categories.

For example, choosing glazed instead of timber fire doors could improve general Health & Wellbeing in the building.

Glazed elements in a building with a high light transmission create the natural connection to the outside world meaning better working, learning and living environments.

REGULATION 38 OF THE BUILDING REGULATIONS - BUILDING HANDOVER REQUIREMENTS

Regulation 38 is often discussed and agreed on during the design process, but then not fully complied with in practice. Handing over the correct information about the certification of the fire door and components is extremely important for future inspection & maintenance. However, when it comes to fire doors in a building, the guidance is not specific about the information that should be provided.

Many design teams and clients will appoint a fire safety engineer to ensure that a development project complies with guidance and regulations. The fire safety strategy given to the 'Responsible Person' at project completion should be correct and accurately reflect the fire safety precautions in the building, so they can conduct a Fire Risk Assessment and so the building can be operated and managed correctly.

Design changes must be reflected in the fire safety strategy

If the building design changes before the completion of the project, the fire safety strategy must be updated. The building's Fire Risk Assessment may be challenged at any time by the approving authorities for not being suitable or sufficient to meet the requirements of the Regulatory Reform (Fire Safety) Order 2005. There is then the very real possibility that members of the design team will be held responsible for not communicating the correct fire safety information on completion of the project, as required by Regulation 38 of the Building Regulations.

5. Bibliography

www.firesectorfederation.co.uk

www.pyroguard.eu

www.vetrotech.com

www.citb.co.uk

www.hse.gov.uk

www.bwfcertifire.org.uk

Codes of Practice:

BS EN 9999 - *Fire safety in the design, management and use of buildings.*

BS EN 16034 - *Pedestrian doorsets – Fire resisting and/or smoke control characteristics.*

BS EN 1634 - the test standard under BS EN 16034, detailing fire resistance and smoke control tests for doors.

BS 476 - *Fire tests on building materials and structures*

Part 22: *Method for determination of the fire resistance of non-loadbearing elements of construc*tion

EN 13501-2 - defines the classifications of Fire Glass.

BS EN1363 - the common Testing Standard for fire glass.

BS 8214

BS EN 1154