



D M Smith & B Gregson
Door and Hardware Federation

Steel fire doors

1 Types of system

Steel fire doors are widely used in shops, offices and prestigious highly visual, high-traffic areas such as shopping malls, airports and cinemas. With their flush faces, clean frame lines, architectural options and selection of factory finishes, they are increasingly a feature of today's construction market, as the demand grows for reliable fire performance characteristics, coupled with low maintenance costs.

Steel doors are normally manufactured in light gauge (1.2 or 1.5mm), zinc-coated steel sheet, primed for finishing on site, or factory finished to require less wet-trade work in the final stages towards handover. Very striking designs can be achieved using brushed or patterned stainless steels.

Steel doorsets are normally supplied in factory-assembled or knock-down form for site assembly, complete with all approved components. This ensures that, when installed correctly, they will meet the fire resisting performance stipulated.

Most of the fire door information available to local fire and building control officers relates to timber fire-resisting doors, so there is a need to understand the differences between timber and steel to ensure that architects, specifiers and end-users have a better understanding of the benefits of the products available.

Timber doors will shrink during a fire, since the moisture content of the timber is driven off and the heat erodes the timber. Generally, timber doors use intumescent strips around the perimeter of the door leaf, which expand in a fire to fill the gap left behind by the receding timber door.

With the exception of a few highly specialised door designs, a steel fire door performs differently and does not require intumescent strips. In a fire, a steel door expands rapidly to seal the gaps between the door leaf and frame. Absence of intumescent seals in steel fire doors is one of the queries most frequently raised by building control officers. In the rare event that a steel doorset requires intumescent strips it will be stated in the fire certification document. If the doorset does not need intumescent strips, this information will not be mentioned.



2 Types of product

Steel hinged door constructions vary from one manufacturer to the next, but generally they consist of a hollow cassette assembly with various infill materials placed inside to provide some other specified function, such as thermal or acoustic insulation, security, etc. They are often referred to as 'hollow metal doors'. There are many types of core available:

a) honeycomb

Other than in certain special locations, the Building Regulations in England and Wales do not require fire doors to be insulated. Industry-standard non-insulated, steel fire doors use a laminated honeycomb core that provides torsional rigidity and impact resistance. This type of door construction can produce doors with fire integrity ratings of up to 4 hours.

In a fire situation, the bonding agent softens, releasing the honeycomb, which gradually collapses to the bottom of the door, where it will eventually char away. The hollow cassette will be unaffected by this and remains stable for the duration of the fire. In addition, while it is not a requirement of the test standard [is this BS 476: Part 22?], honeycomb core steel fire doors can usually still be operated once they have cooled at the end of a fire test.

b) semi-rigid

These are usually mineral-wool cores in various densities to suit an acoustic or thermal requirement. The heavier density, lamella-cut mineral wool cores can make use of thin-gauge steel skins. However, some lower-density mineral wool cores require thicker door skins and vertical or horizontal stiffeners to compensate for the reduced rigidity of the infill material.

Because of this, the new EN fire test standards include pre-fire cycle testing to provide a 'shake-down' test on the core, since any settlement could affect the thermal insulation and fire-resisting properties of the doorset.

c) rigid

For enhanced insulation performance, cores such as vermiculite, gypsum or ceramic are used. Doors of this type can achieve fire integrity and insulation performances of up to 4 hours.

Frames

Frames can be single or double-rebate profiles, or purpose-made to suit the application providing test evidence is available. They are manufactured in

material gauges to suit the application and in-filled as required to match the insulation requirements of the door. Where frames require an infill to achieve the fire rating, this will be shown in the fire certification document.

Frames are not usually a problem with steel fire doors because the basic material is non-combustible. If adequately fixed to the supporting structure, they will remain stable almost indefinitely, providing they are not subject to any additional loading.

Steel fire doors can be installed in masonry, protected steel, or stud partition walling systems. They will generally behave better in steel stud partitions than comparable timber doorsets, since the steel studwork and the door move in a similar manner when subjected to fire. However, it is essential that the overall arrangement be considered, not just the doorset. Approval for installation in partitioning should be covered by the certification or assessment.

Ancillary items

In addition to the basic doorset, clients may specify the addition of ancillary items, such as vision panels and louvre units, but these items can have a significant effect on fire performance.

Vision panels and louvres used in fire doors must have the required fire performance. Also, to prove that the removal of the body material does not affect the behaviour of the door leaf, there must be test evidence stating that it has been tested with cut-outs in the locations these items are to be fitted.

Glass dimensions and position can affect the performance of other elements. For example, a large area of un-insulated glass directly beneath a door closer could cause heat build-up within the closer, prematurely igniting the hydraulic fluid.

Hardware

Door hardware is still regularly misunderstood and incorrectly specified. Specifiers may select steel doors for heavy-duty applications, while choosing lightweight latches that will not stand up to prolonged use and abuse. They may also select lightweight hinges that will not support the door weight, in conjunction with the cycling requirements of other items of hardware.

Only hardware listed in the evidence of performance should be installed, unless alternative types are covered by CERTIFIRE, the Loss Prevention Certification Board (LPCB) or other recognised approval schemes for installation of fire-resisting metal doorsets, or appropriate evidence of performance is available from the hardware manufacturer.

In particular, door closers must have fire certification relevant to the type of steel door being supplied. A closer that is approved for use on a timber fire door may not be acceptable on a steel fire door.

Metal door manufacturers typically provide their own architectural standard steel hinges as part of the fire-rated doorset, covered by the evidence of performance. Alternative hinges should not be installed unless covered by such evidence.



3 Design and installation

Steel doorsets are usually provided on a supply and install basis. Therefore, installers will be trained on the product, which will ensure its fire performance is not compromised by poor fitting. Where installation is to be carried out by purchasers' own installers, they should employ trained personnel with a prior knowledge of the type of doorset to be fitted.

The key to successful door specification is to:

- select fire doors produced by a member of the Door and Shutter Manufacturers' Association (DSMA) Metal Doorset Forum, with ISO 9001 quality certification and preferably CERTIFIRE or LPCB product certification

- discuss door requirements with the door manufacturer at an early stage to ensure that the products required are within the manufacturers' scope of fire certification (or that a formal fire assessment can be obtained from a recognised test house on completion, if the design is of an unusual nature)
- do not specify hardware for the door until its suitability has been discussed with the door manufacturer to ensure compatibility in terms of certification
- refer to the *Code of Practice for Fire Resisting Metal Doorsets*, published by the DSMA, which is a valuable reference document for all who specify or evaluate fire-resisting metal doors.

4 Inspection and maintenance

It is essential that fire-resisting doors be adequately maintained to ensure that they will continue to provide their prime function, which is to resist fire, save lives and protect property. The manufacturer will provide maintenance instructions for his product and any work should be carried out in accordance with these instructions, using authorised personnel who have a prior knowledge of the product.

5 Relevant standards and other documents

Evidence of performance should ideally be in the form of third-party product conformity certification issued through independent bodies, such as CERTIFIRE or LPCB, backed by audited manufacturing procedures to BS EN ISO 9001.

In the absence of such certification, fire-resisting doorsets should be covered, as a minimum, by an assessment report issued by a United Kingdom Accreditation Service-accredited test laboratory, which should support the claimed performance for the complete doorset as a combination of door, frame, glass, hardware and ancillary fittings. A fire test report alone is insufficient evidence.

Installation of fire-resisting steel doorsets should be by certified FIRAS or LPCB

installers, to ensure that the installation is in accordance with the manufacturer's instructions and certification procedures.

There are many standards applicable to fire doors, associated components and ironmongery, but from a fire performance point-of-view, specifiers must ensure that the doorset has test evidence to BS 476: Part 22: *Fire tests on building materials and structures. Methods for determination of the fire resistance of non-loadbearing elements of construction*: 1987, or the new European test standard, BS EN 1634: Part 1: *Fire resistance tests for door and shutter assemblies. Fire doors and shutters*: 2001.

6 Other issues

Steel doors are delivered to site as a complete doorset with leaf and frame components, all hardware plus any vision panels, louvres, etc, factory-fitted and ready for use. This allows the specifier the peace of mind of knowing that the supplier has checked that every component used on the steel door is suitable for use on that product and that it has been fitted to the product in the correct manner to achieve the fire performance required.

Steel fire doors should always carry a nameplate that includes the fire rating, the manufacturer's name, date of manufacture and a unique serial number for complete traceability.

Further information and a copy of the *Code of Practice for Fire Resisting Metal Doorsets* are available from the DSMA website: www.dsma.org.uk; tel: +44 (0)1827 52337.

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Published by *Fire Prevention & Fire Engineers Journal*
Bastille Court, 2 Paris Garden, London SE1 8ND