

# IFC ENGINEERING ASSESSMENT PRINCIPLES

## TECHNICAL NOTE 2: ORIENTATION OF STEEL FIRE DOORS

October 2018

**About us** | International Fire Consultants Ltd

**IFC are very proud of our reputation as one of the world's leading fire engineering solution providers; trusted by many of the world's most prestigious construction firms, architects and estate owners.**

Our holistic approach to fire safety ensures clients always receive bespoke best value advice and quality assurance for the lifetime of their projects. Indeed, we have lent our expertise to developments right across the built environment spectrum, from the necessities of residential structures, education and healthcare to the more iconic buildings of the past, such as historic palaces.

Our highly experienced Fire Engineers, Fire Safety Professionals, CAD/BIM Designers and Commercial Team work in partnership with our clients to deliver an independent and unique top-to-toe fire safety consultancy service.

Our expertise includes fire strategy, computational modelling, product engineering assessments, fire risk management, as well as the design of tailored passive and active fire safety systems. We ensure that your buildings not only comply with relevant legislation, but also provide a safe environment for the occupants and users in the most cost-effective manner, that does not compromise the fabric of the building or the architectural integrity of the designs.

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This technical note is issued to provide comment upon the guidance for fire doors in Approved Document B (ADB) of the Building Regulations England, which states that *"...the requirement is for test exposure from each side of the door separately"*. ADB refers to fire resistance testing in accordance with BS476: Part 22: 1987 or BS EN 1634-1: 2014.

Peter Jackman, the founder of International Fire Consultants Ltd (IFC), was lead author of **BS476: Part 22: 1987**, and he included the statement that *"doorsets and shutter assemblies shall be tested from both sides, i.e. two specimens, unless the doorset or shutter assembly, including the hardware, is entirely symmetrical, or unless the weakest direction can be clearly identified, or unless the doorset or shutter assembly is known to be exposed to a fully developed fire from one side only ..."*.



IFC has established principles, based upon extensive experience of testing steel doors for fire resistance in both directions of exposure. These principles define which orientation is 'the weakest direction' for steel doors.

When testing steel hinged door assemblies, it is the opinion of IFC that the weakest direction is that where specimens are installed with the leaf opening away from the furnace. Testing in this orientation is therefore incorporated into Engineering Assessments to cover doors opening in the opposite direction.

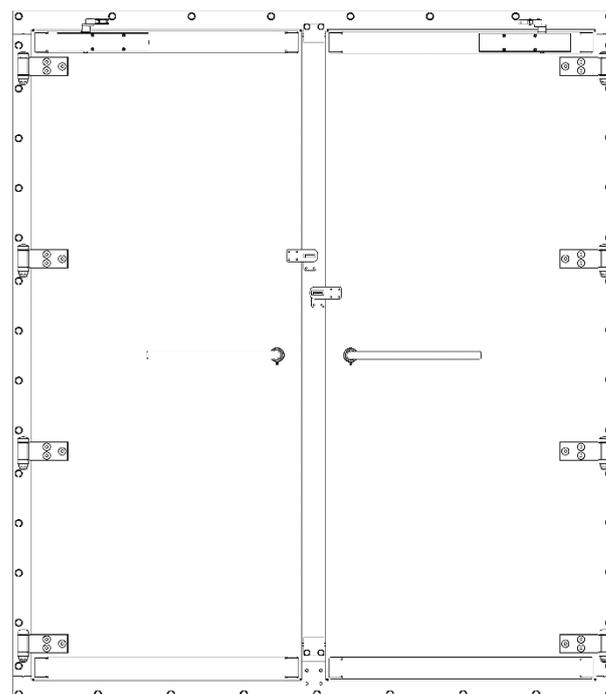


*Images of door assemblies, supplied by Clark Door Ltd*

The primary reason for this is that as steel is heated under fire resistance test conditions it expands. Due to higher temperatures on the exposed face, it follows that the exposed face expands more in relation to the unexposed face resulting in a steel leaf tending to bow away from the heating conditions of the fire resistance test at the top and bottom corners. When tested opening away from the heating conditions of the test the corners tend to bow away from the door stop. The bowing of the door leaf will create the potential for the passage of hot furnace gases around the leaf perimeter, potentially leading to premature integrity failure under the heating conditions of the test standard. Further, if the leaf bows sufficiently quickly before expanding and locking into position within the frame, there is potential for the leaf to bow out of the frame and a gap gauge failure may occur.

When tested in the opposite orientation, bowing of the leaf will generally be arrested by the stops, hence why this is the less onerous direction. It is noted that there is potential for the door leaf to push out of the frame at the jambs if there isn't sufficient restraint through hardware, however this is normally taken into consideration and if required additional hardware is incorporated.

It is the opinion of IFC that if symmetrical, hinged, steel door assemblies are tested with the leaf opening away from the furnace, the result, in terms of integrity performance, can also be applied to door assemblies, of the same symmetrical design, with the leaf opening towards the furnace. The principle is only applicable when the door construction, and any features within the door leaf, such as glazing, are symmetrical.



*Illustration of generic steel fire door*

This principle has been endorsed in the European Standard for fire resistance testing of doors, shutters and openable windows, **EN 1634-1: 2014(+A1: 2018)**. Table 2 in Clause 13.4 lists the 'direction for testing' for different door types. For a hinged metal leaf in a metal frame, Table 2 states that a door assembly tested with the leaf opening away from the furnace, for integrity only and without insulation in the core, will cover the same door assemblies when installed to open in the opposite direction provided a movement restrictor is installed at approximately mid-height on the hinge side.

Whilst **BS476: Part 22: 1987** and **EN 1634-1: 2014** each have an independent methodology, it is evident that the principles long established within IFC are echoed within the more recent **EN 1634-1 Standard**. This only serves to confirm the suitability of the principle that has been applied by IFC within Engineering Assessments.

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