

FIRE RESISTANCE

Testing, Assessment and Certification

1 Introduction

In many buildings there is a requirement for products, such as doors, screens, partitions and ceilings to resist the passage of fire. These products help to control the growth and spread of the fire. They protect both life and property by allowing occupants to escape and the fire services to gain access to fight the fire.

The location and period of fire resistance required for construction products is determined by the relevant legislation, codes of practice or the accepting authority.

- Fire resistance is determined through destructive fire testing and by assessment.
- Third party certification demonstrates consistency of manufacture which, in combination with test evidence, provides the confidence that every product will perform as expected.



2 Testing

2.1 The Standards

A number of test standards are used to show the performance of a product or construction under a generalised fire situation. There are British Standards (the BS 476: Part 20 series) and European Standards (BS ENs) for different types of building element e.g.

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|---------------------|--|
| • Doors | BS 476: Part 22 / BS EN 1634-1 |
| • Walls/Partitions | BS 476: Part 21 & 22 / BS EN 1364-1 & 1365-1 |
| • Floors and roofs | BS 476: Part 21 / BS EN 1365-2 |
| • Beams and columns | BS 476: Part 23 |
| • Ceilings | BS 476: Part 22 / BS EN 1364-2 |

2.2 The Method (BS 476: Part 22 & BS EN 1634-1)

The tests are designed to replicate the product's intended end-use i.e. doors are built into an appropriate supporting construction.

The specimen and any relevant supporting construction is built into a 3m x 3m restraint frame which is mounted on the front of a furnace. The temperature within the furnace is controlled according to an internationally-accepted time/temperature regime.



The time/temperature and pressure regime within the standard is intended to represent a post flashover condition. Flashover is the point at which all objects in the fire compartment have ignited.

In a real fire, the time period to flashover can be extremely long or extremely short. It is controlled by aspects such as the nature of the fire load, compartment size and shape and the available ventilation. Given the unknown time to flashover, it is therefore only reasonable to represent a fire from the point of flashover and not to consider the fire growth period.

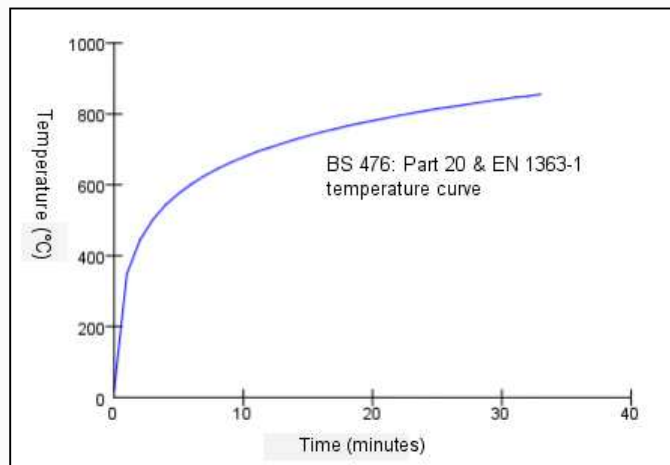


Figure 1: The BS 476: Part 20 & EN 1363-1 time temperature curve.

Testing is continued for the required duration (e.g. 30, 60, 90, 120 minutes) or until the specimen fails and it is no longer safe to continue. Failures relate to integrity, insulation and load-bearing capacity (if appropriate).

Failure is determined by the following criteria:

- **Continuous flaming** - sustained flaming for more than 10 seconds occurring on the non-fire side.
- **Cotton pad test** - A cotton pad is applied against the specimen on any glowing or flaming visible.
- **Gap gauges** - these measure the width of gaps, cracks or splits in the specimen and evaluate the size of these.
- **Insulation** - this is measured by attaching thermocouples - each of which is monitored throughout the test to determine a temperature rise. Insulation failures occur when either the temperature measured by an individual thermocouple on the sample increases by more than 180°C, or a temperature not in excess of 140°C measured by an average group of thermocouples.
- **Radiation** - radiation from the sample is measured for non-insulating samples and is measured using a heat flux radiometer, which is positioned central to the sample and 1m away. The levels are measured in kW/m^2 , and in the case of European test methods, the sample is deemed to have failed once 15kW/m^2 is reached.

A free DVD describing fire resistance testing is available from Chiltern International Fire.

2.3 The Process

The actual process of testing is relatively straight-forward. A manufacturer or designer simply submits a specimen and the test house installs it within a suitable structural surround and tests it! However, for a manufacturer to determine what size and configuration to test is a little more complicated because there are many options for the designer to consider in order to cover final market requirements, such as different types of hardware and different glazing options.

It is important to understand that the test standards are documents that detail a testing procedure only, they are not documents that detail how to manufacture 'deemed to satisfy' fire resisting constructions. Therefore, it is possible to submit any make-up of construction for testing and, provided that it meets the minimum fire resistance periods using the appropriate test method, it can be considered as a fire resisting construction for that given period.

2.4 The Report

Once a product has been tested, a report will be issued that will contain all the construction details of the tested specimen together with information on the size and configuration of the test sample. The test report itself is a purely factual document, stating times to failure of the specimen. Other relevant information such as observations taken by the test engineers, graphs

showing furnace and specimen temperatures and distortions (if applicable) will also be contained within the final test report.

3 Assessments

3.1 Global Assessments

Test reports relate only to what has been tested and allow very little in the way of variations. Changes to a construction tested under the British standards will either require another fire test or an assessment undertaken by an experienced fire consultant. The nature and scope of any variations will largely depend on the size and configuration of the test specimen.

It is important that discussions take place between the client and the testing laboratory prior to testing, to establish the client's requirements for the complete product range. The laboratory will advise whether a single test is appropriate or whether a series of tests will be required to meet the intended end-use applications.

Once the test programme has been completed (and all results are successful), Chiltern Fire is able to write a product assessment report that will bring together all items of test data into a single document. The product assessment report becomes the document that the client will trade from, as these reports will clearly explain the full scope of the product.

Assessments cover the following aspects of design:

- how to adjust the leaf dimensions and whether leaf size adjustment is appropriate
- the use of overpanels and how to install them
- increases in leaf dimensions (height and width)
- changes in doorset configurations (single leaf, double leaf, single acting, double acting)
- the use of and installation of glazed apertures
- the option to use various glass types
- door frame variations if appropriate
- smoke control requirements

These rules are described in further detail in TI-0802: Fire Resistance - Design Considerations. Project specific assessments can also be produced which are tailored to the specific needs of a building project.

3.2 European Direct and Extended Field of Application

When testing to the BS EN standards, some scope is available for minor variations to the tested specimen. These changes can be introduced automatically without the need for the sponsor to seek additional evaluation, calculation or approval. This is known as 'Field of Direct Application' and can be written directly into the fire test report. The allowable changes are governed by test performance and certain criteria must be met in order to provide all applicable variations. Further changes will be covered by 'Extended Field of Application' much like a Global Assessment, but these rules are still in the drafting stage of development and are not publicly available yet.

4 Third Party Certification

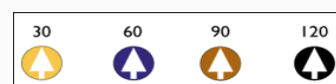
Once all the evidence is in place, and any assessment report has been prepared, confidence in the manufacture of the product may be enhanced through third party audits of the quality management system. This will ensure that the quality of the product, when sold to an end-user, is of a similar quality to that tested and will be able to achieve the minimum stated fire resistance period that has been tested and claimed. Such inspections of manufacture are carried out through a third party accreditation scheme such as the BM TRADA Q Mark.



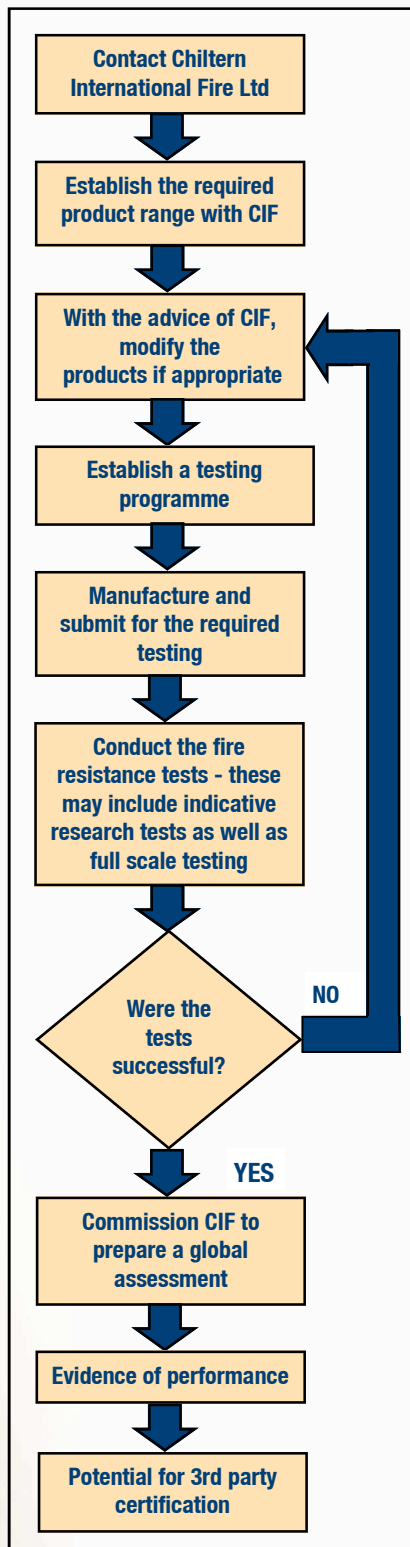
The complete manufacturing process must be quality controlled to the relevant ISO standard (or similar system), with the process audited yearly to ensure that areas such as calibration of equipment, handling of material, stock control and documentation are all controlled appropriately. Further audit testing of the product may also be required as a part of this type of accreditation scheme.

BM TRADA Certification operates Q-Mark certification schemes for fire door manufacture, fabrication and installation. Further details can be found at www.bmtrada.com.

Q-Marked fire doors are marked as being certified by BM TRADA using colour-coded plastic plugs.



5 Testing Process



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