



Technical information

Fire resistance

Testing assessment and certification

01 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.

- CE marking for fire resistance products in accordance with the Construction Products Regulation (EU) No 305/2011 (CPR) is currently possible for some fire resistance products. CE marking, since 1st July 2013, is mandatory for any product covered by a published harmonised product standard which has reached the end of its co-existence period. A harmonised product standard is identifiable by containing an Annex ZA. Other products may be voluntarily CE marked using European Assessment Documents (formally known as ETAG's or CUAP's). Further guidance on CE marking products can be found in TI-16.

02 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.

- 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
- Non load bearing ceilings BS 476: Part 22 / BS EN 1364-2

2.2 The method (BS 476: Part 20 & BS EN 1363-1)

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 restraint frame which is mounted on the front or top 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.

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).

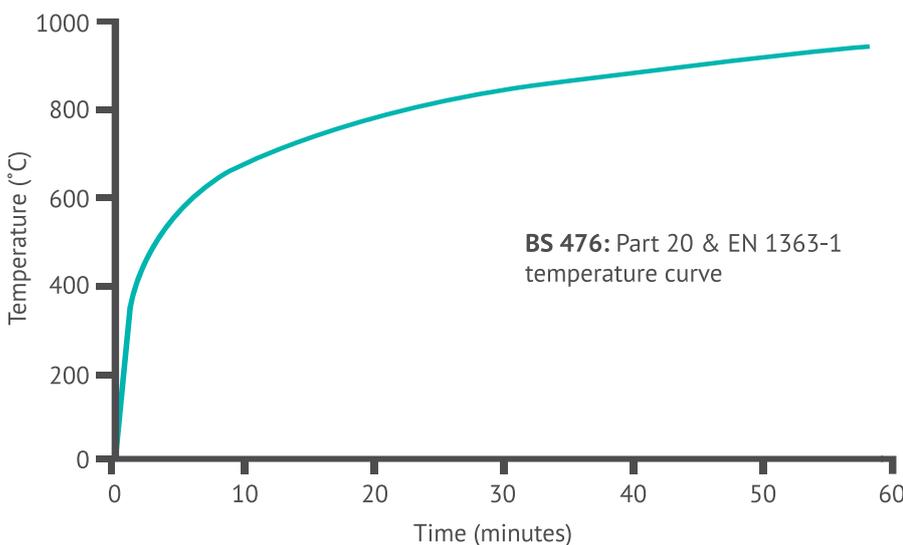
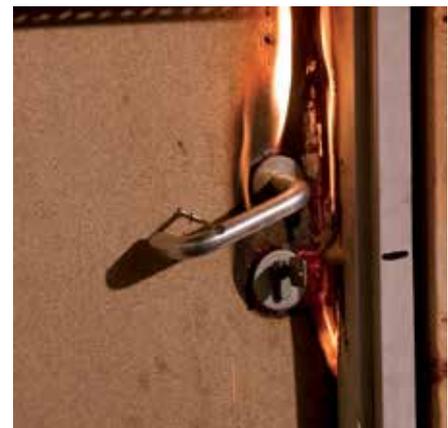


Figure 1: The BS 476: Part 20 & EN 1363-1 time temperature curve



Thermocouples measure a rise in temperature.



Hardware failure.



Continuous flaming.



Cotton pad test.

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 the average temperature rises by in excess of 140°C measured by the 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/m², and in the case of European test methods, the sample is deemed to have failed once 15kw/m² is reached.

A free DVD describing fire resistance testing is available from BM TRADA.

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 test 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.



2.5 The classification report

A classification report can be written in accordance with BS EN 13501-2 after a BS EN test or series of tests which may include other tests such as ambient or low temperature smoke leakage tests and self closing tests for a fire doors. The classification report will be based on the raw test data stated within the test report and will classify its performance against set performance characteristics and time periods (10, 15, 20, 30, 45, 60, 90, 120, 180, 240 or 360 minutes). The main performance characteristics are defined by the letters:

R - Load bearing capacity (if applicable)

E - Integrity

I - Thermal insulation

For example:

A loadbearing element which achieved 66 minutes loadbearing capacity, 56 minutes integrity and 36 minutes insulation performance will be classified R 66, RE 45 and REI 30.

Additional performance characteristics may be defined by other letters:

W - Radiation

M - Mechanical action

C - Self closing

S - Smoke leakage

G - 'Soot fire' resistance

K - Fire protection ability

03 Assessments

3.1 Product assessment

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 resistance product assessor. 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), BM TRADA 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

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' (DIAP) 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 are covered by 'Extended Field of Application' (EXAP) documents which are similar to a Product Assessment and must be written by a suitably qualified product assessor from a Notified Body who has carried out at least one of the fire tests used in the appraisal. It is advisable to consider your requirements fully before carrying out any fire testing as maximising the product scope often demands a reverse engineering approach. It is important to design the test to suit the rules stated within the EXAP document.

3.3 Classification report following Direct and Extended Field of Application

A classification report may also be written after DIAP and EXAP rules have been applied, see section 2.5.

04 Third party certification and CE marking

4.1 Q-Mark

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 certification 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 operates Q-Mark certification schemes for fire door manufacture, installation and maintenance. 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.

Timber Fire Door Certification Scheme Card

BMTRADA

Timber Fire Door Certification Scheme



Outer colour - period of fire resistance.
Inner/tree colour - status.
Unique member's certification number.

Outer colour
Period of fire
resistance (mins)

30
(Yellow)

60
(Blue)

90
(Brown)

120
(Black)

Inner/Tree colour - when fixed to door

▲ (Red)
Approved door.
(FD30 & FD60 only).
Intumescent not yet
fitted.

▲ (Orange)
Approved factory
fitted glazing.

▲ (Green)
Approved door.
Intumescent in door
factory fitted.

▲ (Silver)
Certified factory
hung doorset.

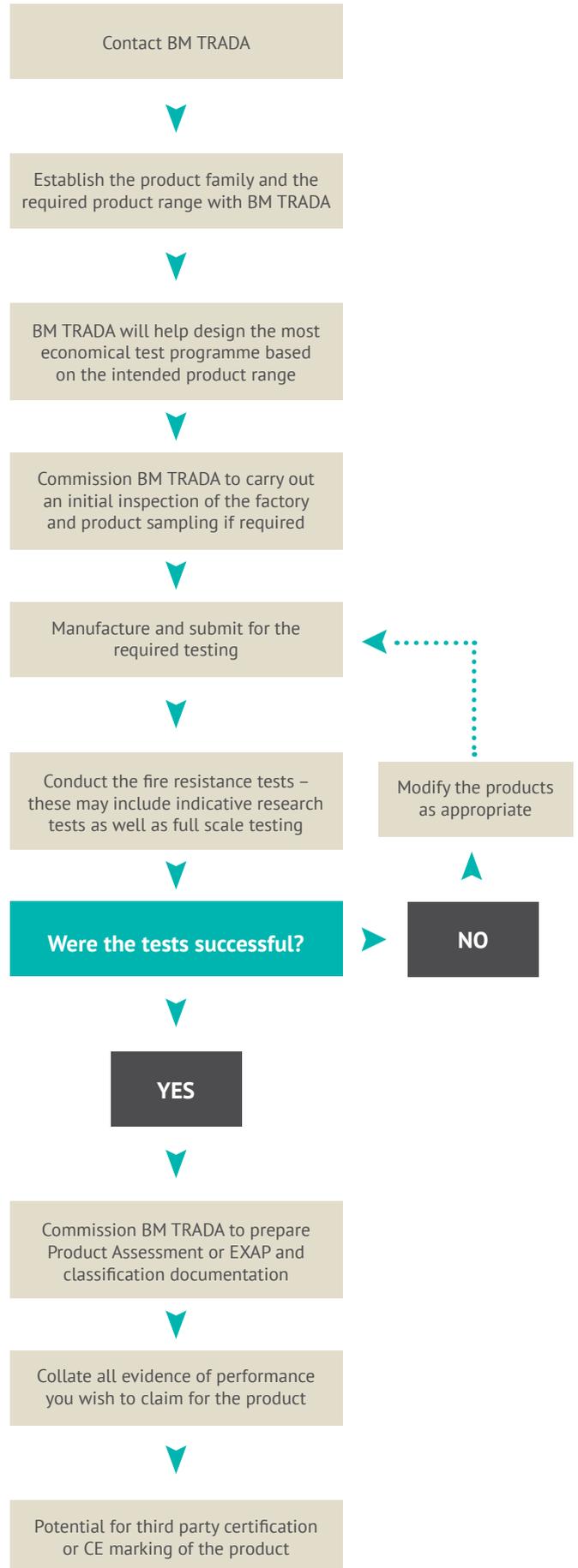
▲ (Gold)
Certified installed
doorset.

Inner/Tree colour - when fixed to frame

▲ (Green)
Approved frame to match door.
All intumescent to door and frame fitted.

For scheme and members' details
visit www.bmtrada.com or
telephone +44 (0) 1494 569826

05 The testing process



4.2 CE marking of fire resistance products

CE marking is a similar process to third party certification. Its aim is to ensure products are suitably proven via testing or assessment carried out in accordance with relevant harmonised European standards. Its secondary aim is to ensure consistent quality of construction products placed on the market within the EU. It does this for fire resistance products by ensuring factory production control systems are in place and audited by a third party on a regular basis in order to monitor quality over time. The product will then be CE marked using a single identifiable label format for each type of construction product. Accompanying data sheets must also be available showing the intended use and scope of the construction product with suitable installation instructions.



BM TRADA provides independent certification, testing, inspection, training, technical services information around the world. We help customers large and small to prove their business and product credentials and to improve performance and compliance. With an international presence across many industry sectors, we offer a special focus and long history of technical excellence in supply chain certification, product certification and testing, and technical services to the timber, building, fire and furniture industries.



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