

INTERNATIONAL ASSOCIATION FOR COLD STORAGE CONSTRUCTION (IACSC)

Summary of the fire testing methods And evidence appropriate to buildings Incorporating insulated panels

INTRODUCTION

One of the factors that is creating confusion in the construction industry is the plethora of tests that the designer of an insulated envelope building is faced with when producing a specification or reviewing manufacturer's literature. This Guidance Note provides the professionals in the design, construction and building certification team with an easy to understand summary of the tests that are, or may be relevant to the construction of the building. The use of tested components/elements is critical to the construction of a building if it is to perform its design function. Fire tests are no exception except that any inability to perform is only normally found out in a disaster situation. Buildings with inadequately tested certificated elements of construction will usually perform adequately in the normal working conditions, masking any inadequacies that they may have when exposed to fire.

For these reasons it is critical that all elements of construction are correctly specified with respect to their fire performance, and that the performance achieved is generated by

the test that is relevant to the aspect of the high temperature performance that requires to be controlled. This summary categorises the tests according to the following performance characteristics:

- fire resistance
- insulated panel performance
 - fire stability
 - propensity to flash-over
- reaction to fire
 - surface spread of flame
 - combustibility

For each test the element or product or material to which the test is applicable is identified. Similarly, where possible, the function or role of the tests in Regulations and/or [third party] certification is also given.

Existing British Standards tests, and tests prepared by UK based organisations or certification authorities will be the main requirement for the foreseeable future.

Recognising that in primary legislation European (EN) test methods will gain growing importance and recognition equivalent EN and ISO tests and also listed.

FIRE RESISTANCE

Fire resistance is the method by which the ability of an element of structure to resist exposure to a fully developed fire is measured and expressed.

There are three performance criteria used in fire resistance testing:

- *Loadbearing capacity*
- *Integrity*
- *Insulation*

Load-bearing capacity expresses the duration for which the element can continue to carry the load during fire exposure.

Integrity expresses duration for which the element has the ability to contain the fire and, to some extent, the products of combustion.

Insulation expresses the duration for which the unexposed face temperature of the element can remain below pre defined 'critical' value.

Radiation from the unexposed face is also measured during the test but does not have any failure criteria.

BS476: Part 20: 1987

This standard describes the equipment and defines the exposure conditions to be used and sets the criteria of failure

to be used in the related parts, which are element specific.

Application

Not direct application to any elements but sometimes quoted as the basis behind some ad-hoc tests on elements for which there are no specific tests, e.g. penetration sealing systems.

Similar Standards

- BS476: Part 8: 1972; Part 20's predecessor (still in Regulations)
- BS EN 1363: Part 1 General requirements
- ISO 834: Part 1 General requirements

BS476: Part 21: 1987

This standard describes the specific test methods for evaluating all types of loadbearing elements used in buildings:

- Columns load-bearing capacity
- Beams load-bearing capacity
- Load-bearing walls, load bearing capacity, integrity, and insulation
- Floors load bearing capacity, integrity, and insulation

Application

- The load-bearing frame - in single storey buildings often waived except near boundaries.
- Compartment walls and floors
- Walls and floors forming protected routes

Similar Standards

- BS476: Part 8: 1972 - Part 21's predecessor (still in Regulations)
- BS EN1365: Parts 1 (walls), 2 (floors/roofs), 2 (beams), 4 columns
- ISO 834: Parts 1-9

BS476: Part 22: 1987

This standard describes the specific test methods for evaluating all types of non-loadbearing elements used in buildings:

- walls/partitions integrity and insulation
- ceilings integrity and insulation
- doors integrity (no insulation in Regulations)
- glazed screens integrity and insulation

Application

Non-loadbearing walls and partitions (including sandwich panels) fire separating ceilings (except suspended ceilings protecting steel) fire doors and

roller shutters, glazed walls and partitions.

Similar Standards

- BS476: Part 8: 1972 - Part 22's predecessor (still in Regulations)
- BS EN1364: Parts; 1 - (walls); 2 (ceilings)
- BS EN1634: Part 1 - Fire resisting doors and shutters
- ISO 834: Parts 8 (walls), 9 (ceilings) [drafts]
- ISO 3008 - Fire resisting doors
- ISO 3009 - Fire resisting glazed screens

BS476: Part 23: 1987

This standard includes the method of test for suspended ceilings, which only have the function of protecting structural steel.

Application

- Loadbearing structural frame (including steel beams supporting a mezzanine)

Similar Standards

- BS476: Part 8: 1972; Part 22's predecessor (still in Regulations)
- pr ENV 13381-1

BS476: Part 24: 1987

This standard describes the method of test for fire resisting ductwork with respect to fire inside the duct, or outside the duct.

Application

Heating, ventilation, and conditioning ductwork or flues designed to extract combustion gases, which pass through fire compartments.

Similar Tests

- prEN1366: Part 5
- ISO 6944-1985

FIRE RESPONSE TESTS FOR INSULATED PANELS

These are tests that establish the response of the building elements with respect to certain pre-set objectives. They may form part of a building specification designed to make the building more insurable or to provide enhanced fire-fighting confidence.

LPS 1181

This test method has been developed by the Loss Prevention Council (LPC) on behalf of the insurance industry (ABI) in order to have a method of test available that could identify those elements of construction that could, in their opinion, increase the fire severity and result in higher losses.

The test uses a 'small' fire source consisting of either a timber crib or a fluid bed gas burner in the corner of a 10m long 3.0m high x 4.5m wide

'garage' type structure with an open end. Maximum heat output 1MW at around 4 minutes reducing.

Originally developed to evaluate insulated external cladding and roofing fixed to sheeting rails and purlins. Recently modified to support free standing panels from an external frame as may be used for insulated envelopes.

Failure is primarily adjudged to occur if 'flashover' happens (gas temperatures of in excess of 600°C) or if the panels exhibit significant damage internally and on the surface.

The test rates panels as being Grade B, or not.

Applications

With internal supports; external insulated cladding and roofing, and with external supports; sandwich panels for walls and ceilings. Not suitable for architectural cladding systems.

Similar Standards

None

LPS 1208

This is not strictly a test, but is a two stage test method for evaluating cladding or panel systems that are fire resisting and which do not contribute to the severity of a fire. The panel has to achieve a Grade A rating to the LPS 1181 method (see above) and achieve a designated fire resistance rating in respect of integrity and insulation

against the BS476: Part 22 test (see the Fire Resistance section).

Applications

Insulated walls that are also compartment walls and in exceptional cases fire resisting roofs.

Similar tests

None.

IACSC Fire Stability Test FST1

This test method has been developed by the IACSC, in response to concerns expressed by the Fire Service, to develop panels, or methods of construction of insulated envelopes that are inherently more stable in fire, and which will naturally reduce disproportionate damage to the facility.

The test uses a centrally positioned timber crib with a heat output of approximately 1.1MW which is maintained steady for in excess of 25 minutes. The chamber is 8m long, 3m high and 3.6m wide with a personnel door in one end.

Failure is adjudged to occur if the panels delaminate and fall into the chamber, if the ceiling or any of the vertical walls distort/deflect more than set amounts, or if the chamber is breached by the fire.

The test grades, panels or the system as being 'fire stable', or not.

Application

Sandwich panels constructions or systems to be used horizontally and/or vertically to form an insulated/clean room envelope constructed in compliance with the IACSC Model Specification*¹⁾ and which will enhance fire-fighter confidence and reduce disproportionate damage.

Similar Tests

None.

FM 4880 (The Corner Wall Test)

This test was developed by Factory Mutual to establish the hazard represented by sandwich panels. It is similar in its objectives to the LPS 1181 test, but is considerably larger and is open on two sides. The length of the largest walls is 15.2m and the shortest wall 11.5m and has a 7.6m height. The heat source is a large timber 'crib', 1.5m high and the rig can incorporate a sprinkler system to control the fire development, making it a condition of approval.

It is probably more onerous than the LPS 1181 test.

Application

For panels used vertically or horizontally to create an insulated envelope that is to be insured by Factory Mutual.

Similar Tests

None. However, FM 4880: 1999 (Metal faced with non-combustible core) for Class 1 approval with no height

restriction. This approval uses 5 tests - a Room test to UBC 17-5 or ISO 9705 / ASTM D482 for ash content re core material / Combustibility via the Flammability test / Heat of combustion for the core ASTM D2015 or ISO 1716 / QC method review. It is not called up under UK Regulations.

ISO have developed two tests for the evaluation of sandwich panels in fire using a 'small' and a 'large' room ie ISO 13784 Part s 1 and 2. Again this is not called up by UK Regulations.

REACTION-TO- FIRE TESTS

Reaction to fire tests are generally smaller 'bench scale' tests designed to evaluate materials, rather than elements, for specific behavioural characteristics that can influence the response of the construction to developing, rather than fully developed fire conditions. Some of the reaction to fire tests are called up in the Guidance to Regulations.

BS476: Part 6: 1989; Fire Propagation Test

This test was developed to permit combustible materials to be used as linings to rooms as long as the contribution that they made to the development of the fire was minimal. The test procedures dimensionless indices which have maximum values applied to them in legislative guidance to indicate a Class '0' performance which is deemed to be the lowest level of flame spread that can be accepted for the linings used in escape routes or circulation spaces. It is, however,

more akin to a rate of heat of heat release test, rather than a surface spread of flame test. It is a pre-requisite for a Class '0' material (that it is rated Class '1', by BS476: Part 7: 1997, (see next item).

Application

For evaluating the surface of elements/materials that border onto escape routes, circulation spaces and linings within a 'boundary' situation, to ensure that they do not propagate fire too rapidly, or fiercely.

Similar Tests

None, directly, albeit at some time in the future BS EN13823: 2002, the Single Burning Item (SBI) test will replace it in legislation.

BS476: Part 7: 1997: Surface Spread of Flame Test

This test was developed to establish the level of flame spread that a lining will exhibit during the fire development, at a late stage, just prior to flashover. The specimen being evaluated is set at right angles to a nominally 1m x 1m radiant plaque and a small pilot flame is applied at the lower corner of the material/specimen for the first 60 seconds. The specimen size is 885mm x 270mm and the categories of flame spread measured by this method ranges from Class '1' (best) to Class '4' (worst). Class '1' and '3' are called up in guidance to legislation throughout the UK.

Application

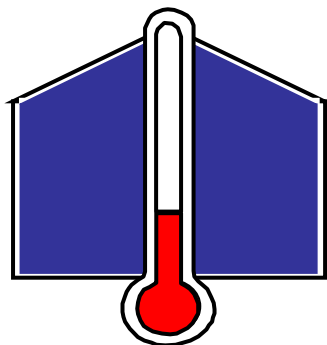
For evaluating the likely spread of fire on linings forming, any rooms, other than small rooms, including the facings to sandwich panels, used anywhere within the building.

Similar Tests

None, albeit, as before, it will in due course be replaced by BS EN13823: 2002, the Single Burning Item (SBI) test method.

BS476: Part 4; 1970; Non-Combustibility Test

This test has been developed to establish whether materials are defined formally as being combustible or non-combustible. The primary component is a tube furnace where a refractory sleeve is installed in an insulating box with an electrical heating element wound around the outside of the tube. A small specimen, 50mm high x 45mm diameter is suspended in this heated tube and failure is deemed to have occurred if visible flaming takes place or the temperature rise by more than the specified amount.



Application

Non-combustibility is rarely called up in regulatory guidance, but 'limited combustibility' is, and could apply to a number of materials that may form part of the building and/or element, and any construction supporting the envelope.

Similar Tests

BS476: Part 22: 1982, Method of assessing the heat emission from building materials (used in the context of limited combustibility).

Contact Points for further information

For either of the documents referred to please contact:

Secretariat:

***International Association for Cold Storage Construction (European Division) (IACSC)
20 Park Street
Princes Risborough
Bucks HP27 9AH***

Tel: +44 (0) 1844 275500

Fax: +44 (0) 1844 274002

e-mail : iacsc@intfire.com

http://www.iacsc.org/iacsc/european_division