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# Fire terms and testing

Have you ever heard some fire terms and wondered what they mean? This guide will help you understand some of the correct terminology and relevant fire test methods.

**FIRE TERMS** often heard include 'fire rating', 'incombustible', 'inflammable' and 'self-extinguishing'. However, these are either not defined or disapproved terms in international standard ISO 13943:2008 *Fire safety – Vocabulary* and should not be used.

ISO 13943:2008 was prepared in consultation with international fire engineering experts and is a valuable guide in the use of fire terminology.

## Fire tests provide the numbers

All organic products are 'combustible' or 'flammable' to some degree, and all building products may potentially provide some 'fire resistance', but the question is, for how long? The only true answer for the fire performance of a product or material comes directly from the result in a fire test.

For the Building Code, fire tests fall into two main categories:

- Resistance to fire – the ability of a building element to prevent fire spreading through it, that is, the fire is on one side and does not penetrate through the barrier to the other side.
- Reaction to fire – a measure of the ability to ignite, sustain flaming and smoke production of a product.

Each category comes with its own terminology, and New Zealand Building Code clause C *Protection from fire* gives clear definitions and cites specific test standards in C/AS1-6. Appendix C in these fire safety documents gives descriptions of the test methods.

## Many names used for fire resistance

The correct term used to define resistance to fire is 'fire resistance rating' or FRR. This is also



known as fire resistance level in Australia, fire endurance in the US and simply fire resistance in the UK.

'Fire rating' is used in the fire safety documents C/AS1-6 to mean 'fire resistance rating'. Fire rating is a misleading term and can cause confusion – for example, can a piece of fabric have a fire rating when it is difficult to ignite and spread flame?

## Fire resistance rating

The fire resistance rating of a building element is always given as three numbers representing the time in minutes, for example, 30/30/30. These, in order, are:

- structural adequacy\* – the ability of the element to carry an applied load
- integrity – the ability to prevent fire spread by flaming on the non-fire side or the creation of gaps to allow the passage of hot gases
- insulation – the ability to limit the temperature rise on the non-fire side.

A non-loadbearing wall would only have integrity and insulation, so its fire resistance rating may be –/60/60. The – (dash) indicates no requirement.

## Test methods for FRR

Fire testing results provide these three numbers. The main test method in C/AS1-6 is AS 1530.4:2014 *Methods for fire tests on building materials, components and structures – Fire-resistance tests for elements of construction*.

Other test methods such as BS 476-20:1987 *Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)* and its other parts are also permitted but not for fire doors or penetration seals.

Fire doors or penetration seals must comply with specification standards:

- AS 1905.1-2005 *Components for the protection of openings in fire-resistant walls – Fire-resistant doorsets* for fire doors
- AS 4072.1-2005 *Components for the protection of openings in fire-resistant separating elements – Service penetrations and control joints* for penetration seals.

AS 1905.1-2005 and AS 4072.1-2005 use AS 1530.4:2014 as the test method.

## Provides method for fire safety

The fire resistance rating defines the requirements for floors, walls, doors, dampers, fire

stopping and other building elements with a fire separating function. This forms the core method of providing fire safety in a building.

### **Reaction to fire**

Several different fire tests cover reaction to fire and apply to:

- internal and external surface finishes
- suspended flexible fabrics – curtains, drapes, underlays and flexible canopies
- membrane structures – tents, marquees and canopies in crowd purpose groups
- flooring.

#### **Internal surface finishes**

Internal surface finishes include wall and ceiling linings and duct and pipe insulation. These have to meet requirements for a Group Number in the range 1 to 3. Smoke requirements for Group Numbers 1 and 2 add an S, for example 1-S.

For each risk group, specific requirements are in C/AS1 paragraph 4.2 and C/AS2–6 Part 4 Table 4.1.

The Group Number is determined from C/VM2 Appendix A using the results from the ISO room test, ISO 9705, or the cone calorimeter test, ISO 5660. There is one exception – for combustibility test AS 1530.1. Details of the test methods can be found in *Build 132* 'Changes to assessing interior surface linings'.

Table A1 of C/VM2 Appendix A gives concessions for some substrates, for example, concrete, steel and fibre-cement board, gypsum plasterboard and wood products.

Foamed plastics have special requirements in C/AS1 paragraph 4.3. C/AS2–6 paragraph 4.17.2 requires a Group Number and a flammability test in accordance with AS 1366 for the type of material being used. If the foamed plastic is behind another material, that material must have the required Group Number, but the foamed plastic must still meet the flammability requirement.

#### **Suspended flexible fabrics and membrane structures**

This applies to various fabrics and building underlays. The appropriate test method is AS 1530.2-1993 *Methods for fire tests on building materials, components and structures – Test for flammability of materials*.

The test is a small ignition test with an alcohol flame applied to the bottom edge of a strip of fabric. The extent and time of vertical flame spread are measured and analysed to give a flammability index (FI).

#### **Floor coverings**

Floor coverings have to meet critical radiance flux requirements given in C/AS2–6 Table 4.2. The test method is ISO 9239-1 and subjects a specimen of flooring to heat radiation.

The least onerous requirement of critical radiant flux is 1.2 kW/m<sup>2</sup>, which is what you might feel from the sun in the middle of summer in Auckland.

#### **External walls**

There are two options for external walls. If the substrate is non-combustible, any coating not exceeding 1 mm may be used, otherwise compliance with Table 5.1 of C/AS1 or C/AS2–6 paragraph 5.8 is necessary.

The test method used is the cone calorimeter test, ISO 5660. This test subjects a 100 × 100 mm specimen to 50 kW/m<sup>2</sup> of radiant heating and a small spark for ignition (if any). The result yields information on peak heat release in kW/m<sup>2</sup> and total heat release in MJ/m<sup>2</sup>. The numbers are then compared with Table 5.1 of C/AS1 or C/AS2–6 paragraph 5.8.

#### **Pass/fail rare for test methods**

It is rare for test methods to offer a pass or fail result. Usually the result is a number that is then used in conjunction with a specification document (a standard or a regulatory document) to give a measure of acceptance.

The only standard called up in C/AS1–6 that gives a pass/fail result is AS 1530.1-1994 *Methods for fire tests on building materials, components and structures – Combustibility test for materials*. The result is 'deemed combustible' or 'not deemed combustible'. All other tests give one or several numbers as the result.

Therefore, when looking at requirements for products in C/AS1–6, check the specific definitions in C/AS1–6 and relate these back to the descriptions of the test methods in Appendix C. ◀