

Fibre cement – Unique fire performance

INTRODUCTION

As a result of urban consolidation, fire performance is an essential design element that must be taken into consideration in the selection of building materials and systems.

This is recognized in the Building Code of Australia (BCA), which defines the level and type of fire protection required for all classes of buildings. Fire protection is specified to provide fire resistance and stability, compartmentation and separation, and provide for the protection of openings.

Buildings must be constructed so that they are protected from fire in other structures. The materials used must be such that if there is a fire, its spread, and the generation of smoke and toxic gases is minimized. Stability must be maintained to allow sufficient time for occupants to escape, to ensure the safety of fire-fighters, and to minimize the risk of collapse onto adjoining property.

The potential fire hazard of a building is assessed by the building's purpose, the fire load of the contents, and its distance from other buildings.

The BCA classifies buildings into one of ten classes according to their usage, (i.e. Class 1 – Domestic, Class 2 – Flats, Home Units, etc.) and further classifies them into three categories of fire-resisting construction (Type A, B and C), depending upon the number of storeys and its usage (domestic buildings only require fire resistant construction under specific circumstances).

Depending upon the classification, building materials and elements are required to meet specific fire performance criteria.

These can be:

- Non-Combustibility
- Fire Protective
- Early Fire Hazard Properties
- Fire Resistance Levels.

James Hardie fibre cement building products achieve the best possibly Early Fire Hazard Properties and, when used in specially designed wall configurations, achieve Fire Resistance Levels of up to two hours.

In addition to the BCA requirements for fire protection, the fire performance of fibre cement material enables it to be used in bushfire prone areas, in accordance with the relevant compliance documentation including AS 3959 – 'Construction in bushfire-prone areas'.

The fire properties of James Hardie fibre cement building products, coupled with proven durability characteristics, combine to give unique advantages in the area of fire protection.



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NON-COMBUSTIBILITY

James Hardie fibre cement building products are 'deemed non-combustible' in accordance with the Building Code of Australia.

Non-combustibility requirements are specified for certain key elements of buildings to ensure that the materials of construction do not contribute to the heat load, and are not consumed, in the case of a fire.

In Australia, 'non-combustible' is defined by conformance to Australian Standard 1530.1 – 'Combustibility Test for Materials'.

The test requires a specially prepared specimen of the building material to be subjected to a standard regime of heating in a ventilated electric furnace. The material is assessed for flaming; the amount of heat generated by the specimen; surface temperature rise; and the mass loss of the specimen during the test.

The exposure condition of this test is extreme, and materials having even small amounts of organic content will typically prove to be combustible.



The results obtained relate only to the behaviour of the specimens under the particular conditions of the test, and are not intended to be the sole criteria for assessing the potential fire hazard of the material in building applications.

This is recognized in the BCA, which exempts thin (less than 1mm) surface finishes on non-combustible substrates from consideration, provided that the surface exhibits low flame spread properties. The BCA also recognises a number of materials which, though containing small amounts of combustible material, do not represent a fire hazard and do not contribute to flame spread. These may be used wherever non-combustible materials are specified.

Section C1.12, Volume 1 of the BCA lists these materials.

FIRE PROTECTIVE COVERING

Throughout the BCA, reference is made to Fire Protective Coverings (Definition Clause A1.1).

These are materials which limit the spread of fire and smoke, delaying fire spread to other compartments, although in isolation they do not provide a Fire Resistance Rating (FRR).

The use of Fire Protective Coverings is mainly called up in the Building Code of Australia in relation to Type B and C construction for ceiling linings in lieu of floor systems with a 30/30/30 FRL (Specification C1.1 Clauses 4.1(i), 5.1(d) and 5.1(e)).

Because of its unique fire resistance properties, James Hardie's 12mm thick fibre cement building products are deemed to be Fire Protective in accordance with the BCA.

EARLY FIRE HAZARD INDICES

During the early stages of a fire in a building, the performance of the materials used for linings and surface finishes is critical in restricting the spread of the fire, and the amount of smoke and toxic gases generated.

Wall and ceiling linings are a means by which a fire can spread along corridors and through shafts to other storeys and compartments.

Materials that are difficult to ignite, restrict the spread of flame and do not generate quantities of smoke and gases, assist in the evacuation process, and slow down the spread of fire. The generation of smoke and toxic gases from linings reduces visibility, and can cause panic along evacuation paths.

This is identified in Section C1.10 of the BCA, which specified the performance requirements for linings and surface finishes in specific locations and particular classes of building.

The Early Fire Hazard Indices determined by AS1530.3 are called up in the BCA as the means by which the performance of lining materials can be assessed with respect to potential fire Hazard.

This standard sets out a test method for the assessment of building materials and components according to:

1. Their tendencies to ignite (range 0-20)
2. Their tendencies to propagate flame (range 0-10)
3. The heat they release once ignition has occurred (range 0-10)
4. Their tendencies to release smoke (range 0-10)

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The indices are measured by using one test method on a number of test specimens. In the test procedure, a specimen is exposed to heat from a radiant source and the specimen is moved towards the heater in steps, over a period of 20 minutes, or until ignition is induced by a pilot flame. In all cases, a zero indice indicates the lowest hazard in terms of fire safety.

James Hardie fibre cement building products have the lowest possible indices in all four Early Fire Hazard Properties, see the table below. As a result of these high performance qualities, there are no regulatory restrictions place upon James Hardie fibre cement building products in terms of Early Fire Hazard Properties.

EARLY FIRE HAZARD INDICES (TESTED TO AS 1530) PART 3	
Ignition Index	0
Flame	0
Heat Evolved Index	0
Smoke Developed Index	0 - 1

FIRE RESISTANCE LEVELS

In the event of a fire in a building must be designed to restrict the potential size of the fire and to control its spread to other compartments within the building, or to other structures.

The BCA ensures these objectives are met by specifying the required Fire Resistance Levels (FRL) for structural members and building elements such as walls, floors, ceilings, doors etc. appropriate to the fire hazard inherent in a building.

The FRL is determined by testing to AS1530.4. In most cases, a single test, carried out in accordance with this standard, establishes the fire resistance for the element of construction concerned.

A representative specimen of a element of construction (minimum size 3m x 3m in the case of walls) is exposed to heat from a furnace which is controlled to satisfy a specified time temperature curve.

Throughout the course of the test, observations are made on the behaviour of the specimen with particular reference to three criteria:

1. **STRUCTURAL ADEQUACY** – the ability of the specimen to support applied loads when exposed to fire and maintain its structural purpose.

2. **INTEGRITY** – the ability of the specimen to resist cracks and fissures, such that flames and heat are not transmitted through the element.
3. **INSULATION** – the effectiveness of the specimen to provide an adequate fire barrier such that the average temperature rise of the face of the specimen not exposed to fire does not exceed 140oC above ambient temperature.

These three performance criteria are expressed in minutes, and go together to form the FRL for the specimen. For example, a one hour fire rated wall will have an FRL of 60/60/60 (Structural Adequacy/Integrity/Insulation).

James Hardie has conducted numerous tests with CSIRO on a wide range of our products. These tests have pushed the fire performance envelope and enables James Hardie to offer a range of load bearing timber and steel frame wall systems utilizing our fibre cement building products.



These systems can provide fire ratings of up to 2 hours to meet the BCA requirements for various types of construction. For more information see the James Hardie Fire & Acoustically Rated Walls technical literature.

MATERIAL GROUPING

Materials used as linings for walls and ceilings are grouped into 4 categories with restrictions being applied for their use in various fire related applications set by the BCA. A material is classified into a particular group based on its fire properties determined by testing.

James Hardie building products are classified as a Group 1 material which is the most resistant group with respect to fire, and places no restriction on their use as specified by the BCA.

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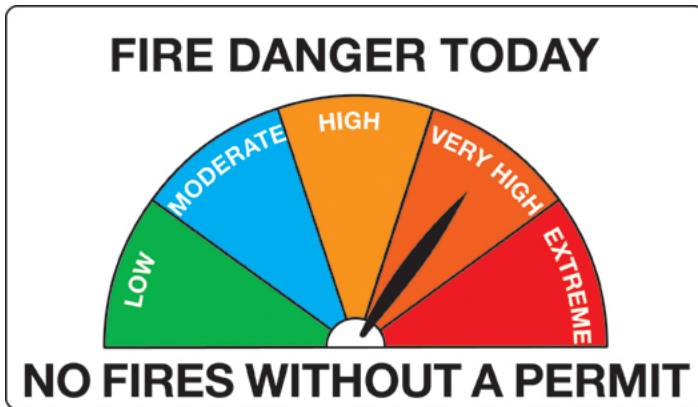
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BUSHFIRE-PRONE AREAS

In Australia, bushfires are part of the nation's fabric, however unfortunate or tragic the results may be. These fires are a natural hazard that occur from time to time – particularly in the heat of summer – and can occur anywhere that there is sufficient vegetation to provide fuel. In fact, our vegetation has evolved to rely on bushfire for its very survival. Bushfires, however, can enter suburban areas and cause devastation to life and housing. The design and siting of buildings is therefore of paramount importance, in order to reduce the risk of property damage and loss associated with bushfires.

Forest fuels in Australia are extremely abundant and the heat yield generated by eucalypt forest and scrub fires is significant. Most states in Australia now have some form of planning provisions relating to bushfire-prone areas. Guidelines have been prepared that aid local governments to establish fire hazard ratings for particular local areas.



The factors responsible for the ignition of buildings during bushfires are burning debris, radiant heat, flame contact and wind. Of these, windblown burning debris is regarded as the most frequent cause of building ignition, and there are a number of construction practices that can be used to minimise this risk.

Most states in Australia now have some form of planning provisions relating to bushfire prone areas. Guidelines have been prepared which aid local governments to establish fire hazard ratings for particular local areas.

Provisions for bushfire protection is also made in the BCA which references AS3959 - 'Construction of buildings in bushfire prone areas'. The standard involves the assessment of bushfire attack risk for sites deemed to be situated within a bushfire-prone area. It has resulted from data obtained from bushfire studies and fire modelling. This has led to steps covering fire weather, vegetation types, forward rate of fire spread, fire line intensity, flame length and radiation load.

In Section 3 of the Standard, three categories of concern (Extreme, High and Medium) are equated to three levels of construction requirements as follows:

LEVEL 1 construction for medium attack

LEVEL 2 construction for high attack

LEVEL 3 construction for extreme attack

The standard specifies the various construction requirements in terms of building elements for these various levels. James Hardie fibre cement building products can be for all levels of bushfire construction as defined by the Standard.

James Hardie has compiled the Bushfire Construction Design Manual which contains an extensive amount of bushfire information covering:

- Bushfire fighting, research and danger
- Design information
- Building materials
- Industry recommendations

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