

OPTIMISING FIRE RESISTANCE IN TIMBER FOR INTERIOR APPLICATIONS



INTRODUCTION

Timber is conventionally thought of as a material best suited for use in structural applications or as external cladding. However, the recent popularity of the 'Scandinavian' (or 'natural') aesthetic has seen an increasing use of timber in decorative or architectural applications. The most popular examples of this are the decorative use of cross-laminate timber (CLT), and the use of timber panels as wall or ceiling linings.

Before specifying timber for interior applications, a number of factors must be considered. Crucially, timber that is used as a wall or ceiling lining is subject to a number of fire-resistance standards which, while different to the standards for structural or exterior use, are just as stringent. While fire performance for structural or exterior timber is oriented toward resistance to heat sources and preventing the spread of fire along the building envelope, fire performance for interior timber has a different focus.

Timber used as a wall or ceiling lining must limit the internal spread of fire and inhibit the production of smoke. Performance in this regard is measured as a combination of three key indices: resistance to ignition, ability to limit or stop the spread of flames, and minimisation of smoke production.

In this whitepaper, we explain the fire-resistance standards that must be satisfied before timber can be deemed suitable for interior application as a wall or ceiling lining. We will also discuss how timber can be optimised for maximum performance in this regard.





WHY TIMBER BURNS

When timbers are exposed to temperatures above 150 degrees Celsius, the cellulose structures start to decompose and release volatile, flammable gases. At 250 degrees Celsius, the accumulation of these gases will ignite in the presence of a spark or flame. When temperatures of 500 degrees Celsius are reached, they may self-ignite. If timber is carefully heated to release most of the volatile gases without igniting the timber, the result is charcoal.

RESISTANCE TO IGNITION

As with timber used in structural or exterior applications, resistance to ignition is a central requirement of timber used as an internal wall or ceiling lining. This is understandable, as timber with a strong flame resistance can make a critical difference when it comes to preventing the spread of fire that is not caused externally (for example, a bushfire or electrical fault), but rather is caused by flames or heat inside a space.

The resistance of a material to ignition is assessed using the ISO 9705 full-scale room test. Results are divided into four 'Groups', with Group 1 being the highest performing classification and Group 4 the poorest. Timber generally achieves a Group 3 rating,¹ which can be enhanced through the use of certain surface treatments and finishes.

The BCA states that materials used as a finish, surface lining, or attachment to a wall or ceiling must have a fire resistance rating of Group 1-3. Group 4 materials are deemed unsuitable for these uses. The type of building and use of any other fire prevention measures – such as sprinklers or fire curtains – affects the required minimum fire resistance rating. Simply put, public crowded spaces and egress paths require higher ratings, while lower risk areas such as offices and well-sprinklered areas have lower requirements.

When determining the fire requirements of any building, the building class must first be identified. Part A3 of the BCA categorises buildings according to use/risk. Buildings are divided into classes 1-10. Certain of these classes have additional requirements. For example, schools are considered class 9b buildings and are – in most instances – not sprinklered. As per Table 3 of spec C1.10-4, these buildings would require Group 1 interior linings to fire-isolated exits and fire control rooms. All public corridors would require Group 1 or 2 linings to walls and ceilings. Since untreated timber products only achieve Group 3 or 4 ratings, their use in schools is greatly restricted unless they are properly treated.

ABILITY TO LIMIT OR STOP SPREAD OF FLAMES

Once a fire has already started spreading, the next line of defence is to contain the flames. As much as possible, timber used for wall and ceiling linings should prevent flames without sustaining significant damage.

Fire Resistance Level (FRL) is tested in accordance with AS 1530.4 – Methods for fire tests on building materials, components and structures. This test measures the ability of a material to contain live fire based on three criteria: structural adequacy, integrity, and insulation. Results are given in terms based on how long a material can resist flames during a standard fire test before failing. These results are measured in minutes.

For example, a material with an FRL of 60/60/30 can be expected to withstand fire for 60 minutes before its structural adequacy and

insulation are compromised, though its insulation capabilities will begin to deteriorate after only 30 minutes. The higher the FRL, the better.

The Spread of Flame Index (SFI) is a measure from 0 to 10 that determines how quickly flames grow in a room lined with a particular material. The lower the index, the better. For example, an SFI of 0 indicates a non-combustible surface, while an SFI of 10 means that flames would reach the ceiling within 10 seconds of ignition.

Materials used in class 2 to class 9 buildings must not have an SFI of more than 9. In their untreated forms, most timbers commonly used as wall and ceiling linings (including Radiata, Hoop, and Slash Pine) have a Spread of Flame Index of 7 or 8²





MINIMISING SMOKE PRODUCTION

It is important that materials used to line walls and ceilings minimise the production of smoke, which creates an additional, significant risk during a fire. This is particularly true within enclosed spaces where wayfinding or the location of emergency exits may be difficult.

Smoke Developed Index (SDI) measures the visual density of smoke, which is toxic and can greatly reduce visibility for those exiting a building. Like SFI, it is measured on a scale of 0 to 10. An SDI of 0 indicates the best possible performance, while a rating of 10 is very poor.

BOSS FIRE & SAFETY

Until recently, timber could not be used in commercial projects unless accompanied by additional cladding (such as plasterboard or FR board), sprinklers, or more timber. For example, in cross-laminated timber (CLT), an additional layer of timber would be needed to provide fire protection.

BOSS Fire & Safety is an Australasian supplier of a wide range of Swedish-manufactured intumescent products designed to increase the fire resistance of timber for interior applications. High performance and sustainable, BOSS FireShield™ products such as TimberClear™ and TimberWhite™ allow timber to be used as a wall or ceiling lining with confidence.

FireShield is an intumescent paint that works by foaming into a thick layer when exposed to high temperatures caused by flames or intensive heat radiation. When exposed to heat over 150 degrees Celsius, this layer quickly expands to create a thick, insulating layer over substrates. This insulation greatly reduces the heat absorbed by a surface, and therefore prevents decomposition and ignition. With only two coats of the water-based, halogen-free product, timber becomes highly fire resistant in accordance with ISO 5660 Part 1 and Part 2.

FireShield products can be used to increase the FRL of structural timbers by greatly reducing the char rate of timber. This allows higher FRLs to be achieved by smaller timber members, while a Group 1 surface finish allows these timbers to be fully exposed as required, saving time and money on additional linings.

FireShield TimberClear achieves a Group 1 rating – the highest possible rating – on all timber substrates thicker than 9mm and denser than 360kg/m³. The surface coating system uses simple insulation – rather than carcinogenic halogen retardants – to defend against fire. TimberClear meets the performance

requirements of the NCC/BCA without the need for specific engineering design, and looks like a traditional clear timber coating.

FireShield TimberWhite has been BRANZ weather and fire-tested, and already meets the exterior cladding requirements of the New Zealand Building Code. It is expected to achieve BAL-FireZone in Australia in early 2018.

As the supplier of the only fully compliant timber coating product of its type in Australia, BOSS Fire and Timber Construction is sure to become synonymous with quality commercial construction. Ultimately, FireShield is a tool that allows architects and engineers the freedom to design with, and express, honest materials.

Available in Matt or Low Sheen, the BOSS FireShield™ range of top coats intumesces and foams into a thick layer when exposed to high temperatures caused by flames or intensive heat radiation from fire. The fire retardant, water-based intumescent resins offer a superior architectural finish and can be easily sprayed, brushed, or rolled on. BOSS FireShield™ is ideal for the environmentally conscious project, and can reduce labour costs and drying times significantly.

Thanks to its quick, easy application on both solid timber and chipboard, FireShield is suitable for new builds and renovations alike. FireShield can be easily brushed, sprayed or rolled onto timber surfaces without needing additional heat or moisture control provisions onsite. Spillage or excess product can be easily cleaned up using standard tap water. Simply apply two coats of FireShield, wait 48 hours for the finish to dry, and then rest easy in the knowledge that your timber wall or ceiling lining is offering the best possible fire protection.

For more info: bossfire.com.au

REFERENCES

- ¹ Hyne Timber. Timber's Performance Against Fire. Fire Performance | Hyne Timber. Accessed November 8, 2017.
<https://www.hyne.com.au/solutions-centre/architects-and-designers/fire-performance>.
- ² Fire Resistance Requirements in Australia, and how to choose the right EWPAA Certified Product to Comply with the BCA.
Engineered Wood Products Association of Australasia.