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Durability of Timberline Thermory claddings

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Introduction

This report describes the durability of Thermory Ash and Thermory Nordic Pine claddings in the New Zealand context and the basis for which the claddings comply with Clause B2 of the Building Code.

Methodology

This report is based on a comparison of New Zealand and international requirements that relate to the durability of building materials and a comparison of the durability classifications of thermally modified wood supplied in New Zealand.

Thermory claddings

Thermory claddings are thermally modified timber weatherboard cladding systems manufactured from timber that is heat-treated at 215 °C or greater with no chemicals added. The thermal modification process changes the physical properties of the timber, so the timber becomes more stable and resistant to rot. The process of thermally modified timber claddings means timber can achieve the necessary service life without the need for chemical treatment (Timber Decking and Cladding Association, n.d.)

Building Code durability requirements for claddings

Building Code Clause B2 sets out the durability requirements for building elements. Clause B2.3.1(b), which applies to claddings, states:

B2.3.1

Building elements must, with only normal maintenance, continue to satisfy the performance requirements of this code for the lesser of the specified intended life of the building, if stated, or:

(b) 15 years if:

(i) t hose building elements (including the building envelope, exposed plumbing in the subfloor space, and in-built chimneys and flues) are moderately difficult to access or replace, or

(ii) failure of those building elements to comply with the building code would go undetected during normal use of the building but would be easily detected during normal maintenance.

Therefore, Clause B2.3.1 requires that claddings are durable for a minimum period of 15 years.

Acceptable Solution B2/AS1 and cited standards

Acceptable Solution B2/AS1, which is a means of compliance with Clause B2 of the Building Code, cites NZS 3602:2003 Timber and wood-based products for use in building and NZS 3640:2003 Chemical preservation of round and sawn timber, which contain chemical preservation requirements for timber.

NZS 3640:2003 sets out the preservative treatment and identification of timber to provide protection from insect attack and decay. It is based on six hazard classes. The only untreated timber permitted by NZS 3640:2003 is in interior situations. B2/AS1 also provides for untreated Douglas fir to be used on low-risk design buildings (Pringle, 2012).

NZS 3602:2003 describes the requirements for the use of timber products in buildings. With respect to unfinished timber claddings, it requires in paragraph 111.2.5 that 'For "no finish" or "stained finish" condition, only the following species are permitted: redwood, heart cypress, western red cedar and sawn H3.2 treated radiata pine.'

While the durability period required to be achieved is explicitly set in the Building Code, as thermally modified timber that is unfinished and not chemically treated is not covered by these standards, an alternative means of compliance must be used if Building Code compliance is to be established.

While hazard classes relate to the level of chemical treatment required as described in NZS 3640:2003, they can also be used to provide an indication of the durability required to comply with Clause B2 as an Alternative Solution (Pringle, 2012).

The hazard class that relates to timber cladding is H3.1 as defined in Table 3.1 of NZS 3640:2003 and includes the following definitions:

- Exposed to the weather above ground.
- Periodic wetting, not in contact with the ground.
- Biological hazard; decay fungi and borer.

Testing and evidence available about Thermory claddings and analysis

The Thermory timbers are manufactured in Estonia to the relevant European standards.

The timbers have declarations of performance (CE mark) that they are in conformity with the provisions of the EC Regulation No 305/2011 Construction Product Regulation system of assessment and verification of constancy of performance: System 3 and is in accordance with the requirements of EN 14915:2013 "Solid wood panelling and cladding – Characteristics, evaluation of conformity and marking".

The manufacturer's data sheets for the timber shows:

- Thermory Ash is classified as Durability Class 1 (Very durable) in accordance with EN 113
- Thermory Nordic Pine is classified as Durability Class 2 (durable) in accordance with EN 113.

The timbers have been tested by CATAS in accordance with EN 113-2:2020 (Thermory Nordic Pine) and EN 113.2:2020 (Thermory Ash).

EN 350:2016 provides the durability classes of wood-based materials and is the overarching guidance standard (which references CEN/TS 15083-1 and CEN/TS 15083-2, which have now been superseded by EN 113.2:2020).

EN 350:2016 provides a guideline for determining natural durability or for allocating natural wood species to durability classes. The installation and exposure to moisture and harmful organisms are expressed in terms of service classes, which are defined in DIN 68800-1:2001-10 and largely correlate to EN 335:2013 Durability of wood and wood-based products. CEN/TS 15083-1/EN 113.2 is the test methodology used to determine the biological (natural) durability of the wood.

Although EN 350:2016 references CEN/TS 15083-1 and CEN/TS 15083-2, the updated standards notes that in comparison with CEN/TS 15083-:2005, EN 113:1996 and EN 113:1996/A1 2004, the changes are to the title, to the way the obligatory fungi are indicated differently, and to the methods for sterilisation. Therefore it is considered that the test results from EN 113.2:2020 can be applied to EN 350:2016.

The durability classes set out in EN 350:2016 are as follows (APA – The Engineered Wood Association, 2020):

Table 1: Durability classes of wood-based materials to attack by decay fungi

Durability Class1	Description
DC 1	Very durable
DC 2	Durable
DC 3	Moderately durable
DC 4	Slightly durable
DC 5	Not durable

Note: The durability classes refer only to the heartwood. Sapwood is classed as not durable (DC 5).

Table 2: Durability classes service life

Durability	Class Designation	Average timber service life
DC 1	Very durable	More than 25 years
DC 2	Durable	15-25 years
DC 3	Moderately durable	10-15 years
DC 4	Slightly durable	5-10 years
DC 5	Not durable	Less than 5 years

Note: Durability classes service life above are supplied by TRADA, the Timber Research and Development Association.

A timber with a durability class of 1 is expected to have a service life of no less than 25 years, whilst durability class 2 infers a service life of no less than 15 years.

In addition to durability classes, the associated EN 335:2013 Durability of wood and wood-based products defines use classes. There are three use classes defined under EN 335. Use class 3 applies as follows:

- Minimum requirement for external use.
- Situations in which wood or wood-based product is above ground and exposed to the weather, particularly rain.
- Attack by disfiguring fungi and wood-destroying fungi is possible.
- Attack by wood-boring insects, including termites, is possible although the frequency and importance of the insect risk depend on the geographical region.

Comparison of New Zealand and European provisions for timber claddings

The provisions that apply to claddings (i.e., for above ground uses) are:

New Zealand Building Code	EN Standards
Clause B2.3.1 durability period for claddings	EN 350:2016 Durability of wood and wood-based products – Testing and classification of the durability to biological agents of wood and wood-based materials
15 years	Class 1: > 25 years Class 2: 15 – 25 years

The relevant provisions about how a timber product can be used in New Zealand and European standards that apply to claddings are:

New Zealand Building Code (and cited standards)	EN Standards
NZS 3640:2003 Chemical preservation of round and sawn timber	EN 335 Durability of wood and wood-based products
H3.1	Use class 3
Exposed to the weather above ground.	Minimum requirement for external use.
Periodic wetting, not in contact with the ground.	Situations in which wood or wood-based product is above ground and exposed to the weather, particularly rain.
Biological hazard; decay fungi and borer.	Attack by disfiguring fungi and wood-destroying fungi is possible. Attack by wood-boring insects, including termites, is possible although the frequency and importance of the insect risk depend on the geographical region.

Comparing the requirements shows that:

- the European durability classes 1 and 2 are equivalent to the Clause B2.3.1 durability period
- the European use class 3 is equivalent to hazard class H3.1 as defined in NZS 3640:2003 Chemical preservation of round and sawn timber.

Testing and evidence available about thermally modified timber

Thermory has empirical evidence of the performance of Thermory timbers in different climates https://thermory.com/blog-and-news/how-does-thermally-modified-wood-perform-in-different-climates/

This empirical evidence is supported by research and studies about thermally modified timber.

The ThermoWood® Handbook published by the International Thermowood Association state that the weather resistance and dimensional stability is significantly enhanced for Nordic softwoods that are subject to modification temperatures of 212°C and enhanced for hardwoods based on its research and testing.

Research about the moisture performance of thermally modified Norway Spruce facades found that the thermally modified wood has much better inherent durability compared to untreated spruce or Scots pine sapwood (Humar et al, 2020) and that thermally modified timber had significantly lower water uptake ability than untreated timber (Zhang, 01/2017).

Conclusion

It is considered that Thermory Ash and Thermory Nordic Pine will meet the minimum 15-year durability periods of the Building Code when installed in accordance with the Timberline recommendations.

References

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