

### 1. How long does the APP Timber*ThermoWood* effect last?

Although there is no long-term evidence of the durability of the **APP Timber*ThermoWood*** effect, because the product is new, tests have indicated that the decay resistance of thermally modified wood is far better than that of normal coniferous trees or of several corresponding tropical deciduous trees. Great dimensional stability also increases the lifespan of **APP Timber*ThermoWood*** products. Several other factors, such as frequent follow-ups for surface treatment damage control, and general maintenance, can help keep thermally modified wood in good condition. Following the instructions in this manual also increases the expected lifetime of the product.

### 2. What guarantees does the product have?

The guarantee should be determined on the basis of the **APP Timber*ThermoWood*** end product and its uses. It is difficult to give a general guarantee for **APP Timber*ThermoWood*** itself. The conditions that **APP Timber*ThermoWood*** is subject to when used in damp rooms inside, such as saunas, are very different to conditions outside. Sauna boards must, therefore, have a different kind of guarantee than, for instance, garden furniture.

Although thermally modified wood itself does not have any specific guarantees, several independent research institutes have obtained consistent results on the biological durability of the product. According to their tests, thermally modified wood is clearly more durable than normal, untreated wood.

Long-term experiments have been used in the past to test the decay resistance and weathering abilities of thermally modified wood. These will continue to be used in the future in order to provide more accurate information.

### 3. Why is APP Timber*ThermoWood* so durable even though resin and other extract substances have been removed?

The durability of **APP Timber*ThermoWood*** derives from changes that take place in the chemical compounds of wood. The hemicelluloses (sugar compounds) of wood are decomposed, and thus fungi have no nutrients to feed on. In order to prosper and decay wood, fungi need the right temperature (at least 5 °C), the right moisture of wood (over 20 %), and sugars. The moisture of thermally modified wood remains well below 20 % when the structures are in contact with the ground or even if the relative humidity of the air is 90 %. This prevents or at least significantly slows down the growth of fungi. In addition, regular surface treatments with wood oil reduce the absorption of moisture into thermally modified wood.

### 4. Are any chemicals added during thermal modification?

No chemical additives are used during the Thermo process. Thermal modification operates entirely on energy and steam. At the end of its lifespan, **APP Timber*ThermoWood*** can thus be put into alternative use or disposed of in the same manner as normal wood.

**5. Can APP Timber*ThermoWood* be used in contact with the ground?**

Research has shown that ThermoWood does not decay even if it is in contact with the ground. Continuous contact with the ground or water does, however produce chemical reactions that cause thermally modified wood to lose some of its strength. These mechanisms are not yet fully known, and further research is required. Thus, it is not recommended to subject **APP Timber*ThermoWood*** to constant contact with damp ground.

**6. What kind of surface treatment is required for outdoor use?**

**APP Timber*ThermoWood*** can be used outside without any surface treatment, but the appearance results are the same as with normal wood. The surface turns gray and starts to crack. The latest research and experience suggest that it is wise to treat the surface of thermally modified wood material as well as any coniferous or deciduous trees and hardwoods. Coatings protect wood from the adverse effects of UV radiation and problems caused by variations in moisture (cracking, changes in color etc.). The same products that are used on normal wood are suitable for **APP Timber*ThermoWood***. The right method of treatment can be determined according to the end use of the product. If a customer expects the product to resemble the original dark-brown color of **APP Timber*ThermoWood***, the product should be treated with a translucent wood stain or oil that contains a dash of brown pigment.

If one wants to create a long-lasting surface, paint provides a good solution. The wood should first be primed. This should then be succeeded by the application of a few coats of paint. Lack of resin and minimal reactions to weather conditions allow the paint to stick to the surface of the **APP Timber*ThermoWood***.

**7. Is the smell of APP Timber*ThermoWood* harmful?**

Tests have proved that **APP Timber*ThermoWood*** does not emit any harmful substances or smells. However, some people might not be very fond of its smell.

**8. Does the smell disappear over time?**

If the surface of the **APP Timber*ThermoWood*** product is finished, the smell disappears and does not come back. If, on the other hand, the product is used without surface treatment, the smell eventually disappears anyway and it cannot be perceived unless one sniffs the wood from a very close distance.

**9. Is it possible to glue APP Timber*ThermoWood*?**

Practical experience has shown that all types of glue can be used on **APP Timber*ThermoWood***. If one wishes to use water-soluble glues, such as PVAc glue, it is necessary to take into consideration that thermally modified wood absorbs water more slowly than normal wood. One must thus allow more time for the glue to dry. Especially in the case of PVAc glue, it is essential to always follow the manufacturer's guidelines on the appropriate use of the product.

**10. Can APP Timber*ThermoWood* be used in structures?**

So far, the durability and strength of **APP Timber*ThermoWood*** has mainly been tested on small, flawless sample pieces. In the future, tests must be extended to larger sample pieces as well as knotted wood. The impact of different types of knots and the number of knots must be examined. Due to insufficient information, at present we **DO NOT** recommend using **APP Timber*ThermoWood*** in supporting structures.

**11. How do the properties of heat-modified wood affect surface treatment?**

A low equilibrium moisture content paired with the slow absorption of moisture increases the dimensional stability of wood. Moreover, heat-modified coniferous wood material does not contain any resin. This has all been removed from the wood during the heat-treatment process. Both of these properties allow for paint to stick to the surface better.

**12. How can one prevent the color from fading?**

If one wishes to preserve the natural dark-brown color of heat-modified wood, the wood should first be treated with a primer and then once or twice with a pigmented wood oil or wood stain. The same treatment should be carried out at regular intervals (usually every 1-2 years) depending on changes in the color. Several manufacturers of wood oils have specified the length of treatment intervals with respect to their products.

**13. What kind of impact does UV radiation have?**

The sun's UV radiation is incredibly strong on the surface of all types of wood. Treating wood with a pigmented wood oil or wood stain helps reduce the damaging effects of UV radiation.

**14. How frequently do maintenance treatments need to be performed?**

According to the most up-to-date information available at present, it is recommended to treat the surface of a terrace, for instance, every 1-2 years if the terrace has been oiled and one wish to preserve the original dark-brown color. In addition to preventing the color from fading, follow-up treatments protect the wood from water and thus cracking. However, wood oils and wood stains should not be spread on planed surfaces on the south- and west side of a house that are often exposed to sunlight. Translucent finishes can create a film on the surface of wood which can then start to peel in the sunlight. The length of treatment intervals varies greatly depending on how much the wood is subjected to rain and sunlight. Painted surfaces tend to last for a longer time.

**15. How does moisture penetrate heat-treated wood and how does it leave?**

As in the case of normal wood, water is primarily absorbed through the cross-cut ends of thermally modified wood as well. In order to prevent the absorption of water, it is therefore recommended to treat the cross-cut ends several times with wood oil or a wood stain. As a general rule, once a film has formed on the edge of the wood, one can rest assured that a sufficient number of treatments have been performed.

In comparison to normal wood, thermally modified wood absorbs remarkably less moisture in the form of water vapor. The hygroscopic equilibrium moisture content of thermally modified wood is 30-50 % lower than that of any other kind of wood, including impregnated wood. In a temperature of approximately 20 °C when the relative humidity of the air is 60-70 %, the equilibrium moisture content of thermally modified wood is about 6-7 %. If the relative humidity rises to 80 %, the equilibrium moisture content of the wood is still only about 8 %. This considerably reduces movement caused by moisture and any damage that results from it.