

THERMOWOOD

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Thermowood Technical Specifications

Thermowood

Wood heat treatment research dates back to the 1930s when German scientists Stamm and Hansen, and American scientist White, pioneered this technique. Further studies were conducted in the 1950s by Bavendam, Runkel, and Buro, and in the 1990s by the Finland Research Center, VTT.

VTT has developed the Thermowood production method, which involves exposing wood to heat treatment up to 180°C, while also protecting it with steam. This process causes notable chemical changes in the wood compared to steam protection alone.

The process produces wood with varying colors due to the caramelization of glucose contained within it, and it is highly stable, resistant to rot, and boasts improved insulation properties. The Thermowood process reduces the material's tendency to undergo post-installation movement.

Thermowood Process

Heat treatment application in industrial sense is developed by VTT in collaboration with the Finnish wood industry. The Thermowood method is licensed by the International Thermowood Association and its members.

Thermowood products are offered for two different applications:

- Thermowood S (For interior applications with a thermal modification process of 180° C – Pine, Ash, and Iroko wood species).
- Thermowood D (For exterior applications with a thermal modification process of between 200° C – 212° C Pine, Ash, and Iroko wood species).

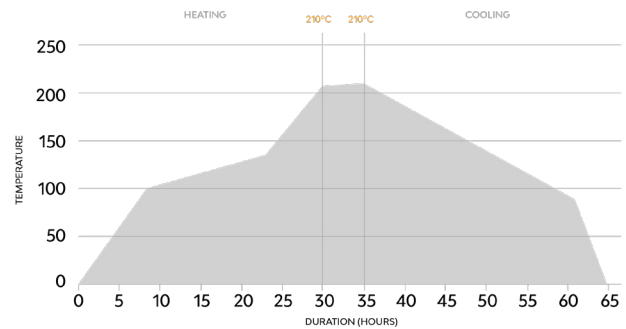
The thermal wood process can be divided into three main stages:

Stage 1: The oven temperature is rapidly increased to 100° C then steadily raised to 130° C. This dries the wood, reducing the moisture content to nearly zero.

Stage 2: The temperature inside the wood is increased by water vapor to 180° C (Thermowood S) and 212° C (Thermowood D). Once the target level has been reached, the temperature remains constant for 2-3 hours.

Stage 3: In the cooling and humidification stage, the wood's temperature is reduced to 80-90° C through the water spray system until the moisture of the wood reaches 4-6%.

Thermowood Method



Main Specifications

Stability:

The Thermowood process increases the wood's stability. Due to structural changes of the wood with high heat treatment, the internal stress is reduced. Also, thanks to the Thermowood process, the equilibrium moisture content and the permeability of the wood is reduced. In fact, the working and the twisting tendency compared to regular wood are minimized.

Durability:

During the Thermowood process, the biological durability of Thermowood products are increased due to the hemicellulose breakdown (arabinose, galactose, xylose, mannose). As these are the nutrients of the bacterias causing decay and fungus which are pulled out during the Thermowood process, the bacteria is unable to attack the wood.

Thermowood products are durable against various types of fungus. Thermowood products are durable against wood-destroying basidiomycetes.

The Thermowood process does not protect the materials from algae and fungus on the surface. These organisms feed from the environment (23% humidity and over) and don't cause any structural changes on Thermowood products. The algae on the surface, which can be seen as an aesthetic problem, can be easily prevented through surface treatment (such as a wood preservative oil or a water-based varnish).

Service Life:

Thermowood products are 80% more efficient than normal wood in outdoor weather conditions. Its working tendency is minimized and its resistance against decay is developed through natural methods. Thermowood products comply with the European norms EN 350 and EN 335-1 classes. It has been documented with the Thermowood Certificate that Thermowood products have sufficient biological resistance according to CEN / TS 15083-1: 2005 technical norms.

Density:

Thermowood Ash products have an average range of 595-629 kg/m³ at 65% relative humidity and 20° C ambient temperature when the specific gravity moisture content is 6%.

The specific weight of Thermowood Pine products is in the range of 362-404 kg/m³. This is the case when the moisture content is 6%, 65% relative humidity and 20° C ambient temperature.

The specific weight of Thermowood Iroko products is measured as in the range of 576-650 kg/m³, when it is at the level of 6% wood moisture, the relative humidity in the environment is 65%, and the ambient temperature is 20° C.

Note: Since Thermowood products are 100% natural products, there may be 10% differences in specific weight between the parts.

Modulus of Elasticity and Strength:

While the Thermowood process reduces the bending and compression strength of the wood due to the removal of moisture and structural changes, the differences compared to regular wood are not significant. Customers can still expect a high level of performance from Thermowood, with only minor differences compared to traditional wood options.

Nail and screw holding strength:

The nail and screw holding strength of Thermowood products does not reveal a significant difference compared to regular wood. However, as the cell wall is changed during the Thermowood process, the screw and nail holding power decreases by 20%. This deficiency can be easily overcome with stainless A2 screws and nails.

Adhesion:

According to tests, Thermowood products exhibit similar gluing properties as untreated wood. Therefore, it is recommended to use adhesives such as MUF, polyurethane, or epoxy.

Brinell Hardness:

After the Thermowood process, the Brinell hardness of the wood is higher than products that are not subjected to heat treatment.

- Brinell hardness degree of Thermowood Ash products are 30.5 N/mm².
- Brinell hardness of Thermowood Pine products are 15 N/mm².
- Brinell hardness of Thermowood Iroko products are 40 N/mm².

Emission:

The Thermowood process produces a distinctive scent. Numerous tests conducted by VTT using the KET 3300495 test method have demonstrated that these emissions are hazardous when released into outdoor environments.

These test results also reveal that the volatile organic compound (TVOC - Total Volatile Organic Compounds) values are much lower than regular wood.

The scent of Thermowood products will disappear within a few days, but then it may reappear for a short time in cases such as surface treatment and rain.

Fire Resistance:

According to the results of European norms EN 13501 (SBI-Test), the reaction class of Thermowood products against fire is defined as "B-s1, d0." Because of its fire-retardant chemicals, the fire resistance of Thermowood products has been upgraded to the "B-s1, d0" class.

Insulation:

The thermal conductivity of Thermowood products is reduced by 20%. In light of the tests performed by VTT, the thermal conductivity of Thermowood Pine materials is 0.099 W/(m K), while the value of pine that has not undergone Thermowood treatment is 0.12 W/(m K).

According to these values, Thermowood products are a very suitable material for outdoor cladding, saunas, windows, and doors.

Color:

Since Thermowood products are completely natural products, the color they get during production is directly proportional to the amount of glucose in the wood. Through the high heat, the sugar in the wood is caramelized, which changes the color of the wood.

- Thermowood Ash and Thermowood Tulipwood products are dark brown.
- Thermowood Pine products have a light brown tint.
- Thermowood Iroko and Thermowood Ayous products are a honey color.

It is a natural phenomenon that Thermowood products turn into silver gray in time due to the UV effect. The change in color has no negative effect on the durability of the wood. In order to prevent graying, product maintenance should be done as described in our maintenance guides.

Moisture Content:

The moisture content of Thermowood products is between 4–6% during the production process. This ratio may vary depending on the atmospheric environment of the area where the material will be applied. The equilibrium moisture content of the Thermowood products is in the range of 10–12% in environments with 95% relative humidity and dry air.

Maintenance:

With proper care, Thermowood products can maintain first-day appearance after years of use. It is recommended that the distance between Thermowood deck products and the ground is in the range of 4–6 cm.

Environment:

Thermowood is FSC and PEFC certified, and all of the products it supplies are obtained from sustainable forests.

1) Working with Thermowood

Thermowood products can be cut just like regular wood. Considering that the material is drier, it should be kept in mind that the wood chips are thinner and more volatile. It is mandatory to use masks and glasses during the application and material cutting process.

2) Health and Safety

Thermowood products are completely natural products that do not contain any chemicals (toxic and harmful substances). During application, it is recommended to remove the splinter quickly in case of sinking. In addition, since the wood chips of Thermowood products are very thin, asthma patients should wear a dust mask during the application/cutting.

3) Storage

It is recommended that Thermowood products be stored horizontally with supporting wedges with a distance of 60 cm. Vertically stacked materials are likely to bend.

The material brought to the plant should be stacked in a closed stock area that is safe and clean. Wood that is ready for installation should be stored on the pallets on a dry floor, with the original manufacturer packaging, and should be protected from external weather conditions.

It is recommended that Thermowood facade products be stored in their original packaging until the installation begins. If cladding products need to be returned, they should be restored to their original packaging as much as possible. When the warehouse receives the returned items, they will be checked.

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