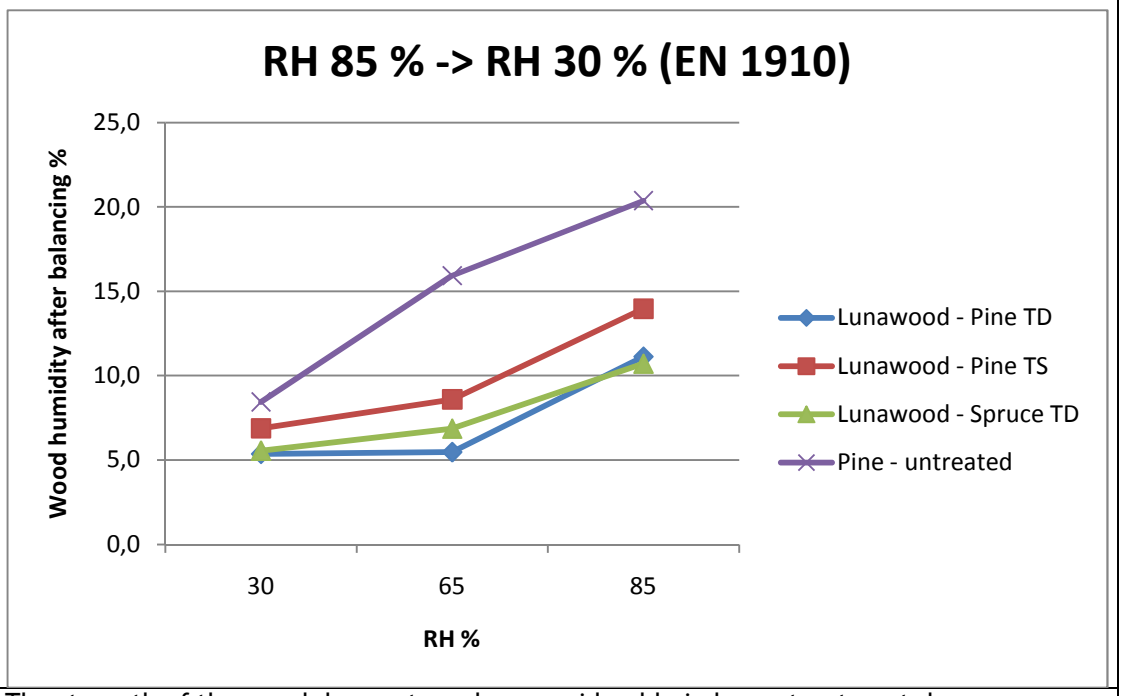
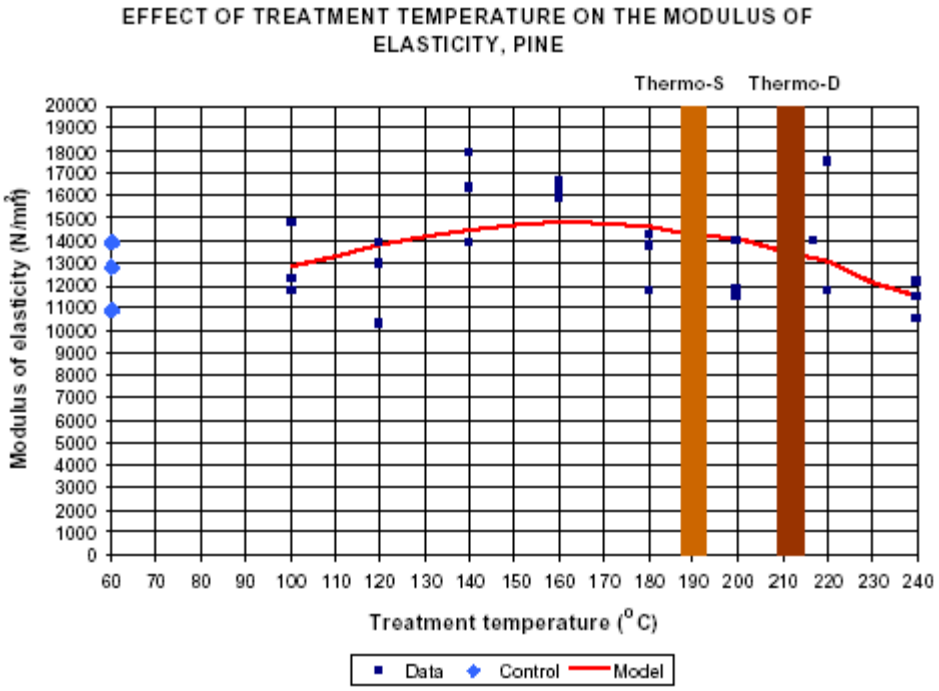
LUNAWOOD®

ThermoWood®

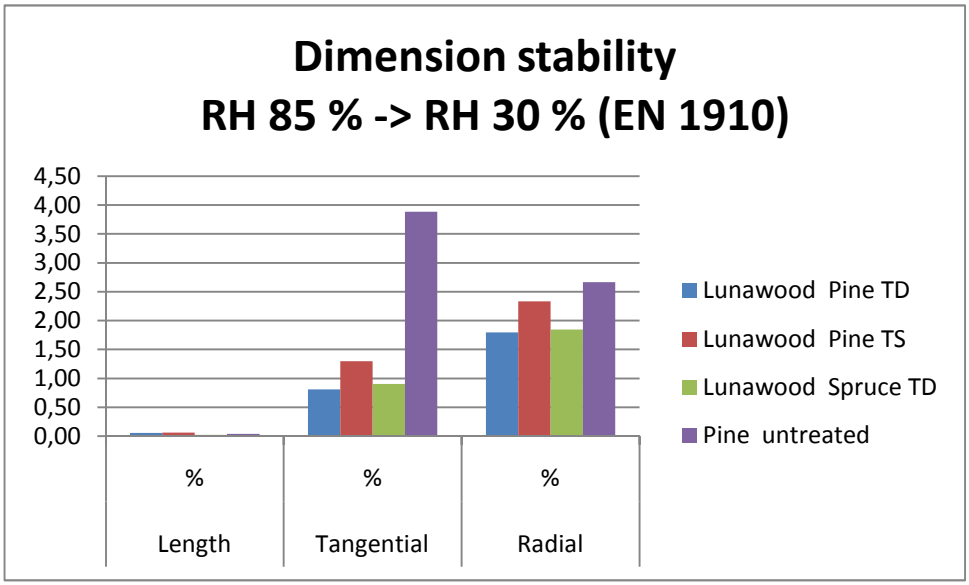
Main Properties

Updated 1.3.2011 / PVäät

Property	Description
Equilibrium moisture content (EMC)	Due to changes in cellular structure, wood's ability to absorb water from the surrounding air has decreased. The EMC of Finnish softwoods and hardwoods becomes 40-50 % lower, compared to untreated wood (depending on heat-treatment degree). As a result of the reduction in EMC, thermowood is more stable than normal wood in changeable climatic conditions. The moisture content does not change as much as untreated wood when stored at a work site. The wood is re-moisturized after treatment to moisture content between 6-9%, depending on end product. 
Strength	The strength of the wood does not weaken considerably in lower treatment degrees.  The reference values for untreated spruce at 12% moisture content are: bending strength 40-50 N/mm2 and modulus of elasticity 9,700-12,000 N/mm2. According this it is recommended to use max 500 mm c/c with Lunawood decking and 600 mm c/c with cladding.

Dimensional stability

Compared to untreated wood the dimensional movement of wood decreases even 80-90 % (depending on heat-treatment degree).
Shrinking and swelling is decreased as well. Cupping, twist and other distortion are significantly reduced compared to normally kiln-dried wood. Treatment significantly reduces the tangential and radial swelling.



Biological durability

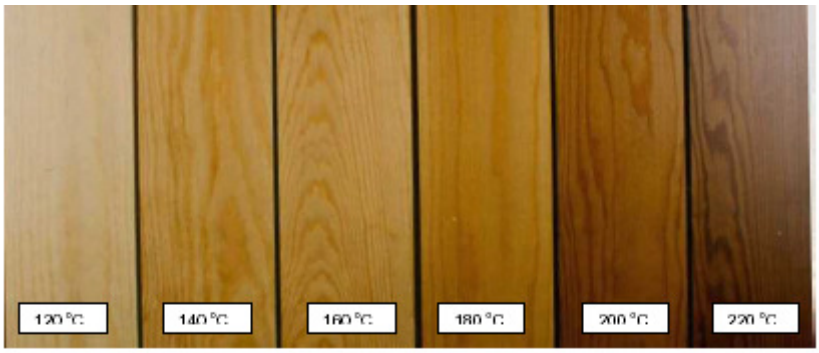
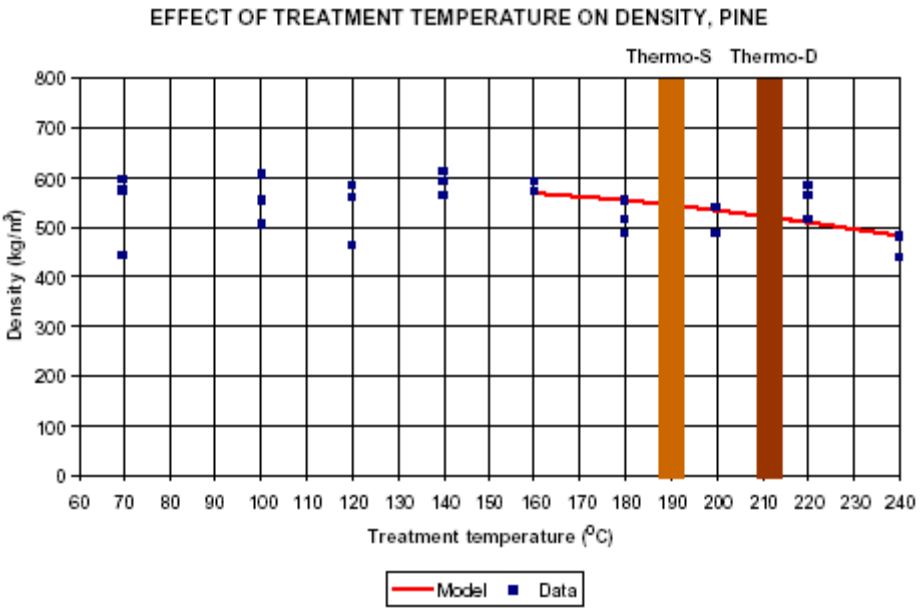
The durability of Lunawood thermowood is based on the changes in chemical compounds in the wood. Wood's hemicellulose (sugar compound) is degraded, leaving no nutritive matter for fungi.

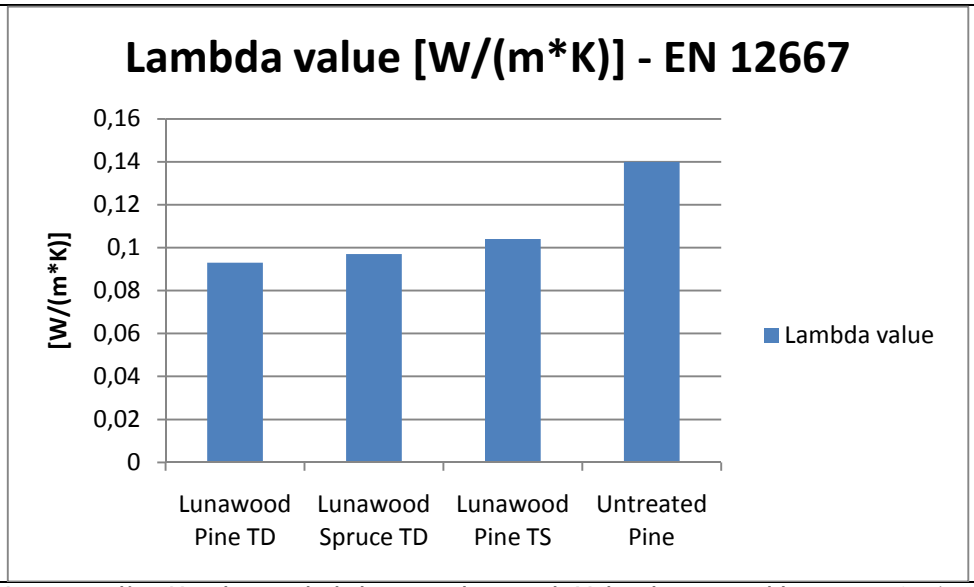
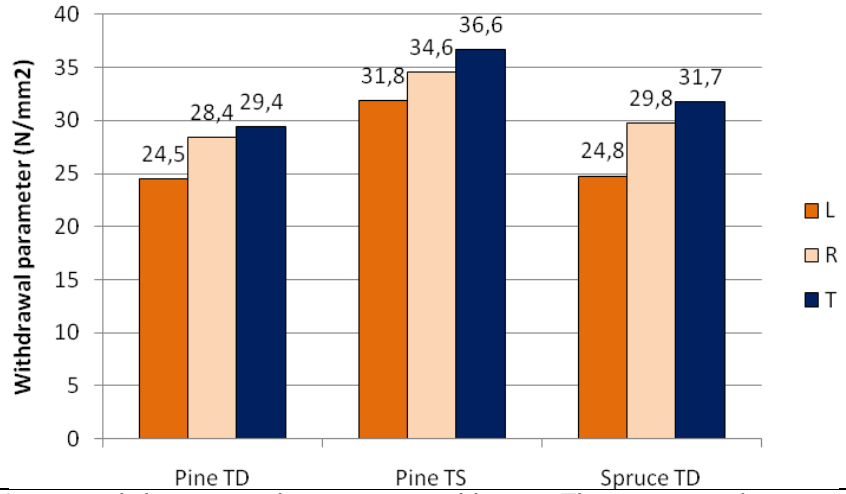
High resistance to moisture and durability against decay-causing fungi makes it an excellent material for use in gardens, terraces as well as many other outdoor applications. Different process levels are used dependant on the required durability (Thermo-S and Thermo-D). As a consequence of heat treatment sugars of wood are in form, that decay funguses can't use them as nourishment.

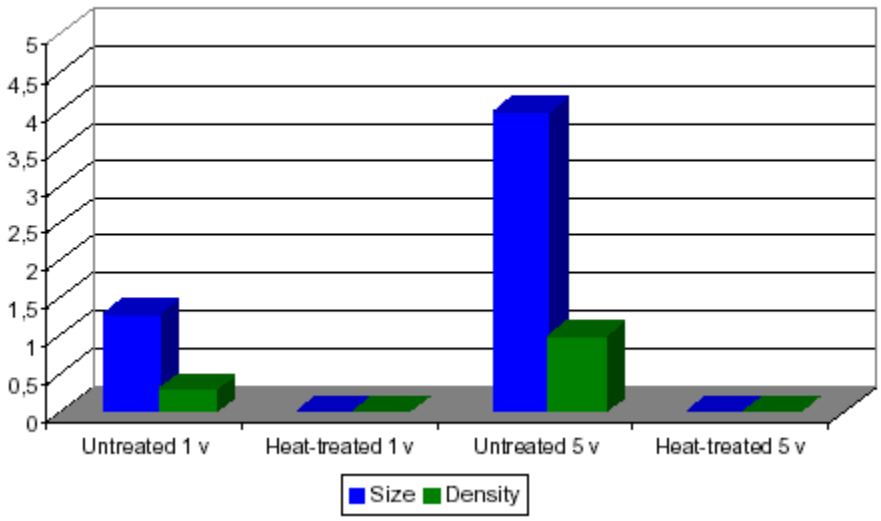
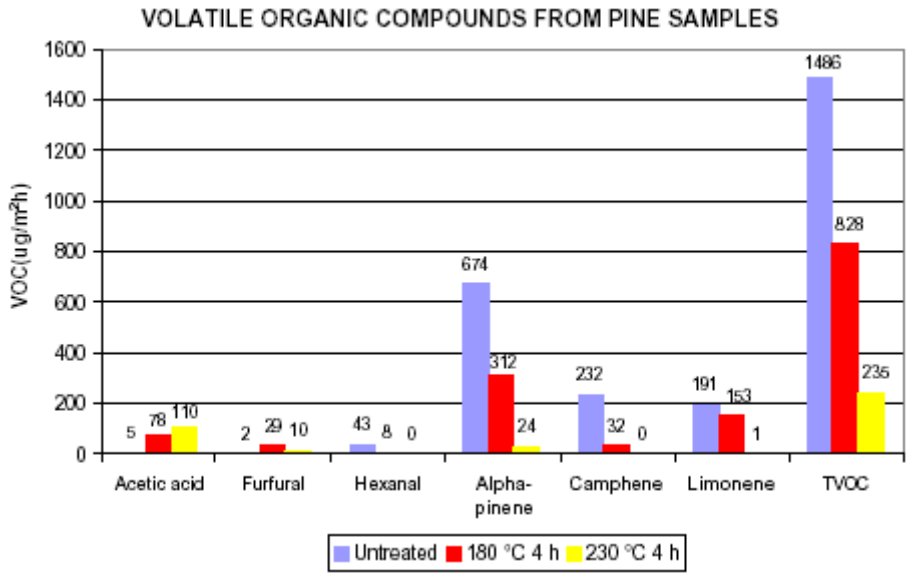
As decay resistance places it in decay resistance category 2, it is an alternative to AB-class impregnated wood (KOMO certificate). Lunawood thermowood is however not recommended to conditions where it would be saturated in water or come in contact with soil. According this information BRE concludes 30 years expected service life for Lunawood cladding and decking products.

DURABILITY CLASSIFICATION OF DIFFERENT WOOD SPECIES

WOOD SPECIE	1 (highest)	2	3	4	5 (weakest)
	Iroko	Iroko			pine spruce
		WRC	WRC		
			Larch	Larch	
		Luna-Thermo-D			
			LunaThermo-S		
		European Oak			
	CCA impegrated		Douglas Fir	Douglas Fir	
		C impegrated			

Colour	The wood attains an even brown colouring throughout. The colour will fade over time due to the effects of both ultraviolet radiation from the sun and humidity. In outdoor applications, the lightening or greying in colour caused by the sun can be reduced by protecting it with a surface-treatment agent containing a pigment and UV-block. In indoor use changes are not strong, but lightening of colour on some level may be observed by time. Surface treatment for Lunawood thermowood in indoors is not necessary but recommended. Surface treatment such as varnishing, waxing or by using oil continues the life cycle of e.g. flooring materials and helps cleaning surfaces.  Figure 20-4. The colour of heat-treated pine. Treatment temperatures from 120 to 220°C at 20°C intervals. Treatment time (photo: VTT).
Weight (density)	The weight of wood decreases depending on treatment temperature and treatment time (by experiences 10-20%). Decreasing of weight is caused both by drying of wood and by degrading of compounds. 

Thermal conductivity and thermal insulation	
pH-value	Lunawood's pH-value is slightly turned to acid. Value has varied between 4 - 6. Stainless and acid-proof fasteners are recommended to use in outdoor applications (humid conditions) to avoid corrosion of fasteners.
Fastener use	Fastener are recommended to place 70 mm from the product ends and 10 mm from sides. Also self drilling fasteners or pre drilling is recommended. The average values of withdrawal parameter of a wood screw (diameter = 2.7 mm and depth of penetration = 20 mm) in heat-treated pine and spruce in different directions (L = longitudinal, R = radial, T = tangential). Test is made according EN 1382. 
Chemical additives	Lunawood thermowood contains no additives. The process only uses vapour and heat, and no chemicals or agents are added to the material. The environmental benefit is that natural surroundings remain unaffected, and processing waste can be disposed e.g. by burning or by taking it to landfill without risk. Lunawood thermowood is easily recycleable.
Fire properties	Tests has been carried out by Single Burning Item SBI test (EN 13823), by CTBA according to the NF B 52501 standard, and by British Standard BS 476 Part 7, and by VTT Finland according to ISO 5660. Tests indicate, that fire properties are almost the same as with untreated wood (D s1-d0).
Smell	The smoke-like smell of heat-treated wood most likely comes from furfural. It has been found to disappear over time, and when surface treatments are applied the smell is removed.

Other	All resin is dispersed from the timber during the heat-treatment process. The benefit of dispersed resin means that there is no risk of resin seeping through surface paintwork. According to tests the best coating systems have consisted of the priming oil and solvent-based alkyd or water-based acrylic topcoat. EFFECT OF SUBSTRATE TO PAINT FLAKING 
Formaldehyde	Formaldehyde contained by natural wood dissolves completely. Heat-treated wood is sterile and practically toxic-free. The total emission for heat-treated pine treated at 180 °C has been in tests 828 g/m^{2}h, and the emission of heat-treated pine treated at 230 °C has been at the lowest 235 g/m^{2}h (by the KET 3300495 test method), while untreated pine has showed the largest quantity of volatile organic compounds, 1486 g/m^{2}h. VOLATILE ORGANIC COMPOUNDS FROM PINE SAMPLES 

Limitations	Based on the results of the field test (EN 252), it is recommended that Lunawood thermowood not be used in deep ground applications where structural strength is required. Lunawood thermowood is not recommended be used in continuous direct contact with moist soil. When constantly immersed in water or making soil contact, it loses its strength properties due to certain chemical reactions. Thermo-D material in ground contact where structural performance is not critical and periodic drying of the surfaces is allowed does not cause any significant deterioration to the material. This is especially apparent when the ground has good drainage and is made up of sand or shingle.