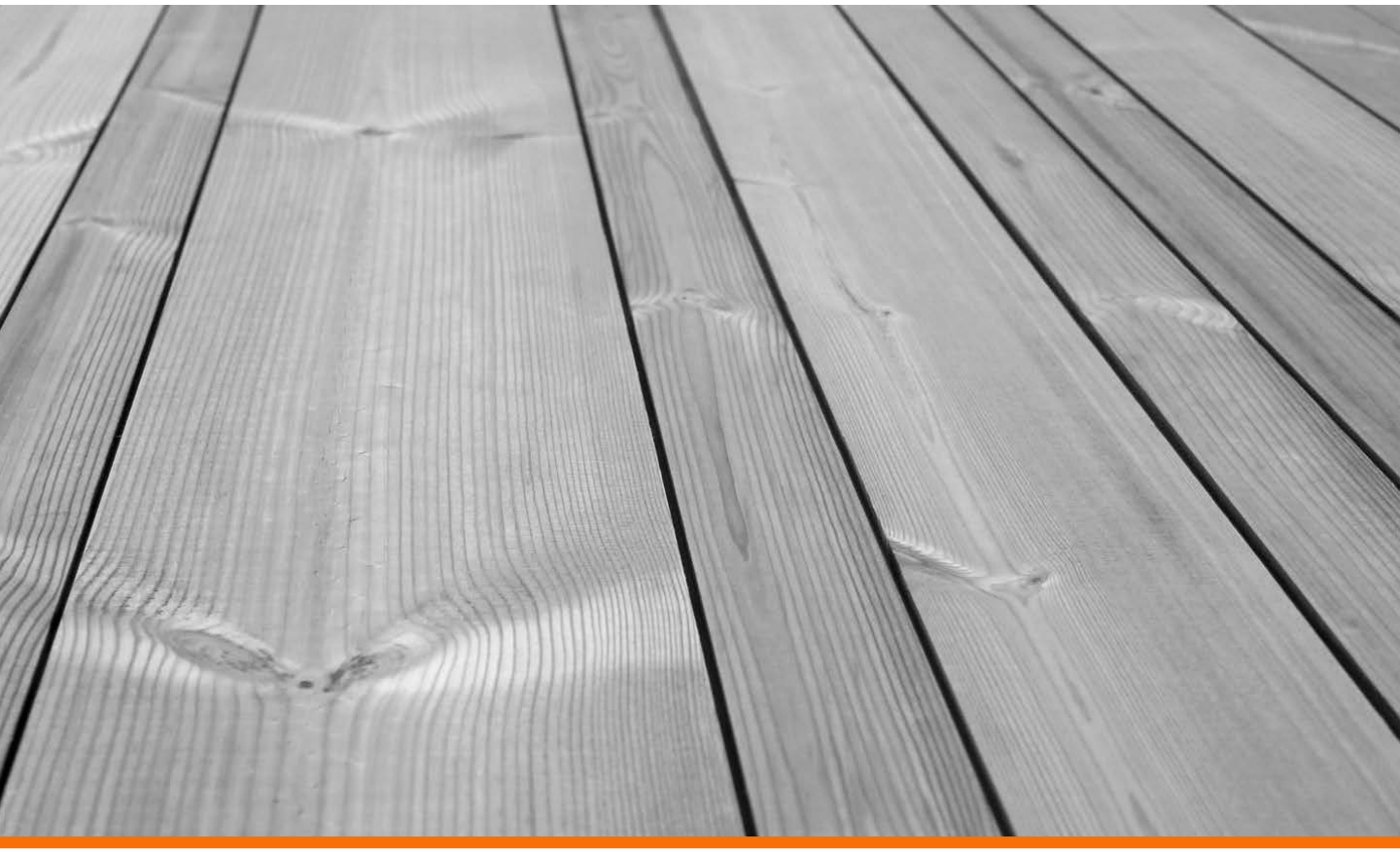
LUNAWOOD®



Lunawood Data Sheet

ABOUT THERMOWOOD

- Thermowood has been produced only using high temperatures and steam
- It has retained its natural qualities in an enhanced form
- Our quality products are quaranteed by our meticulous attention to the selection of raw material – We use only the best timber and just the heart wood
- There is variation within each batch and individual product produced as this is a natural product

ABOUT THE TESTING PROCEDURE

- Each standard determines its own test setting but generally they are: temperature 20 ±2 °C and humidity Rh 65±5 %.
- The test pieces are stabilized and the test is then carried out according to the specifications.
- Comparisons are: untreated Scots Pine ja Norway Spruce if not otherwise stated

EQUIPMENT USED

Climate test chamber

Stabilizing Unit

Scales and ovens at Lunawood production facility

TESTS

1. BENDING STRENGTH (4-POINT) (N/mm²)

Test done according to SFS-EN 408

TESTED PRODUCT	TESTED BY	VALUE N/mm²
LUNAWOOD THERMO-D PINE 26 mm thickness planed	SAVONIA 1	fm 19,67 N/mm² MOE 11240 N/mm²
LUNALAM THERMO-D PINE (LD2) 26 mm thickness planed	SAVONIA 1	Fm 22,75 N/mm² MOE 11545 N/mm²
LUNAWOOD THERMO-S PINE GENERAL 190 degrees	SAVONIA 1	Fm 21,56 N/mm² MOE 11284 N/mm²
PINE COMPARISON	*	MOE 10000 N/mm²
SPRUCE COMPARISON	*	MOE 10900 N/mm²

TESTED BY / DATE
SAVONIA 1 Knuutinen, Ilja: 8/2009
* www.puuinfo.fi

1. BENDING STRENGTH (4-POINT) (N/mm²)

Test done according to SFS-EN 408

METHOD
Test pieces are bent from four points in a testing jig until they fail.

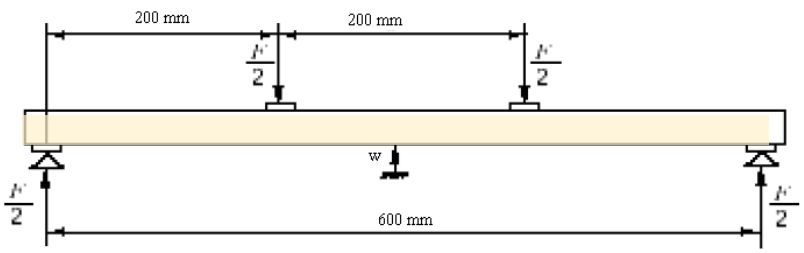
TEST MEASURES
Timbers load bearing ability in relation to dimensions.

MOE (MODEL OF ELASTICITY)
A number that measures an object or substance's resistance to being deformed elastically (i.e., non-permanently) when a force is applied to it

ABOUT MOE
The larger the figure, the better for building:
Example: with a 26 mm thermowood decking board, 500 mm structural support where as 600 mm needed with regular wood.

Fm 20 is about the equivalent of 500 kg maximum load

TO NOTE
Density has a significant effect so natural variations occur.



Knuutinen, Ilja 8/2009 (SFS-EN 408)

TESTED BY / DATE
SAVONIA 1 Knuutinen, Ilja: 8/2009
* www.puuinfo.fi

2. BENDING STRENGTH (3-POINT) (N/mm²)

Test done according to SFS-EN 310, three point bending
(NOTE: SAVONIA 3:SFS-EN 408:2003, 13)

TESTED PRODUCT	TESTED BY	VALUE N/mm²
LUNAWOOD THERMO-D PINE 26X140 212 degrees	SAVONIA 2	**MOE 7944 N/mm²** **fm 49,1 N/mm2** (Span was fixed: 400 mm) **MOE 6703 N/mm²** **fm 38,9 N/mm²** (Span was fixed: 300 mm)
LUNALAM THERMO-D PINE 26 mm thickness planed	SAVONIA 1	**MOE 10120 N/mm²** (Span was fixed: 600 mm) **MOE 9085 N/mm²** (Span was fixed: 450 mm)
LUNAWOOD THERMO-S PINE GENERAL 190 degrees	SAVONIA 3	**fm 77,99 N/mm²** (Span was fixed: 380 mm)
PINE COMPARISON 26X140	MOE* SAVONIA 3	**MOE 10900 N/mm²** **fm 76,31 N/mm²** (Span was fixed: 380 mm)
SPRUCE COMPARISON 26X140	MOE* SAVONIA 3	**MOE 10000 N/mm²** **fm 73,08 N/mm²** (Span was fixed: 380 mm)

TESTED BY / DATE:
SAVONIA 1: Arbelius, Esa 11/2014
SAVONIA 2: Närhi, Emmi 5/2012
SAVONIA 3: Knuutinen, Ilja 7/2009
*: www.puuinto.fi

2. BENDING STRENGTH (3-POINT) (N/mm²)

Test done according to SFS-EN 310, three point bending
(NOTE: SAVONIA 3:SFS-EN 408:2003, 13)

METHOD
Test pieces are bent from three points n a testing jig until they fail.

TEST MEASURES
Timbers load bearing ability in relation to dimensions.

MOE (Model of Elasticity)
A number that measures an object or substance's resistance to being deformed elastically (i.e., non-permanently) when a force is applied to it

ABOUT MOE
The larger the figure, the better for building:
Example: with a 26 mm thermowood decking board, 500 mm structural support where as 600 mm needed with regular wood.

Fm 20 is about the equivalent of 500 kg maximum load

TO NOTE: Density has a significant effect so natural variations occur.

Arbelius, Esa 11/2014

TESTED BY / DATE:
SAVONIA 1: Arbelius, Esa 11/2014
SAVONIA 2: Närhi, Emmi 5/2012
SAVONIA 3: Knuutinen, Ilja 7/2009
*: www.puuinto.fi

3. SURFACE TRACTION TEST (g/dm²)

Test done according to SFS-EN ISO 11998

INSTRUMENT USED	LUNAWOOD THERMO-D PINE 26 mm thickness planed g/dm²	PINE COMPARISSON g/dm²	SPRUCE COMPARISSON g/dm²	TESTED BY
WILD BOAR	0,23 g/dm²	1,29 g/dm²	0,84 g/dm²	SAVONIA 1
NYLON BRUSH	0,22 g/dm²	0,86 g/dm²	0,57 g/dm²	SAVONIA 1
ABRASIVE SPONGE	0,21 g/dm²	0,63 g/dm²	0,92 g/dm²	SAVONIA 1
SANDPAPER	0,32 g/dm²	1,20 g/dm²	1,13 g/dm²	SAVONIA 1
STEEL BRUSH	0,90 g/dm²	--	--	SAVONIA 2

TESTED BY / DATE:
SAVONIA 1: Närhi, Emmi 7/2012
SAVONIA 2: Närhi, Emmi 8/2012
COMPARISSONS: Närhi, Emmi 2/2016

3. SURFACE TRACTION TEST (g/dm²)

Test done according to SFS-EN ISO 11998

METHOD

Test pieces are placed into a special instrument and brushed with different brushes. Altogether the test consists of 11 000 beats, 37±2 beats/min, total test time 297 min = aprox 5 h.

TEST MEASURES

Wear of the surface is expressed in mass loss in relation to area (g/dm2).

ABOUT THE TEST

The test has been modified from a paint/lacquer test to give data about the wear the product can withstand in use.

STEEL BRUSH TEST

The abrasion resistance was determined by scrubbing the surface of the test specimen with a wire brush (total weight 3500 g). Test pieces were subjected to 100 scrub cycles. The tester operated at approximately (37 ± 2) scrub cycles per minute. The loss in mass was used to evaluate the abrasion resistance. Abrasion distance was 155 mm.

Närhi, Emmi: 8/2012

TESTED BY / DATE:
SAVONIA 1: Närhi, Emmi 7/2012
SAVONIA 2: Närhi, Emmi 8/2012

4. VOC (mg/m²h)

Test done according to KET 3300495

TESTED PRODUCT	TESTED BY	VALUE mg/m²h
THERMOWOOD PINE GENERAL 212 degrees		0,24 mg –> 0,04 mg
LUNAWOOD THERMO-D PINE 19 mm thickness planed	--	--
LUNAWOOD THERMO-D PINE 26 mm thickness planed	--	--
LUNAWOOD THERMO-D PINE 40 mm thickness planed	--	--
LUNALAM THERMO-D PINE 19 mm thickness planed	--	--
LUNALAM THERMO-D PINE 26 mm thickness planed	--	--
LUNALAM THERMO-D PINE 40 mm thickness planed	--	--
LUNAWOOD THERMO-S SPRUCE GENERAL 190 degrees		0,22 mg –> 0,08 mg
PINE COMPARISON		2 mg –> 1 mg
SPRUCE COMPARISON	--	--

Spruce samples tested: Thickness 25 mm, width 100 mm length 100 pmm
Pine samples tested: Thickness 15 mm, width 100 mm, length 100 mm

EXAMPLE:
Max. values for VOC for indoor use in the best class M1 (Finnish classifying system) is 0,2mg/m²h (28 days after assembly)

-> For thermowood the figure is 0,04 and untreated Scots Pine 0,1 mg/m²h

TESTED BY / DATE:
KUOPIO UNIVERSITY: Marko Hyttinen 2010

4. VOC (µg/m²h)

Test done according to KET 3300495

ABOUT VOC
(Volatile Organic Compounds)
VOC emissions are harmful gases emitted into indoor air. This test gives a value which can not be exceeded in indoor air. Possible effects of these emissions to humans are respiratory problems and odors. It should be noted that a smell that in conceived as bad does not automatically mean that there are harmful emissions.

Typical emissions tested:

Carboxylic Acids (Acetic acid, Benzoic acid)

Aldehydes (furfural, hexanal, neonatal)

Ketones (2-butanone and 3-hydroxy)

Terpenes (alpha pinene and dl-limonene)

With wood based products the emissions are larger at the beginning of the test and even out during the test period which is 28 day. The values given have been measured at the beginning and after 28 days.

REGARDING THERMOWOOD
The results of thermowood are much better compared to untreated normal wood. The values received with the lower temperature Thermo-S process are however slightly less impressive as some emissions still remain in the wood.

TESTED BY / DATE:
KUOPIO UNIVERSITY: Marko Hyttinen 2010

4. VOC (µg/m²h)

Test done according to KET 3300495

METHOD

VOC emissions are measured by collecting air samples in Tenax GR absorbent which are then analyzed by gas chromatography connected to the mass-selective detector . The results are then transformed into a standardized format by using mathematical formulas.

In this test the test pieces were gathered directly of the production line and sent in aluminum foil to the test facility to avoid contamination.

Two identical metal chambers (volume 120L) were used. Compressed air was first cleaned from VOCs by activated carbon. Temperature of air was 23 °C and the relative humidity (RH) of air was adjusted to ca. 50%

Labmax gas chromatograph machine which is used to measure VOC

TESTED BY / DATE:
KUOPIO UNIVERSITY: Marko Hyttinen 2010

5. STABILITY SHRINKING AND SWELLING (changes by %)

Test done according to SFS-EN 317

TESTED PRODUCT	TESTED BY	VALUE %
LUNAWOOD THERMO-D PINE GENERAL 212 degrees	--	--
LUNAWOOD THERMO-D PINE 19 mm thickness planed	--	--
LUNAWOOD THERMO-D PINE 26 mm thickness planed	SAVONIA	24h 1,3 % 168h 1,5 %
LUNAWOOD THERMO-D PINE 40 mm thickness planed	--	--
LUNALAM THERMO-D PINE 19 mm thickness planed	--	--
LUNALAM THERMO-D PINE 26 mm thickness planed	--	--
LUNALAM THERMO-D PINE 40 mm thickness planed	--	--
LUNAWOOD THERMO-S PINE GENERAL 190 degrees	--	--
PINE COMPARISON	SAVONIA	24 h 1,6 % 168 h 2,3 %
SPRUCE COMPARISON	--	--

TESTED BY / DATE:
SAVONIA: Närhi, Emmi: 05/2012

5. STABILITY SHRINKING AND SWELLING (changes by %)

Test done according to SFS-EN 317

METHOD
Test pieces are measured, submerged into water for 24h and 168h and measured.

TEST MEASURES
Changes are expressed by percentage. The percent change from the original thickness represents the thickness of swell.

COMPARISON
(Picture below)
At X-axle the maximum change in swelling is:
4 % in thermowood
8 % in untreated Scots Pine

At Y-axle the maximum change in swelling is:
2% in thermowood
4% in untreated Scots Pine

HUMIDITY
Normal indoor humidity in Finnish circumstances (+20°C) is 50-60%.
In that case typical shrinking and swelling of:
untreated Scots Pine is 10-12%
thermowood 5-6%

= Thermowood is 50% more stable

Y Most changes occur within the first 24h of wood being exposed to moisture.

Swelling of wood

X

Lunawood

6. pH (value)

Test done according to pulp industry test

TESTED PRODUCT	TESTED BY	VALUE
LUNAWOOD THERMO-D PINE GENERAL 212 degrees	SAVONIA	4
LUNAWOOD THERMO-D PINE 19 mm thickness planed	--	--
LUNAWOOD THERMO-D PINE 26 mm thickness planed	--	--
LUNAWOOD THERMO-D PINE 40 mm thickness planed	--	--
LUNALAM THERMO-D PINE 19 mm thickness planed	--	--
LUNALAM THERMO-D PINE 26 mm thickness planed	--	--
LUNALAM THERMO-D PINE 40 mm thickness planed	--	--
LUNAWOOD THERMO-S PINE GENERAL 190 degrees	SAVONIA	4
PINE COMPARISON	*	4,5-5
SPRUCE COMPARISON	*	4,5-5

* Pine and spruce are typically similar with a pH-value of 4,5-5

TESTED BY / DATE:
SAVONIA: Kiviranta, Kalle 6/2010

6. pH (value)

Test done according to pulp industry test

METHOD
Test material is smashed, boiled with water and tested with Universal Indikator papier 1-14 (Macherey-Nagel).

TEST MEASURES
pH tells the acidity or alkalinity of a solution on the scale of 1 to 14. Indicator alters color accordingly and is compared to the color coded scale on the package.

ABOUT THERMOWOOD
Individual differences occur but thermowood is more acidic than untreated scots pine.

The acidity of normal wood is about 4,5 and thermowood 5.
However the 0,5 difference in acidity means that the thermowood contain 4-times as much acid than untreated scots pine.

WHAT DOES THIS MEAN?
Nails and screws used for outdoor applications need to be stainless steel. The thermowood can develop spots of rust when in contact with iron particles so avoid using grinders etc. right next to it.

Note that the acidity of thermowood needs to also be considered when choosing:
- Glue
- Surface treatment
- Cleaning products

TESTED BY / DATE:
SAVONIA: Kiviranta, Kalle 6/2010

7. EQUILIBRIUM MOISTURE CONTENT (EMC) (%)

Test done according to EN 13183-1 (KYAMK)
”Moisture content of a piece of sawn timber. Part 1: Determination by oven dry method.”

TESTED PRODUCT	TESTED BY	VALUE %
LUNAWOOD THERMO-D PINE GENERAL 212 degrees	KYAMK	6,4 %
LUNAWOOD THERMO-D PINE 19 mm thickness planed	--	--
LUNAWOOD THERMO-D PINE 26 mm thickness planed	--	--
LUNAWOOD THERMO-D PINE 40 mm thickness planed	--	--
LUNALAM THERMO-D PINE 19 mm thickness planed	--	--
LUNALAM THERMO-D PINE 26 mm thickness planed	--	--
LUNALAM THERMO-D PINE 40 mm thickness planed	--	--
LUNAWOOD THERMO-S PINE GENERAL 190 degrees	KYAMK	9,1 %
LUNAWOOD THERMO-D SPRUCE GENERAL 212 degrees	KYAMK	7.3%
PINE COMPARISON	TKK	12,6 %
SPRUCE COMPARISON	TKK	11,8 %

TESTED BY / DATE:
TKK: Mehtälä, Tiina: 3/2006
KYAMK: Väärä, Tuomo: 2/2010

7. EQUILIBRIUM MOISTURE CONTENT (EMC) (%)

Test done according to EN 13183-1 (KYAMK)
”Moisture content of a piece of sawn timber. Part 1: Determination by oven dry method.”

METHOD

Test pieces are stabilized (20 +/- 2) °C, air humidity (65+/- 5)%, weighted out, dried at 103 ±2 °C so long that the wood has stabilized, and weighted out again. The final weighing is done after the piece is completely dry.

TEST MEASURES

The percent weight change from the original weight represents the moisture content.

TESTED BY / DATE:
TKK: Mehtälä, Tiina: 3/2006
KYAMK: Väärä, Tuomo: 2/2010

7. EQUILIBRIUM MOISTURE CONTENT (EMC) (%)

Test done according to EN 13183-1 (KYAMK)

THERMOWOOD
The thermal modification process lowers the EMC. The higher the process temperature the lower the EMC.

COMPARISON

EMC depends on the weight loss which occurs during the thermal modification process. With thermowood like Lunawood Thermo-D it is 7%, 2/3 lower than with untreated scots pine

With Lunawood Thermo-S it is 2%, about half of the weight loss in untreated Scots Pine.

When EMC (equilibrium moisture content) drops 50 % compared to normal wood, the swelling drops also which means thermowood is more dimensionally stable

HUMIDITY/EMC/WHEATHER CONDITIONS

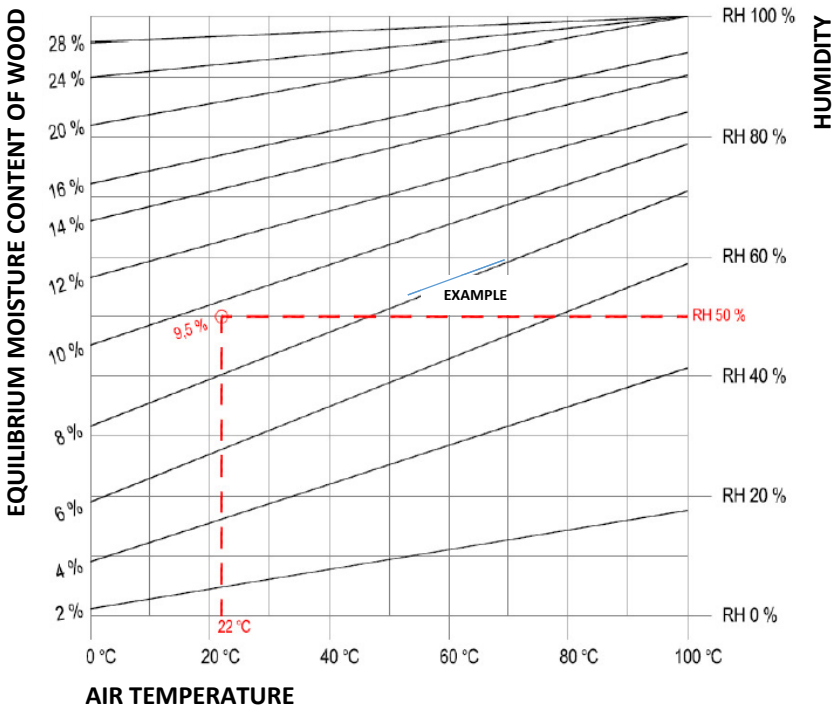
Humidity 65% /	EMC Thermo-S 7%, Thermo-D 5%
Humidity 100% /	EMC Thermo-S 14%, Thermo-D 10%

All in all the maximum EMC of thermowood is 14%, which it will reach in any weather conditions. In warmer climates where it is also more humid this will just occur more rapidly.

PROVEN ENDURANCE
Mold spores need a minimum 28% EMC to grow and start the decay process. As the maximum EMC for thermowood is only 14% they won't grow in it. This is why we can state that we offer proven endurance.

TESTED BY / DATE:
TKK: Mehtälä, Tiina: 3/2006
KYAMK: Väärä, Tuomo: 2/2010

7. EQUILIBRIUM MOISTURE CONTENT (EMC) (%)



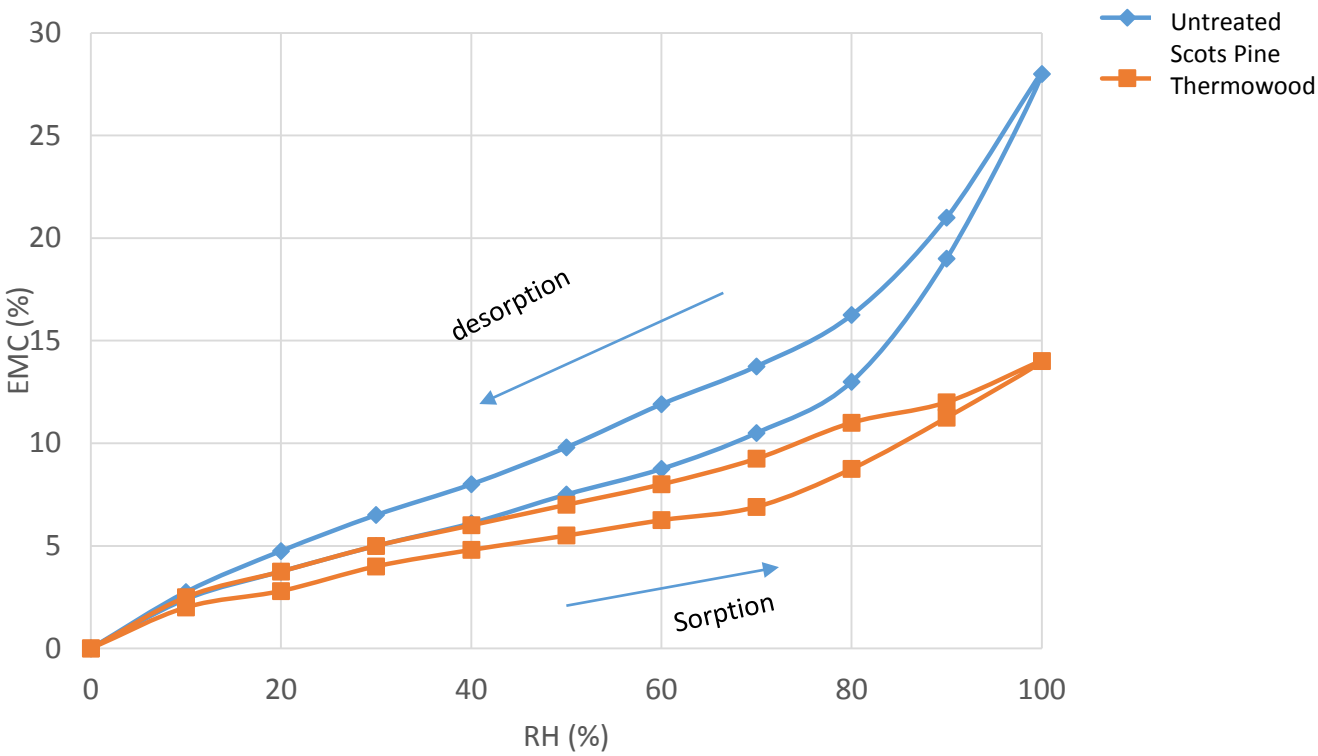
THE RELATION OF EQUILIBRIUM MOISTURE CONTENT TO TEMPERATURE AND HUMIDITY IN UNTREATED SCOTS PINE

FOR THERMOWOOD THE FIGURE IS HALF

EQUILIBRIUM MOISTURE CONTENT
(recomendation for different materials)

FRAMES	**≤ 24%**
EXTERIOR CLADDING BOARDS	**≤ 18%**
INTERIOR CLADDING BOARDS	**≤ 16%**
FLOORS	**≤ 10%**

7. EQUILIBRIUM MOISTURE CONTENT (EMC) (%)



Sorption = gain of moisture from the surrounding air
Desorption = loss of moisture to the surrounding air

Lunawood production facility,
Stabilizing equipment

TESTED BY / DATE:
TKK: Mehtälä, Tiina: 3/2006
KYAMK: Väärä, Tuomo: 2/2010

8. FRICTION TEST (PTV value)

Test done according to CEN/TS 15676 & BS 7976: 1-3 2002

TESTED PRODUCT	TESTED BY	VALUE
LUNAWOOD THERMO-D PINE GENERAL 212 degrees	--	--
LUNAWOOD THERMO-D PINE 19 mm thickness planed	--	--
LUNAWOOD THERMO-D PINE 26 mm thickness planed	SAVONIA	Dry conditions: 56 Wet conditions: 29
LUNAWOOD THERMO-D PINE 40 mm thickness planed	--	--
LUNALAM THERMO-D PINE 19 mm thickness planed	--	--
LUNALAM THERMO-D PINE 26 mm thickness planed	--	--
LUNALAM THERMO-D PINE 40 mm thickness planed	--	--
LUNAWOOD THERMO-S PINE GENERAL 190 degrees	--	--
PINE COMPARISON	--	--
SPRUCE COMPARISON	--	--

TESTED BY / DATE:
SAVONIA Närhi, Emmi: 5/2012

8. FRICTION TEST (PTV value)

Test done according to CEN/TS 15676 & BS 7976: 1-3 2002

METHOD

Test surface is subjected to swings by a pendulum that has shoe sole rubber on the tip.

TEST MEASURES

Slip potential is expressed by PTV value and divided into four categories:

High (≤24)
Moderate (25 – 34)
Low (35 – 64)
Extremely low (≥65)

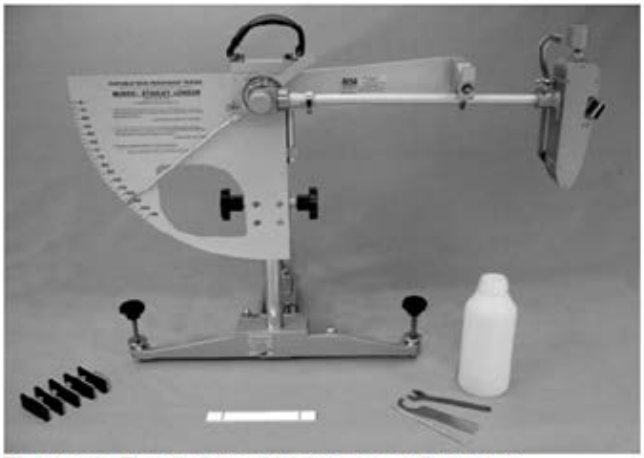


Figure 6. Pendulum Skid test equipment

Närhi, Emmi: 5/2012

TESTED BY / DATE:
SAVONIA Närhi, Emmi: 5/2012

9. DYNAMIC COEFFICIENT OF FRICTION

Test done according to EN 13893:2002

TESTED PRODUCT	TESTED BY	VALUE
LUNAWOOD THERMO-D PINE GENERAL 212 degrees	--	
LUNAWOOD THERMO-D PINE 19 mm thickness planed	--	
LUNAWOOD THERMO-D PINE 26 mm thickness planed	---	
LUNAWOOD THERMO-D PINE 40 mm thickness planed	--	
LUNALAM THERMO-D PINE 19 mm thickness planed	--	
LUNALAM THERMO-D PINE 26 mm thickness planed	SAVONIA	Dry conditions: 0,65 Wet conditions: 0,50
LUNALAM THERMO-D PINE 40 mm thickness planed	--	
LUNAWOOD THERMO-S PINE GENERAL 190 degrees	--	
PINE COMPARISON	SAVONIA	Dry conditions: 0,75 Wet conditions: 0,51
SPRUCE COMPARISON	--	

TESTED BY / DATE:
SAVONIA Närhi, Emmi: 5/2012

9. DYNAMIC COEFFICIENT OF FRICTION

Test done according to EN 13893:2002

METHOD

The test was done using a floor slide control 2011 –unit which has sliders that are loaded to impose a specified force on the test surface. The sliders are then pulled parallel to the surface at a constant speed.

From this horizontal force a value can be then calculated.

Total mass of loaded slider:	24 N
Testing speed:	0,20 m/s
Measured path:	30 cm
Slider:	Shoe rubber slider

Both wet and dry surfaces were evaluated. The specimens were soaked in water for 10 minutes before the wet friction test.

TEST MEASURES

The dynamic coefficient of friction of floor coverings.

The minimum value requirement is 0,43 which means the material is safe for pedestrians.

Närhi, Emmi: 5/2012

TESTED BY / DATE:
SAVONIA Närhi, Emmi: 5/2012

10. THERMAL CONDUCTIVITY (W/(m*K))

Test done according to EN ISO 13787 + EN 12667

TESTED PRODUCT	TESTED BY	VALUE W/(m*K))
LUNAWOOD THERMO-D PINE GENERAL 212 degrees	VTT	0,09 W/(m*K)
LUNAWOOD THERMO-D PINE 19 mm thickness planed	--	--
LUNAWOOD THERMO-D PINE 26 mm thickness planed	--	--
LUNAWOOD THERMO-D PINE 40 mm thickness planed	--	--
LUNALAM THERMO-D PINE 19 mm thickness planed	--	--
LUNALAM THERMO-D PINE 26 mm thickness planed	--	--
LUNALAM THERMO-D PINE 40 mm thickness planed	--	--
LUNAWOOD THERMO-S PINE GENERAL 190 degrees	VTT	0,10 W/(m*K)
PINE COMPARISON	VTT	0,12 W/(m*K)
SPRUCE COMPARISON	VTT	0,12 W/(m*K)

TESTED BY / DATE:
VTT: Hyttinen, Hannu and
Lepistö-Saukko, Eeva-Liisa: 9/2009

10. THERMAL CONDUCTIVITY (W/(m*K))

Test done according to EN ISO 13787 + EN 12667

METHOD

Test pieces are balanced (23°, Rh 52%) then placed between a cooling plate and a heating plate. The heat then starts to transfer evenly from the hot side to the cold.
Lambda-value/thermal conductivity is then calculated using the temperature difference, the transfer of heat etc. measured in the process.

TEST MEASURES

Thermal conductivity of the material so that two different materials (same piece size and density) can be compared. Thermal conductivity is determined by the heat flow.

ABOUT THIS TEST

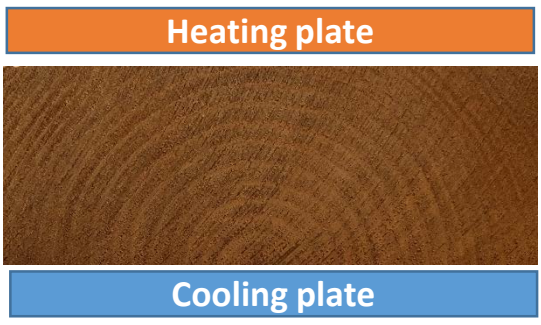
All materials have a unique thermal conductivity value (unit W/mK).
Thermal conductivity = Lambda-value (λ).

The smaller the value the better the insulation properties.

For the calculation of the heat penetration value (U-value, previously K-value) the entire structure must be known.

WITH THERMOWOOD

As the moisture content decreases, the density of the thermowood also lowers. This lessens its ability to conduct heat so making it better at insulating.
The density of the material also improves its insulation properties.



EN 12667

The temperature of this surface is measured, with sensor attached to the cooling plate, to see how well the material insulates heat in other words how poorly it conducts heat.

TESTED BY / DATE:
VTT: Hyttinen, Hannu and
Lepistö-Saukko, Eeva-Liisa: 9/2009

11. SCREW TRACTION RESISTANCE (N/mm²)

Test done according to: SFS-EN 13446 using screws 4,5X50/35 mm

TESTED PRODUCT	TESTED BY	VALUE N/mm²	(kg/cm²)
LUNAWOOD THERMO-D PINE GENERAL 212 degrees	SAVONIA	19,45 ± 1,47 N/mm²	198
LUNAWOOD THERMO-D PINE 19 mm thickness planed	--	--	
LUNAWOOD THERMO-D PINE 26 mm thickness planed	--	--	
LUNAWOOD THERMO-D PINE 40 mm thickness planed	--	--	
LUNALAM THERMO-D PINE 19 mm thickness planed	--	--	
LUNALAM THERMO-D PINE 26 mm thickness planed	--	--	
LUNALAM THERMO-D PINE 40 mm thickness planed	--	--	
LUNAWOOD THERMO-S PINE GENERAL 190 degrees	SAVONIA 2	19,98 N/mm²	204
PINE COMPARISON	SAVONIA 2	21,12 N/mm²	215
SPRUCE COMPARISON	SAVONIA 2	17,57 N/mm²	179

TESTED BY / DATE:
SAVONIA: Knuutinen, Ilja: 6-8/2009
SAVONIA 2: Knuutinen, Ilja: 7/2009

11. SCREW TRACTION RESISTANCE (N/mm²)

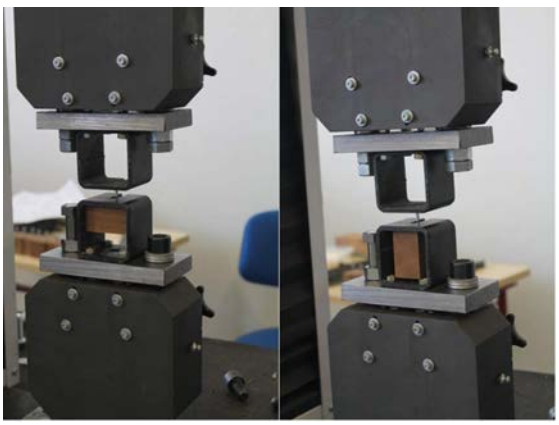
Test done according to: SFS-EN 13446 using screws 4,5X50/35 mm

METHOD
Screw is inserted into the test piece and ripped out in a testing jig. Force is measured and calculated.

TEST MEASURES
The received value expresses the withdrawal force in relation to the screw dimensions.

NOTE
When correct screws are used as per manufacturers instructions the mounting does not significantly effect the properties.

The density of the material has a greater effect.



Närhi, Emmi 4/2012

TESTED BY / DATE:
SAVONIA: Knuutinen, Ilja: 6-8/2009
SAVONIA 2: Knuutinen, Ilja: 7/2009

12. DURABILITY AGAINST DECAY 1/2

Test done according to no. Standard AWPA E10

Official durability class for Lunawood Thermowood is 2 (EN 350-1)

TESTED PRODUCT	TESTED BY	BROWN 1	BROWN 2	BROWN 3	WHITE
LUNAWOOD THERMO-D PINE GENERAL 212 degrees	SP Trätek 1	1	1	1	1
LUNAWOOD THERMO-D PINE 19 mm thickness planed	--	--	--	--	--
LUNAWOOD THERMO-D PINE 26 mm thickness planed	--	--	--	--	--
LUNAWOOD THERMO-D PINE 40 mm thickness planed	--	--	--	--	--
LUNALAM THERMO-D PINE 19 mm thickness planed	--	--	--	--	--
LUNALAM THERMO-D PINE 26 mm thickness planed	--	--	--	--	--
LUNALAM THERMO-D PINE 40 mm thickness planed	--	--	--	--	--
LUNAWOOD THERMO-S PINE GENERAL 190 degrees	SP Trätek 1	3	1	3	3
PINE COMPARISON	SP Trätek 1	5	5	5	5
SPRUCE COMPARISON	--	--	--	--	--

TESTED BY / DATE:
SP Trätek 1: Westin, Mats: 12/2006

12. DURABILITY AGAINST DECAY 1/2

Test done according to no. Standard AWPA E10

METHOD

Test pieces are weighted before and after a ten week fungi inoculation.

TEST MEASURES

Test gives a value of rot resistance on the scale of 1 to 5.

ROUGH SCALE

1 = 0-5 %
2= 5-10 %
3= 10-15%
4= 15%-20%
5= >20 %

Westin, Mats: 12/2006

TESTED BY / DATE:
SP Trätek 1: Westin, Mats: 12/2006

13. DURABILITY AGAINST DECAY 2/2

Test done according to ENV 807

Official durability class for Lunawood Thermowood is 2 (EN 350-1)

TESTED PRODUCT	TESTED BY	COMPOST*	BROWN*	WHITE*
LUNAWOOD THERMO-D PINE GENERAL 212 degrees	SP Trätek 2	24: 1, 40: 1	24: 1, 40: 1	24:1, 40: 1
LUNAWOOD THERMO-D PINE 19 mm thickness planed	--	--	--	--
LUNAWOOD THERMO-D PINE 26 mm thickness planed	--	--	--	--
LUNAWOOD THERMO-D PINE 40 mm thickness planed	--	--	--	--
LUNALAM THERMO-D PINE 19 mm thickness planed	--	--	--	--
LUNALAM THERMO-D PINE 26 mm thickness planed	--	--	--	--
LUNALAM THERMO-D PINE 40 mm thickness planed	--	--	--	--
LUNAWOOD THERMO-S PINE GENERAL 190 degrees	SP Trätek 2	24: 1, 40: 2	24: 4, 40: 2	24: 3, 40: 4
PINE COMPARISON	SP Trätek 2	24: 3, 40: 3	24: 5, 40: 3	24: 3, 40: 4
SPRUCE COMPARISON	--	--	--	--

*

COMPOST: Garden Compost, *pH 7*
BROWN: Woodland soil, *pH 5.2*
WHITE: Woodland soil from a coniferous forest, *pH 4.6*

TESTED BY / DATE:
SP Trätek 2: Westin, Mats: 09/2008

13. DURABILITY AGAINST DECAY 2/2

Test done according to ENV 807

METHOD

Test pieces are weighted before and after 24 and 40 week fungi inoculation.

TEST MEASURES

Test gives a value of rot resistance on the scale of 1 to 5. Comparisons can be made only to the control piece.

ROUGH SCALE

1 = 0-5 %
2= 5-10 %
3= 10-15%
4= 15%-20%
5= >20 %

Westin, Mats: 09/2008

TESTED BY / DATE:
SP Trätek 2: Westin, Mats: 09/2008

14. DENSITY (kg/m³)

Test done according to SFS-EN 4773 (SAVONIA 1 & 2), SFS-EN 317 (SAVONIA 3)

TESTED PRODUCT	TESTED BY	VALUE kg/m³
LUNAWOOD THERMO-D PINE GENERAL 212 degrees	SAVONIA 1 SAVONIA 2	401 kg/m³ 380 kg/m³
LUNAWOOD THERMO-D PINE 19 mm thickness planed	--	--
LUNAWOOD THERMO-D PINE 26 mm thickness planed	SAVONIA 3	408 kg/m³
LUNAWOOD THERMO-D PINE 40 mm thickness planed	--	--
LUNALAM THERMO-D PINE 19 mm thickness planed	--	--
LUNALAM THERMO-D PINE 26 mm thickness planed	--	--
LUNALAM THERMO-D PINE 40 mm thickness planed	--	--
LUNAWOOD THERMO-S PINE GENERAL 190 degrees	SAVONIA 1 SAVONIA 2	457 kg/m³ 450 kg/m³
PINE COMPARISON	*	480 +/- 20 kg/m³
SPRUCE COMPARISON	*	470 +/- 20kg/m³

TESTED BY / DATE:
SAVONIA 1: Närhi, Emmi :6/2009
SAVONIA 2: Knuutinen, Ilja: 7/2009
SAVONIA 3: Närhi, Emmi :11/2011
* www.puuinfo.fi

14. DENSITY (kg/m³)

Test done according to SFS-EN 4773 (SAVONIA 1 & 2),
SFS-EN 317 (SAVONIA 3)

Actual weight of Thermo-D is aprox. 420 kg +/- 20 kg
Actual weight of Thermo-S is aprox. 430 kg +/- 20 kg

Variations due to equilibrium moisture content and natural differences in individual wood pieces compared to values received from laboratory tests.

METHOD
Test piece is dried, measured, weighted and the density is calculated.

TEST MEASURES
Density tells the weight of the material per cubic meter.

TESTED BY / DATE:
SAVONIA 1: Närhi, Emmi :6/2009
SAVONIA 2: Knuutinen, Ilja: 7/2009
SAVONIA 3: Närhi, Emmi :11/2011
* www.puuinfo.fi

15. BRINELL HARDNESS (N/mm²)

Test done according to SFS-EN 1534

TESTED PRODUCT	TESTED BY	VALUE N/mm²
LUNAWOOD THERMO-D PINE GENERAL 212 degrees	SAVONIA 1	1,28 N/mm²
LUNAWOOD THERMO-D PINE 19 mm thickness planed	--	--
LUNAWOOD THERMO-D PINE 26 mm thickness planed	SAVONIA 2	1,39 N/mm²
LUNAWOOD THERMO-D PINE 40 mm thickness planed	--	--
LUNALAM THERMO-D PINE 19 mm thickness planed	--	--
LUNALAM THERMO-D PINE 26 mm thickness planed	--	--
LUNALAM THERMO-D PINE 40 mm thickness planed	--	--
LUNAWOOD THERMO-S PINE GENERAL 190 degrees	--	--
PINE COMPARISON	SAVONIA 1	1,52 N/mm²
SPRUCE COMPARISON	SAVONIA 1	1,53 N/mm²

TESTED BY / DATE:
SAVONIA 1: Kiviranta, Kalle: 10/2013
SAVONIA 2: Närhi, Emmi: 5/2012

15. BRINELL HARDNESS (N/mm²)

Test done according to SFS-EN 1534

METHOD

Test pieces are pressed several times with a steel ball, the diameters of the impressions are measured and the HB is calculated.

TEST MEASURES

The ability of test surface to resist local pressure.

NOTE

+/- depending on the exact traits of the spot tested
(knot, density of the species).

GENERAL DIVISION

Hard woods	4-5
Medium woods	3
Soft Woods	1-2

Arbelius, Esa, 4/2015

TESTED BY / DATE:
SAVONIA 1: Kiviranta, Kalle: 10/2013
SAVONIA 2: Närhi, Emmi: 5/2012