THE FULL DECK

Real wood yacht decks - the sustainable alternative to Burmese teak
AWARD-WINNING LIGNIA® YACHT, THE ALTERNATIVE TO TEAK
For centuries, Burmese teak has been viewed by yacht builders as the King of Wood, trusted as the material of choice for yacht decks due to its durability, hardness and beauty.

However, there is now a need for a more sustainable timber alternative.

This alternative needs to have all the performance and visual characteristics of teak, while providing a cost-effective real wood alternative for the yacht sector.

LIGNIA Wood Company sources FSC® Clear radiata pine from sustainably-managed forest plantations. Through rigid grading standards we ensure our product has been carefully selected from large diameter logs, which are then cut to produce quarter-sawn material.

Award-winning LIGNIA Yacht was developed over many years to match Burmese teak (and even surpass it in some characteristics), while reducing the cost for yacht deck manufacturers. It also reduces the need to use so much hardwood from tropical rainforests. LIGNIA Yacht is available now from approved distributors.

Spirit Yachts, a world-leading designer and builder, chose LIGNIA Yacht for their Spirit CRS50 deck. The Bermudan sloop will be used for cruising and racing around the UK and Europe.
LIGNIA Wood Company is based in Barry in South Wales, UK in a 50,000 sq. ft. state-of-the-art manufacturing plant that is dedicated to modifying timber for the marine and construction sectors. The team is run by real experts in timber who understand not just the mechanics and science of wood but also the end applications in the yachting and building world. LIGNIA has its own R&D plant and research team that are led by wood scientists who are specialists in modifying timber and who carry out continuous testing using LIGNIA’s own test rigs that face the sea.

LIGNIA’s factory is modern and bespoke but the actual site is over 100 years old with most of this time being dedicated to working with wood, particularly connected to the manufacture of ocean-going vessels.

So, LIGNIA continues with a proud tradition in the marine world on one site. The team is dedicated to making the finest possible modified wood for yacht decks that will last for years with minimal maintenance.

LIGNIA Yacht is a main focus of the company’s production which is exported to four continents via specialist distributors. The focus on the yacht world is further enhanced by membership of both British Marine and Superyacht UK.

Award-winning Innovation from LIGNIA Yacht
Our LIGNIA Yacht product won the Innovation Award for Boatbuilding Methods and Materials at IBEX, the major international boatbuilders’ exhibition, held in Florida in October 2019.
LIGNIA Yacht, the modified timber made to endure.

Manufactured through a unique and patent-pending process, LIGNIA Yacht is a high-performance modified timber which is delivered with minimal visual defects. The timber’s properties are enhanced to include greater durability against rot, stability, density and hardness and what’s more, has a rich golden-brown colour that resembles teak.

LIGNIA Yacht weighs no more than Burmese teak so from a practical yacht-building view there is no difference in weight between the two products.

LIGNIA Yacht has undergone extensive testing through established and accredited test facilities in the UK, France, Germany and the USA, proving the product is a real wood alternative that has the endurance, beauty and flexibility to replace Burmese teak in yacht deck applications.

Combining technology and nature to save tropical forests.

LIGNIA Yacht is FSC® approved and for peace of mind is the sustainable choice for the yacht world.
## KEY PROPERTIES

The following provides information about the properties and performance of LIGNIA Yacht.

Testing is undertaken by independent test houses/laboratories using calibrated equipment. In some instances, LIGNIA Yacht is tested directly against teak of a quality typically used for yacht deck construction. In some cases, test data is compared against published values for teak.

These published values were obtained using the same test methods with testing conducted on Burmese teak and that grown in plantation.

All test reports are provided in their entirety in our March 2019 ‘Test Data for LIGNIA Wood Company’ report with a summary of findings provided for each test in this brochure available on our website www.lignia.com.

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density through modification is increased to an average of 650 kg/m³</td>
<td>Improving mechanical properties</td>
</tr>
<tr>
<td>Less than 10% moisture content</td>
<td></td>
</tr>
<tr>
<td>Durability Class 1 – very durable (60-year minimum life against fungal decay and against rot)</td>
<td></td>
</tr>
<tr>
<td>Superior machining finish with minimal sanding required</td>
<td></td>
</tr>
<tr>
<td>LIGNIA Yacht weighs no more than Burmese teak</td>
<td>Which from a sustainability viewpoint means that fuel use is not increased</td>
</tr>
<tr>
<td>Exceptional weathering performance, through accelerated weathering tests and extended five-year testing in Florida, showing minimal levels of fading when exposed to high levels of U.V., salt and tropical storms</td>
<td></td>
</tr>
<tr>
<td>During sustained testing, LIGNIA Yacht has superior bending properties that have surpassed those of Burmese teak in the manufacture of decks</td>
<td></td>
</tr>
<tr>
<td>Unlike chemical synthetic deck products, LIGNIA Yacht does not suffer from high surface temperatures</td>
<td></td>
</tr>
<tr>
<td>Supplied with minimal visual defects and with good levels of colour-consistency</td>
<td></td>
</tr>
<tr>
<td>pH neutral status so standard fixings can be used</td>
<td></td>
</tr>
<tr>
<td>Surface coatings are easy to apply on LIGNIA Yacht if required</td>
<td></td>
</tr>
<tr>
<td>Comparable bonding performance to Burmese teak, through third party tests conducted by West Systems.</td>
<td></td>
</tr>
</tbody>
</table>
## LIGNIA Yacht Working Properties

<table>
<thead>
<tr>
<th>Element</th>
<th>Result or Ranking</th>
<th>Description</th>
<th>Test body and date</th>
</tr>
</thead>
</table>
| **Slip resistance – pendulum test** | BS 7976: 2002 Parts 1 and 3                                                      | This test demonstrates that LIGNIA Yacht has a similar slip resistance to teak, both wet and dry | Wessex Precision Instruments Ltd, UK  
October 2018                      |
|                                 | With shoes: 53 (Avg Dry); 33 (Avg Wet)                                            |                                                                                                |                                 |
|                                 | Barefoot: 82 (Avg Dry); 44 (Avg Wet)                                             |                                                                                                |                                 |
| **Strength**                    | Modulus of Rupture 83.79 N/mm² (Av 20)                                           | The tested batches of LIGNIA Yacht performed well in three point bending tests, with strength and stiffness values which were comparable to teak | Timber Products Inspection, Inc, USA  
July 2019                         |
|                                 | Modulus of Elasticity 12044.04 N/mm³ (Av 20)                                      |                                                                                                |                                 |
| **Hardness – Janka**            | 5170 N (Av 60)                                                                    | The hardness test revealed that LIGNIA is as hard as teak                                        | BioComposites Centre, Bangor University, UK  
February 2019                      |
| **Impact resistance**           | Impact of Resistance 9.0 kJ/m² (average)                                         | LIGNIA shows lower impact resistance than teak.                                                | BioComposites Centre, Bangor University, UK  
February 2019                      |
| **Density**                     | Density 650 kg/m³ (average)                                                       | LIGNIA shows increased density through modification                                            | BioComposites Centre, Bangor University, UK  
February 2019                      |
| **Thermal effusivity**          | LIGNIA 372.3 Ws 1/2/(m²K)                                                        | Test results show that LIGNIA Yacht is comparable to teak for warmth retention when cold when exposed to external heat from sun | ThermoTest Inc, Canada  
February 2019                      |
| **ASTM D7984**                  | Teak 354                                                                          |                                                                                                |                                 |
| **Surface burning characteristics** | Class 1 / Class A ASTM E 84                                                        | Test results in North America show that the fire protection properties of LIGNIA are classified as Class 1/Class A ASTM E 84 | Exova Warringtonfire North America, Canada  
August 2018                        |
| **Moisture movement**           | 2.02 (Av 20)                                                                      | Movement tests demonstrate that LIGNIA falls into the Small Movement class.                     | BioComposites Centre, Bangor University, UK  
February 2019                      |
| **Radial and tangential cumulative movement 90 to 60% RH (%)** | 4.02 (Av 20)                                                                      | Pull-off adhesion tests show LIGNIA Yacht has the same adhesion figures as teak.                | BioComposites Centre, Bangor University, UK  
February 2019                      |
| **Bonding measured in MPa**     | Wood face: 4.02 (Avg)                                                             | Pull-off adhesion tests show LIGNIA Yacht has the same adhesion figures as teak.                | BioComposites Centre, Bangor University, UK  
February 2019                      |
|                                 | Laminate face: 5.65 (Avg)                                                         |                                                                                                |                                 |
| **Formaldehyde emissions from LIGNIA** | Detection threshold 0.008 ppm                                                      | The CARB 2 emissions limit for formaldehyde is set at 0.05ppm so LIGNIA emissions are at least 6.25 times lower. Emissions under European E1 Class are 0.1ppm so our samples are at least 12.5 times lower | HPVA Laboratories, USA  
March 2019                         |
SAFETY DATA

Handling and storage

Precautions for safe handling
Handle in accordance with good industrial hygiene and safety practice. Machining of LIGNIA Yacht, like all wood products, generates wood dust. Avoid dust formation since fine dust exposed in the air in sufficient concentrations and in the presence of an ignition source is a potential dust explosion hazard.

Hardwood wood dust has been classified by International Agency for Research on Cancer (IARC) as a known human carcinogen (Group 1). For this reason, measures should be in place to avoid wood dust inhalation.

No special measures are necessary when handling LIGNIA Yacht, as there is no hazard to health caused by touch or any other contact with the boards.

Care should be taken during handling to protect hands from small splinters of wood. It is recommended that gloves and safety glasses be worn when processing and handling.

Conditions for safe storage including any incompatibilities
Store under dry and ventilated conditions. Keep away from sources of ignition.

Exposure controls/personal protection

Control parameters

<table>
<thead>
<tr>
<th>Exposure limits</th>
<th>Follow workplace regulatory exposure limits for all types of airborne dust (e.g. total dust, respirable dust):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical name</td>
<td>Dust, hardwood &amp; softwood</td>
</tr>
<tr>
<td>European Union</td>
<td>TWA: 5 mg/m³</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>TWA: 5 mg/m³ 8 hr</td>
</tr>
</tbody>
</table>

Recommended monitoring procedures
Gravimetric monitoring where necessary

Derived No Level Effect (DNEL)
No information available

Predicted No Effect Concentration (PNEC)
No information available

Exposure

Appropriate engineering controls
Ensure adequate ventilation and/or extraction to minimise airborne dust

Personal protection

<table>
<thead>
<tr>
<th>Dust will be generated during processing; individual protection measures (PPE) include:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye protection</td>
</tr>
<tr>
<td>Hand protection</td>
</tr>
<tr>
<td>Skin and body protection</td>
</tr>
<tr>
<td>Respiratory protection</td>
</tr>
</tbody>
</table>
Stability and reactivity

Reactivity
Stable

Chemical stability
Stable

Possibility of hazardous reactions
Avoid contact with oxidising agents

Conditions to avoid
Open flames, hot surfaces, sources of ignition

Incompatible materials
Keep away from strong acids, bases and oxidising agents

Hazardous decomposition products
CO, CO₂, aldehydes (including formaldehyde) particulate matter and other organic compounds

Exposure controls/personal protection

<table>
<thead>
<tr>
<th>Information on toxicological effects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
</tr>
<tr>
<td>Exposure to product itself is unlikely to result in any effect. However, exposure to wood dust related to the handling and manufacturing of the product may result in the following:</td>
</tr>
</tbody>
</table>

| **Eye contact** | Dust contact can lead to irritation |
| **Skin contact** | Irritation |
| **Inhalation**   | Irritation of the respiratory tract |
| **Ingestion**    | An unlikely exposure route |
| **Allergy**      | Repeated and long-term exposure to wood dust can cause an allergic reaction |
| **Carcinogenicity** | Wood dust has been classified by IARC as a known carcinogen |

**Regulatory information**

**Restrictions on use**
None

**Disclaimer**
All chemicals may pose unknown hazards and should be used with caution. This Safety Data information applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not included in this sheet. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this Safety Data information is based on technical data judged to be reliable, LIGNIA Wood Company Limited assumes no responsibility for the completeness or accuracy of the information contained. Users should consider these data for information purposes and be responsible for proper use and disposal of materials and the safety and health of employees, customers and protection of the environment.
LIGNIA Yacht is an exciting development in yacht decking and we expect you have questions about its manufacture and use. Some of the answers might be found right here, but if not then please contact us at lignia.com to find out more.

**LIGNIA contains formaldehyde, is this safe to use in a house, structure or yacht?**
Yes, completely. Resin used in our wood modification process does contain formaldehyde, a naturally occurring chemical that is found in all wood. Our modification process removes this chemical and testing has consistently shown emissions of formaldehyde from our product are at levels considered safe.

**Will resin leach out of LIGNIA in service?**
No, the LIGNIA modification process polymerises resin locking it into the wood over the lifetime of the product.

**Can I cut into it safely?**
Yes, all LIGNIA products can be processed in the same way as any other wood. Once cured, the resin's composition resembles that of lignin a naturally occurring wood polymer. As for all wood products appropriate measures should be used to prevent dust generated by wood machining operations being inhaled or contacting the eyes.
Can LIGNIA processing waste (shavings, sawdust and offcuts) be used for animal bedding?
No, the UK Environment Agency classifies wood treated with resin as GRADE C wood waste along with particleboard, MDF and plywood. As such it should not be used for the manufacture of animal bedding. Where pieces are too small to manufacture into product, the best route for disposal is via incineration with energy recovery in a WID-compliant incinerator. Biomass is making a significant contribution to the UK’s energy security.

How is LIGNIA made?
Softwood that has been graded to make sure it is of suitable appearance is impregnated with a resin. Wood is next dried, and resin cured at high temperature to lock the resin in place.

How durable is LIGNIA?
Independent laboratory testing has shown LIGNIA to be Very Durable (Class 1 Durability) against decay fungi. Independent testing has also shown improved resistance against termite attack.

Is LIGNIA hard wearing?
Although density of LIGNIA is increased the Taber resistance test showed it to be less resistant to wear than hardwoods such as oak and beech.

Will LIGNIA change colour over time?
Yes, in time. As for other timbers, when exposed uncoated outdoors to the weather LIGNIA will silver over time due to interaction of UV and rainfall with the wood surface. Rate of colour change will depend on level of exposure and will differ with geographic location and elevation.

Can LIGNIA be glued and painted?
LIGNIA can be glued and painted in the same way as other timbers. Guidance on suitable adhesives and coatings and their applications are available on request.

Can LIGNIA be screwed and nailed?
Yes, LIGNIA can be screwed and nailed like any other timber. However, since its average density is 650 kg/m³ to avoid splitting of the wood (for thicker pieces) pre-drilling is recommended. Fixings should be at least 20 mm from the ends and 15 mm from edges of boards respectively to avoid splitting.

How easy is LIGNIA to machine?
LIGNIA saws, planes and sands well to a good finish. Wood working machinery should be set up to as if machining a medium density hardwood such as Iroko.

How stable is LIGNIA?
LIGNIA is classed as a Small Movement timber similar to teak or Western Red Cedar. Small movement timbers are preferred for use externally because fluctuations in environmental conditions result in changes to wood moisture content and shrinkage and swelling of wood. Small Movement timbers shrink and swell less and are more suitable for use in joinery, cladding, decking or outdoor furniture.

Does LIGNIA contain defects?
LIGNIA may contain resin pockets/streaks, blemishes or small pin knots, some of these may be hidden within the timber and not visible on faces. Good working practice should be applied to
trim these defects out, when they occur. Our grade means only small knots <5 mm diameter and small resin streaks will ever be present at the surface of our LIGNIA products.

What are emissions from LIGNIA under ambient conditions?
LIGNIA has been tested for formaldehyde emissions using appropriate standards.

Using BS EN 120, LIGNIA was shown to meet the requirements of European Emissions Standards E1 (low emission) classification when tested. Emissions under European E1 Class are 0.1 ppm so our samples are at least 12.5 times lower.

The EPA TSCA Title VI federal regulation emissions limit for formaldehyde is set at 0.05 ppm so LIGNIA emissions are at least 6.25 times lower.

Using the JIS 1460A its emission levels were ≤0.3 mg/l, the lowest classification available under the test.

Can it be burned?
Yes, the best route for disposal of LIGNIA waste is incineration in a Waste Incineration Directive (WID) boiler with recovery of energy.

Is dust produced from LIGNIA machining carcinogenic?
All wood dusts and not just LIGNIA dust are considered hazardous to health since they can cause skin disorders, respiratory problems and nasal cancer. As such, the same precautions need to be taken when processing LIGNIA as for any other wood or wood product.

Can LIGNIA be used for structural applications?
The modification process does not reduce the strength of the wood but since LIGNIA is manufactured from wood graded for appearance rather than strength, then it is not suitable for use in structural applications.

Is LIGNIA sustainable?
Yes, highly. LIGNIA is manufactured from softwood harvested from sustainably-managed plantation forests. All timber used is FSC Certified. Carbon dioxide sequestered by these trees as they grow remains locked-in the wood over the life of the product. Since LIGNIA products are durable, there is less of a need to replace these, reducing demand for wood to manufacture replacements. Where LIGNIA products cannot be re-used at the end of their service life they are suitable for use as biomass.

What does the 50-year warranty cover?
The warranty covers LIGNIA against wood destroying fungi in Use class 3 as defined in BS EN 335:2013. This Use class includes situations in which the wood or wood-based product is above ground and exposed to the weather (particularly rain). Typical products which fall under this Use class are decking boards, cladding and windows and exterior doors.

Will there be any surface checking or splitting?
LIGNIA is manufactured from wood graded to exclude splits and allow only a small number of checks. Care is taken during the modification process to prevent checking and splitting. Every piece of LIGNIA is graded at the end of the modification process as part of our quality control procedures. The Company provides assurance to its customers about the quality of each piece of LIGNIA through our Selling grade available for each LIGNIA product type. The Selling grade places limits on splits and surface checking in pieces.

What is the moisture content of LIGNIA?
As with other timbers, the moisture content of LIGNIA will equilibrate to a level that depends on the environmental conditions (i.e. temperature and relative humidity) it is exposed to.

Is LIGNIA acidic?
No, independent testing and regular QC checks on LIGNIA product have shown it to be pH neutral or slightly alkaline unlike most timbers that are acidic in nature. As it is not acidic, regular stainless steel or other metal fixings can be screwed into LIGNIA wood without causing corrosion.

What process do you use to modify your timber?
LIGNIA is manufactured using a patent pending resin modification process. During manufacture, wood is fully impregnated with resin. The wood is then dried, and the resin cured through heating under high temperature and pressure to polymerise the resin and ‘lock it’ into the wood altering its properties throughout the piece.

How should LIGNIA be disposed of?
LIGNIA must be disposed of in accordance with local regulations. This applies to unused material, processing waste (dust, shavings and offcuts) and to end of life material.

Is LIGNIA safe to handle?
LIGNIA can be handled like any other timber. On leaving our production facility it is completely dry. However, it is rough sawn and for that reason, we recommend that gloves be worn to avoid splinters.
How should I store LIGNIA?
Effort is made to ensure that the quality of LIGNIA leaving our manufacturing plant meets requirements set out in our Selling grade. However, in common with other timber products it is important that LIGNIA be appropriately handled and stored to prevent damage and degrade as it moves along the supply chain. LIGNIA Wood Company recommend that it be protected from direct wetting and packs to be supported off the ground on bearers extending the full width of the pack and at intervals that keep timbers flat to prevent warp. For further guidance contact LIGNIA.

Is LIGNIA combustible?
Understanding combustibility is important to specifiers of construction products including cladding in the EU and siding and decking in the USA. In the EU (and UK) only construction products in Euroclass A1 can be classed as non-combustible, with those in A2 classed as limited combustibility. All wood and wood-based materials are rated as Euroclass B or lower and therefore classed as Combustible albeit to different degrees.
LIGNIA Yacht is supplied with minimal visual defects, straight grained with minimum grain deviation.

Kiln-dried, quarter-sawn deck strips are available in the following dimensions:

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Widths</th>
<th>Lengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 mm</td>
<td>52 mm</td>
<td>1.8 – 3 m</td>
</tr>
<tr>
<td>25 mm</td>
<td>63 mm</td>
<td>3.1 – 4 m</td>
</tr>
<tr>
<td>32 mm</td>
<td>75 mm</td>
<td>4.1 – 4.8 m</td>
</tr>
<tr>
<td>50 mm</td>
<td>100 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>125 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>150 mm</td>
<td></td>
</tr>
</tbody>
</table>

*It is also available in custom cut sizes.*