# Lignumvitae (t)



## General information

**Designation**

Guaiacum spp. (T)

**Typical uses**

Bearing & bushing blocks; lining of stern tubes for steamship propeller shafts; underwater use; mallets; pulley sheaves; caster wheels; stencil; chisel block; turned articles; brush backs.

## Composition overview

**Compositional summary**

Cellulose/Hemicellulose/Lignin/12%H2O

| | | | | |
|---|---|---|---|---|
| Material family | Natural | | | |
| Base material | Wood (tropical) | | | |
| Renewable content | 100 | | | % |

## Composition detail (polymers and natural materials)

| | | | | |
|---|---|---|---|---|
| Wood | 100 | | | % |

## Price

| | | | | |
|---|---|---|---|---|
| Price | * 3.04 | - | 4.88 | USD/lb |
| Price per unit volume | * 211 | - | 411 | USD/ft^3 |

## Physical properties

| | | | | |
|---|---|---|---|---|
| Density | 0.0401 | - | 0.0488 | lb/in^3 |

## Mechanical properties

| | | | | |
|---|---|---|---|---|
| Young's modulus | * 1.62 | - | 1.81 | 10^6 psi |
| Yield strength (elastic limit) | * 0.627 | - | 0.766 | ksi |
| Tensile strength | * 1.04 | - | 1.28 | ksi |
| Elongation | * 0.19 | - | 0.23 | % strain |
| Compressive strength | * 3.16 | - | 3.86 | ksi |
| Flexural modulus | 1.46 | - | 1.64 | 10^6 psi |
| Flexural strength (modulus of rupture) | * 1.04 | - | 1.28 | ksi |
| Shear modulus | * 0.167 | - | 0.23 | 10^6 psi |
| Shear strength | * 9.01 | - | 11 | ksi |
| Rolling shear strength | * 0.334 | - | 1 | ksi |
| Bulk modulus | * 0.753 | - | 0.848 | 10^6 psi |
| Poisson's ratio | * 0.02 | - | 0.04 | |
| Shape factor | 5.7 | | | |
| Hardness - Vickers | 18 | - | 22 | HV |
| Hardness - Brinell | * 68.2 | - | 83.3 | HB |

| | | | | |
|---|---|---|---|---|
| Hardness - Janka | 4.05e3 | - | 4.95e3 | lbf |
| Fatigue strength at 10^7 cycles | * 0.313 | - | 0.383 | ksi |
| Mechanical loss coefficient (tan delta) | * 0.007 | - | 0.009 | |
| Differential shrinkage (radial) | * 0.32 | - | 0.39 | % |
| Differential shrinkage (tangential) | * 0.53 | - | 0.65 | % |
| Radial shrinkage (green to oven-dry) | * 3.2 | - | 7 | % |
| Tangential shrinkage (green to oven-dry) | * 6.8 | - | 11.5 | % |
| Volumetric shrinkage (green to oven-dry) | * 11 | - | 18 | % |
| Work to maximum strength | * 0.259 | - | 0.315 | ft.lbf/in^3 |

## Impact & fracture properties

| | | | | |
|---|---|---|---|---|
| Fracture toughness | * 1.12 | - | 1.37 | ksi.in^0.5 |

## Thermal properties

| | | | | |
|---|---|---|---|---|
| Glass temperature | 171 | - | 216 | °F |
| Maximum service temperature | 248 | - | 284 | °F |
| Minimum service temperature | * -99.4 | - | -9.4 | °F |
| Thermal conductivity | 0.127 | - | 0.156 | BTU.ft/hr.ft^2.°F |
| Specific heat capacity | 0.396 | - | 0.408 | BTU/lb.°F |
| Thermal expansion coefficient | * 25.6 | - | 32.8 | µstrain/°F |

## Electrical properties

| | | | | |
|---|---|---|---|---|
| Electrical resistivity | * 8.27e13 | - | 2.76e14 | µohm.in |
| Dielectric constant (relative permittivity) | * 6.45 | - | 7.89 | |
| Dissipation factor (dielectric loss tangent) | * 0.1 | - | 0.122 | |
| Dielectric strength (dielectric breakdown) | * 25.4 | - | 50.8 | V/mil |

## Magnetic properties

| | |
|---|---|
| Magnetic type | Non-magnetic |

## Optical properties

| | |
|---|---|
| Transparency | Opaque |

## Critical materials risk

| | |
|---|---|
| Contains >5wt% critical elements? | No |

## Durability

| | |
|---|---|
| Water (fresh) | Limited use |
| Water (salt) | Limited use |
| Weak acids | Limited use |
| Strong acids | Unacceptable |
| Weak alkalis | Acceptable |

| | |
|---|---|
| Strong alkalis | Unacceptable |
| Organic solvents | Acceptable |
| Oxidation at 500C | Unacceptable |
| UV radiation (sunlight) | Good |
| Flammability | Highly flammable |

## Primary production energy, CO2 and water

| | | | | |
|---|---|---|---|---|
| Embodied energy, primary production | * 4.99e3 | - | 5.5e3 | BTU/lb |
| CO2 footprint, primary production | * 0.574 | - | 0.633 | lb/lb |
| Water usage | * 1.84e4 | - | 2.03e4 | in^3/lb |

## Processing energy, CO2 footprint & water

| | | | | |
|---|---|---|---|---|
| Coarse machining energy (per unit wt removed) | * 285 | - | 315 | BTU/lb |
| Coarse machining CO2 (per unit wt removed) | * 0.0496 | - | 0.0549 | lb/lb |
| Fine machining energy (per unit wt removed) | * 1.01e3 | - | 1.11e3 | BTU/lb |
| Fine machining CO2 (per unit wt removed) | * 0.176 | - | 0.194 | lb/lb |
| Grinding energy (per unit wt removed) | * 1.81e3 | - | 2e3 | BTU/lb |
| Grinding CO2 (per unit wt removed) | * 0.316 | - | 0.349 | lb/lb |

## Recycling and end of life

| | | | | |
|---|---|---|---|---|
| Recycle | ✗ | | | |
| Recycle fraction in current supply | 8.55 | - | 9.45 | % |
| Downcycle | ✓ | | | |
| Combust for energy recovery | ✓ | | | |
| Heat of combustion (net) | * 8.49e3 | - | 9.16e3 | BTU/lb |
| Combustion CO2 | * 1.69 | - | 1.78 | lb/lb |
| Landfill | ✓ | | | |
| Biodegrade | ✓ | | | |

## Notes

**Warning**

All woods have properties which show variation; they depend principally on growth conditions and moisture

## Links

| |
|---|
| ProcessUniverse |
| Reference |
| Shape |