# Marine Grade Plywood Douglas Fir Okoume – Technical Material Specification

## 1.0 Material Overview & Common Uses

Marine Grade Plywood (Douglas Fir / Okoume) is a high-performance engineered wood panel constructed from multiple veneer layers bonded with waterproof phenol-formaldehyde (WBP) adhesive. It is manufactured to BS 1088 and EN 314-2 Class 3 standards, ensuring exceptional resistance to delamination, moisture, and fungal decay. Douglas Fir offers high strength-to-weight ratio and impact resistance, while Okoume provides a lighter, fine-grained alternative with excellent surface finish. Common applications include boat hulls, marine decking, dock construction, exterior signage, concrete formwork, and high-moisture structural components in coastal environments.

## 2.0 Core Technical Properties & Sizing

- Density (Douglas Fir): 530–640 kg/m³ at 12% moisture content
- Density (Okoume): 440–530 kg/m³ at 12% moisture content
- Standard panel sizes: 1220 x 2440 mm (4x8 ft), 1525 x 3050 mm (5x10 ft)
- Thickness options: 4 mm, 6 mm, 9 mm, 12 mm, 15 mm, 18 mm, 21 mm, 25 mm
- Thickness tolerance: ±0.3 mm for panels ≤12 mm; ±0.5 mm for panels >12 mm
- Squareness tolerance: Diagonal difference ≤ 2 mm per 1220 mm panel width
- Moisture content: 8–14% at time of manufacture (target 12%)
- Modulus of Elasticity (Douglas Fir): 12,400 MPa (parallel to grain)
- Modulus of Rupture (Douglas Fir): 55 MPa (parallel to grain)
- Janka hardness (Douglas Fir): 3,800 N (side hardness)
- Bond durability: EN 314-2 Class 3 (fully waterproof, boil-proof)
- Formaldehyde emission class: E1 (≤0.1 ppm) per EN 717-1

## 3.0 Processing, Machinability & Application

Marine plywood machines well with standard woodworking tools, but due to the dense interlayered construction and waterproof glue lines, carbide-tipped tooling is recommended for extended life. Cutting, drilling, and routing produce fine dust; dust extraction is mandatory. Pre-drilling is required for fasteners within 20 mm of panel edges to prevent splitting. For bonding, use only marine-grade epoxy or polyurethane adhesives; avoid PVA glues. For finishing, apply two coats of marine varnish or epoxy sealer to all edges and faces, especially cut edges. Fasteners must be stainless steel (316 grade) or hot-dipped galvanized to prevent galvanic corrosion.

- Saw blade recommendation: 80-tooth carbide-tipped blade with 10° hook angle for clean, chip-free cuts
- Feed rate for routing: 3–5 m/min with 12,000–18,000 RPM spindle speed
- Drill speed: 1,500–2,500 RPM with brad-point or Forstner bits; use backer board to prevent tear-out
- Sanding: Progress from 80 to 220 grit; avoid over-sanding face veneers (thickness <0.6 mm)

- Edge sealing: Apply two coats of epoxy or marine varnish within 2 hours of cutting to prevent moisture ingress
- Fastener spacing: 150 mm on centre along edges, 300 mm in field; pre-drill 1 mm smaller than screw diameter
- Adhesive cure time: Epoxy – 24 hours at 20°C; Polyurethane – 12 hours at 20°C (clamp pressure 0.7–1.0 MPa)
- Not recommended for steam bending; use solid lumber for curved applications

## 4.0 Common Defects & Quality Control

- Reject if any open glue line is visible on panel edges or faces under 5x magnification
- Reject if surface veneer has knots > 6 mm diameter, or more than 2 pin knots per 0.1 m²
- Reject if panel is out-of-square by more than 2 mm diagonal difference per 1220 mm width
- Reject if bow exceeds 3 mm over 1220 mm length (measured on concave side)
- Reject if twist exceeds 2 mm over 1220 mm diagonal
- Reject if moisture content is below 6% or above 16% at time of delivery
- Reject if any delamination is detected after 72-hour water immersion test (BS 1088 Clause 5.3)
- Reject if surface has blisters, soft spots, or crushed grain exceeding 5% of panel area
- Reject if core veneer gaps exceed 2 mm width or are present in more than 3 plies
- Acceptable: minor colour variation, small hairline checks (≤0.5 mm wide, ≤50 mm long) in face veneer

## 5.0 Storage, Handling & WHMIS Guidelines

- Store panels flat on a level, dry surface with stickers (19x38 mm) at 400 mm centres to allow air circulation
- Maintain storage environment at 15–25°C and 40–60% relative humidity; avoid direct sunlight and water exposure
- Shelf life: Indefinite if stored properly; use FIFO (first-in, first-out) to prevent extended storage beyond 12 months
- WHMIS classification: Not classified as hazardous under WHMIS 2015 (no GHS pictograms required)
- Dust from machining is a respiratory hazard: use local exhaust ventilation and wear N95 respirator (NIOSH approved)
- Wood dust is classified as a Group 1 carcinogen (IARC); mandatory PPE includes safety glasses, hearing protection, and cut-resistant gloves
- Handle panels with clean, dry hands or gloves; avoid dragging panels across rough surfaces to prevent surface damage
- Do not stack more than 20 panels per pallet; use edge protectors and banding for transport
- Inspect each panel upon receipt for transit damage; reject any panel with crushed edges, water stains, or mould growth
- Dispose of waste in accordance with local municipal solid waste regulations; wood dust must not be released into storm drains