Black Walnut (Juglans Nigra) Solid Wood – Technical Material Specification for Machining & Fabrication

1.0 Material Overview & Common Uses

Black Walnut (Juglans Nigra) is a premium North American hardwood prized for its rich chocolate-brown heartwood, straight grain, and excellent dimensional stability. It is one of the few domestic hardwoods that darkens with age, developing a deep, lustrous patina. The wood is moderately heavy, hard, and strong, yet machines well and holds detail cleanly. It is naturally resistant to decay and is often used in high-end furniture, cabinetry, gunstocks, architectural millwork, flooring, and musical instruments. In industrial fabrication, Black Walnut is specified for its workability, finishing characteristics, and resistance to warping when properly dried.

2.0 Core Technical Properties & Sizing

- Average dried weight: 640 kg/m³ (40 lb/ft³) at 12% moisture content.
- Specific gravity (basic, 12% MC): 0.55 – 0.64.
- Janka hardness: 5,400 N (1,010 lbf) – moderately hard, resists dents but is softer than maple or oak.
- Modulus of rupture (MOR): 100.7 MPa (14,600 psi).
- Modulus of elasticity (MOE): 11.6 GPa (1.68 million psi).
- Crushing strength (parallel to grain): 52.4 MPa (7,600 psi).
- Radial shrinkage (green to 12% MC): 2.7% – low movement, good stability.
- Tangential shrinkage (green to 12% MC): 5.5% – moderate movement.
- Volumetric shrinkage (green to 12% MC): 8.5%.
- Standard lumber thicknesses (S2S): 4/4 (1 inch), 6/4 (1.5 inch), 8/4 (2 inch), 12/4 (3 inch).
- Standard widths: 3 inch to 12 inch (random widths, FAS grade).
- Standard lengths: 4 ft to 16 ft (random lengths, FAS grade).
- Moisture content specification: 6% – 8% for interior applications; 10% – 12% for exterior millwork.
- Grading: NHLA (National Hardwood Lumber Association) grades – FAS (First and Second), Select, #1 Common, #2 Common.

3.0 Processing, Machinability & Application

Black Walnut is considered one of the best hardwoods for machining. It cuts cleanly, sands to a smooth finish, and holds threads and glue well. However, its open grain requires proper sanding and filling for a glass-smooth finish. The wood contains natural oils that can slow the curing of some finishes, so solvent-based or oil-based finishes are recommended over water-based systems unless a sealer is used. Below are specific processing parameters for common operations.

- Sawing: Use carbide-tipped blades with 24–40 teeth for ripping (feed rate 10–15 m/min) and 60–80 teeth for crosscutting (feed rate 8–12 m/min). Avoid dull blades to prevent tear-out on figured grain.
- Planing: Use sharp carbide knives with a 20–30 degree hook angle. Take light passes (0.5–1.0 mm depth) to avoid tear-out on interlocked or curly grain. Feed rate: 8–12 m/min.

- Routing: Use carbide-tipped bits with a 1/2 inch shank minimum. For edge profiling, use a 1/4 inch radius round-over bit at 18,000–22,000 RPM with a feed rate of 3–5 m/min. Climb cutting reduces tear-out on figured grain.
- Sanding: Start with 80-grit and progress to 220-grit. For a pore-free finish, sand to 320-grit and apply a sanding sealer before final coats. Avoid over-sanding which can burnish the surface and reduce stain absorption.
- Drilling: Use brad-point or Forstner bits for clean holes. For deep holes, use a 118-degree split-point twist drill with a slow feed rate (0.1–0.2 mm/rev) to prevent burning.
- Turning: Black Walnut turns excellently. Use a 1/2 inch bowl gouge with a 40–45 degree bevel angle. Spindle speed: 1,000–2,000 RPM depending on diameter. Apply light cuts (1–2 mm) for a smooth finish.
- Gluing: Use Type I or Type II PVA (polyvinyl acetate) glue. Apply within 5 minutes of spreading. Clamp pressure: 100–150 psi for 30–60 minutes. Avoid water-based glues if the wood is oily (use epoxy or polyurethane for oily stock).
- Finishing: Apply a sanding sealer (shellac or vinyl sealer) before staining to prevent blotching. For a natural look, use Danish oil or tung oil. For high-gloss, use a catalyzed lacquer or conversion varnish. Cure time: 24 hours between coats at 20°C.
- Fastening: Pre-drill for screws (pilot hole diameter = 60–70% of screw shank). Use stainless steel or brass fasteners to avoid black staining from tannin reactions with iron.

4.0 Common Defects & Quality Control

Incoming Black Walnut lumber must be inspected against NHLA grading rules and the following specific rejection criteria. Any material failing these criteria shall be quarantined and returned to the supplier.

- Reject if moisture content exceeds 10% for interior applications or 14% for exterior applications (measured with a pin-type moisture meter at three points per board).
- Reject if any board contains live knots larger than 1/2 inch diameter in FAS grade, or any unsound (loose or decayed) knots regardless of size.
- Reject if surface checks (cracks) exceed 1/16 inch in width or extend more than 1/4 of the board thickness.
- Reject if end checks exceed 1/4 of the board length or are wider than 1/8 inch.
- Reject if bow (lengthwise curvature) exceeds 1/4 inch over an 8-foot span.
- Reject if crook (edgewise curvature) exceeds 1/8 inch over an 8-foot span.
- Reject if cup (widthwise curvature) exceeds 1/8 inch across a 6-inch width.
- Reject if twist (spiral distortion) exceeds 1/4 inch over a 6-foot length.
- Reject if wane (bark or missing wood on edge) exceeds 1/4 of the board thickness or 1/3 of the board width.
- Reject if any board contains evidence of insect infestation (holes, frass, or tunnels) – quarantine immediately and notify supplier.
- Reject if mineral streaks (dark discoloration) cover more than 10% of the board face in FAS grade.
- Reject if surface pitting or tear-out from planing exceeds 1/32 inch depth on any face.
- Reject if any board has been treated with a chemical preservative without clear labeling and MSDS documentation.

5.0 Storage, Handling & WHMIS Guidelines

Black Walnut lumber must be stored and handled in accordance with Canadian woodworking safety standards and WHMIS 2015 regulations. The primary hazards are wood dust (respirable), physical injury from handling, and potential allergic reactions to the wood itself.

• Store lumber in a dry, well-ventilated area with relative humidity between 35% and 50% to maintain target moisture content (6–8% for interior use).

• Stack boards flat on 3/4 inch stickers spaced 24 inches apart, aligned vertically to prevent warping. Cover with a breathable tarp to protect from dust but allow air circulation.
• Shelf life: Indefinite if stored properly, but moisture content must be verified before use if stored longer than 6 months.
• FIFO protocol: Use first-in, first-out rotation. Label each bundle with receipt date, grade, moisture content, and supplier lot number.
• WHMIS 2015 – Wood Dust (Hazard Category: Carcinogenicity Category 1A, Skin Sensitization Category 1):
• Signal word: Danger. Hazard statements: H350 (May cause cancer by inhalation), H317 (May cause an allergic skin reaction).
• Precautionary statements: P201 (Obtain special instructions before use), P202 (Do not handle until all safety precautions have been read and understood), P280 (Wear protective gloves/protective clothing/eye protection/face protection), P308+P313 (IF exposed or concerned: Get medical advice/attention), P302+P352 (IF ON SKIN: Wash with plenty of soap and water).
• Mandatory PPE: NIOSH-approved N95 or P100 respirator when sanding or machining; safety glasses with side shields; cut-resistant gloves (ANSI A2 or higher) when handling rough lumber; hearing protection (earplugs or earmuffs) when using power tools.
• Dust control: Use dust collection systems with HEPA filters (minimum 1 micron). Maintain air velocity of 4,000 ft/min in branch lines to prevent settling. Never use compressed air to clean surfaces – use a HEPA vacuum.
• Allergic reactions: Some individuals may develop contact dermatitis or respiratory sensitivity to Black Walnut dust. Workers with a history of skin allergies should wear long sleeves and nitrile gloves. If symptoms occur, remove from exposure and seek medical evaluation.
• Fire safety: Wood dust is a combustible dust hazard. Keep work areas free of dust accumulation. Use explosion-proof vacuums and grounding straps on dust collection systems. Store waste dust in metal containers with tight-fitting lids.
• Spill procedure: For solid lumber, no special spill procedure – pick up and stack. For fine dust, use a HEPA vacuum or wet mop. Do not sweep dry dust as it may become airborne.
• First aid: For eye contact, flush with water for 15 minutes. For skin contact, wash with soap and water. For inhalation, move to fresh air. If irritation persists, seek medical attention.