# Poplar Solid Wood Machining – Technical Material Specification

## 1.0 Material Overview & Common Uses

Poplar (Liriodendron tulipifera) is a diffuse-porous hardwood species native to eastern North America, widely used in Canadian industrial woodworking and fabrication. It is valued for its straight grain, uniform texture, moderate density, and excellent machinability. Poplar is commonly specified for painted or stained interior millwork, furniture components, cabinet frames, shelving, and edge-banding. It is also a preferred substrate for veneering and CNC routing due to its dimensional stability and low resin content.

Poplar is not suitable for high-moisture exterior applications without extensive finishing. It is typically kiln-dried to 6-8% moisture content for interior use. Common grades include FAS (First and Second), Select, and #2 Common, with FAS being the primary grade for machined components requiring minimal defects.

## 2.0 Core Technical Properties & Sizing

- Density (kiln-dried at 12% MC): 0.40 – 0.45 g/cm³ (25 – 28 lb/ft³)
- Janka Hardness: 540 lbf (2,400 N) – rated as soft hardwood
- Modulus of Rupture (MOR): 10,100 psi (69.6 MPa)
- Modulus of Elasticity (MOE): 1.58 × 10⁶ psi (10.9 GPa)
- Crushing Strength (parallel to grain): 5,540 psi (38.2 MPa)
- Radial Shrinkage (green to 6% MC): 2.5%
- Tangential Shrinkage (green to 6% MC): 5.5%
- Volumetric Shrinkage (green to 6% MC): 8.0%
- Standard Rough Lumber Thickness: 4/4 (1.00 inch), 6/4 (1.50 inch), 8/4 (2.00 inch) – actual thickness after planing: 0.75 inch, 1.25 inch, 1.75 inch respectively
- Standard Widths (rough): 4, 6, 8, 10, 12 inches (nominal)
- Standard Lengths: 8, 10, 12, 14, 16 feet (nominal)
- Moisture Content (MC) at delivery: 6-8% for interior applications; 8-10% for exterior-grade after acclimation
- Tolerance on planed thickness: ±0.010 inch (0.25 mm) for S4S (surfaced four sides)
- Tolerance on width (S2S or S4S): ±0.015 inch (0.38 mm)
- Maximum allowable warp (bow, crook, twist) per 8-foot length: 0.125 inch (3.2 mm)

## 3.0 Processing, Machinability & Application

Poplar is rated as excellent for machining, with low tool wear and clean cuts. It responds well to both hand and power tools. For CNC routing and shaping, use high-speed steel (HSS) or carbide-tipped tooling. Recommended spindle speeds for routing: 12,000 – 18,000 RPM. Feed rates for CNC: 150 – 300 inches per minute (IPM) for profiling, 200 – 400 IPM for straight cuts. For planing and jointing, use a knife angle of 20-25 degrees and a feed rate of 15-25 feet per minute (FPM).

Poplar glues well with PVA (yellow glue), polyurethane, and epoxy. For edge-gluing panels, apply glue at a spread rate of 180-200 grams per square meter, clamp with moderate pressure (50-100 psi), and allow 30-60 minutes clamp time at 20°C.

Sanding is straightforward: start with 80-grit and progress to 180-220 grit for paint-grade finish. For stain-grade, sand to 220-320 grit. Avoid over-sanding as poplar can become burnished.

- Use carbide-tipped saw blades with 40-60 teeth for ripping; 60-80 teeth for crosscutting.
- For drilling, use brad-point bits at 2,000-3,000 RPM with light feed pressure to prevent tear-out.
- Poplar accepts nails and screws well without pre-drilling for small fasteners (#6 or #8 screws). For larger fasteners, pre-drill to 75% of screw diameter.
- Sanding dust is fine and can clog abrasives; use open-coat sandpaper or stearate-coated discs.
- Poplar is not recommended for steam bending due to low flexibility; use white oak or ash for bent components.
- For finishing, poplar absorbs stain unevenly; use a pre-stain wood conditioner or apply a gel stain for uniform color. Paint adhesion is excellent.

## 4.0 Common Defects & Quality Control

- Reject if moisture content exceeds 10% for interior applications or 12% for exterior applications after acclimation.
- Reject if warp (bow, crook, twist) exceeds 0.125 inch over 8-foot length.
- Reject if surface checks (cracks) exceed 0.010 inch in width or 1 inch in length on any face.
- Reject if knots are loose, have a diameter greater than 0.5 inch on FAS grade, or greater than 1.0 inch on Select grade.
- Reject if mineral streaks (dark discoloration) cover more than 10% of the board surface for paint-grade applications.
- Reject if wane (bark edge) is present on more than 1/4 of the board width or extends more than 1/8 of the board length.
- Reject if planed surface has tear-out deeper than 0.005 inch (0.13 mm) or chatter marks visible to the naked eye.
- Reject if board has insect damage (pinholes, galleries) or fungal decay (soft spots, discoloration).
- Acceptable tolerance for cupping: maximum 0.020 inch per 4-inch width for boards under 6 inches wide; 0.030 inch for wider boards.
- For CNC-machined parts, reject if edge chipping exceeds 0.010 inch depth or if surface roughness (Ra) exceeds 125 microinches.

## 5.0 Storage, Handling & WHMIS Guidelines

Poplar lumber must be stored in a dry, well-ventilated area with relative humidity between 35% and 50% and temperature between 15°C and 25°C. Boards should be stacked flat on 1-inch stickers spaced 24 inches apart, with stickers aligned vertically to prevent warping. Allow at least 4 inches of clearance from walls and 6 inches from the floor for air circulation. For long-term storage (>30 days), wrap stacks in breathable plastic sheeting to protect from dust while allowing moisture exchange.

WHMIS 2015 (GHS) classification: Wood dust (hardwood) is classified as a Category 1A carcinogen (H350 – May cause cancer by inhalation). Poplar dust is a respiratory sensitizer. All machining operations must be equipped with dust collection systems meeting OSHA/CSA standards (minimum 400 CFM per machine). Operators must wear NIOSH-approved N95 or P100 respirators when dust levels exceed exposure limits. Safety glasses and hearing protection are mandatory during machining.

• Shelf life: Indefinite when stored at 6-8% MC and 35-50% RH. If MC exceeds 10%, re-dry before use to prevent dimensional changes.

• FIFO protocol: Use first-in, first-out rotation. Label each bundle with receipt date, grade, and MC reading. Inspect monthly for mold or insect activity.

• PPE requirements: Safety glasses with side shields, hearing protection (earplugs or earmuffs), cut-resistant gloves (ANSI A2 or higher) for handling, and N95 respirator for sanding or machining operations.

• Fire safety: Wood dust is combustible. Maintain dust collection systems to prevent accumulation. Use explosion-proof vacuums for cleanup. No smoking or open flames in storage or machining areas.

- Spill procedure: For small spills of wood dust, use a HEPA-filtered vacuum. For large accumulations, wet down with water to suppress dust before sweeping. Dispose of waste in sealed containers labeled 'Combustible Wood Waste'.
- First aid: For eye contact with dust, flush with water for 15 minutes. For skin irritation, wash with soap and water. If inhaled, move to fresh air. Seek medical attention if symptoms persist.