
Polycarbonate Sheet (Lexan / Makrolon) – Technical Material Specification

1.0 Material Overview & Common Uses

Polycarbonate sheet is an amorphous thermoplastic polymer known for its exceptional impact resistance, optical clarity, and dimensional stability. Common trade names include Lexan (SABIC) and Makrolon (Covestro). It is widely used as a lightweight, shatter-resistant alternative to glass in applications such as safety glazing, machine guards, skylights, signage, and protective barriers.

- Impact strength: 250 times greater than glass and 30 times greater than acrylic.
- Operating temperature range: -40°C to 120°C continuous.
- Flame rating: UL 94 V-2 (standard grade) to V-0 (flame-retardant grades).
- Common applications: bullet-resistant glazing, riot shields, aircraft canopies, greenhouse panels, and electronic enclosures.

2.0 Core Technical Properties & Sizing

- Density: 1.20 g/cm³ (0.043 lb/in³).
- Tensile strength (yield): 60–70 MPa (8,700–10,150 psi) per ASTM D638.
- Flexural modulus: 2.3 GPa (334,000 psi) per ASTM D790.
- Izod impact strength (notched): 600–850 J/m (11–16 ft-lb/in) per ASTM D256.
- Light transmission: 88–90% (clear grade, 3 mm thickness).
- Standard sheet sizes: 1220 mm x 2440 mm (4 ft x 8 ft) and 1830 mm x 2440 mm (6 ft x 8 ft).
- Thickness tolerances: ±0.25 mm for sheets up to 6 mm; ±0.50 mm for 6–12 mm; ±0.75 mm for 12–25 mm.
- Hardness: Rockwell M70–M80 per ASTM D785.
- Coefficient of thermal expansion: 65–70 x 10⁻⁶ /°C.
- Melting point: 155°C (311°F) – amorphous, no sharp melting point; softening begins at 147°C.

3.0 Processing, Machinability & Application

Polycarbonate is readily machinable using standard woodworking or metalworking tools, but requires sharp tooling and controlled feed rates to prevent melting, chipping, or stress cracking. Cooling is essential to avoid heat buildup.

- Sawing: Use carbide-tipped blades with 10–12 teeth per inch (TPI) for clean cuts. Feed rate: 3–5 m/min. Avoid climb cutting to reduce edge chipping.
- Drilling: Use high-speed steel (HSS) or carbide drill bits with a 118° point angle. Peck drilling recommended; spindle speed 1,000–2,000 RPM, feed 0.05–0.10 mm/rev.
- Routing/CNC: Use single-flute or compression spiral bits. Spindle speed 12,000–18,000 RPM, feed rate 2–4 m/min. Apply compressed air or mist coolant to prevent melting.
- Edge finishing: Flame polishing with a hydrogen-oxygen torch (1:1 ratio) for optical clarity. Sand edges with 400–600 grit wet/dry paper before polishing.

- Bonding: Use methylene chloride-based solvents (e.g., Weld-On 3, 4, or 16) for capillary action joints. Cure time: 24 hours at 20°C. Avoid silicone or cyanoacrylate adhesives.
- Thermoforming: Heat to 160–180°C (320–356°F) in a convection oven. Drying required: 4 hours at 120°C to remove moisture. Forming pressure: 0.5–1.0 MPa. Cooling rate: slow to minimize residual stress.
- Laser cutting: CO₂ laser (10.6 µm) recommended. Power: 150–300 W for 3 mm sheet. Cut speed: 10–20 mm/s. Edge quality: clean with minimal charring.
- Welding: Ultrasonic welding possible for thin sections (0.5–3 mm). Hot plate welding at 260–300°C with 0.5–1.0 MPa pressure.

4.0 Common Defects & Quality Control

- Reject if surface scratches exceed 0.1 mm depth or are visible under normal lighting at 1 m distance.
- Reject if internal bubbles or inclusions are larger than 0.5 mm in diameter or more than 3 per 100 cm².
- Reject if sheet is out-of-square by more than 2 mm per 1 m of edge length.
- Reject if warp (bow or twist) exceeds 3 mm per 1 m of sheet length.
- Reject if surface has orange peel, die lines, or sink marks visible under raking light.
- Reject if UV-stabilized grade shows yellowing (Delta E > 2.0 per ASTM D2244) after 500 hours QUV exposure.
- Reject if thickness variation exceeds ±0.25 mm for sheets ≤6 mm, or ±0.50 mm for sheets 6–12 mm.
- Acceptance criteria: Visual inspection per ASTM D1003 for haze (≤1% for clear grade).

5.0 Storage, Handling & WHMIS Guidelines

- Store in a dry, indoor environment at 15–25°C with relative humidity below 50% to prevent moisture absorption.
- Keep sheets in original packaging with interleaving paper or polyethylene film to prevent scratching.
- Store flat on a level surface; vertical storage may cause bowing. Maximum stack height: 1 m.
- Shelf life: Indefinite if stored properly; however, UV-stabilized grades may degrade after 2 years if exposed to direct sunlight.
- FIFO protocol: Rotate stock by date of manufacture; use older sheets first for non-critical applications.
- WHMIS classification: Not classified as hazardous under WHMIS 2015 (GHS). Polycarbonate is considered a manufactured article; no SDS required for solid form.
- Dust from machining: May cause respiratory irritation. Use local exhaust ventilation or N95 respirator if airborne dust is generated.
- PPE: Safety glasses with side shields; cut-resistant gloves (ANSI A2 or higher) when handling sharp edges. Hearing protection if sawing or routing.
- Fire safety: Polycarbonate is slow to ignite but burns vigorously once ignited. Use water fog, CO₂, or dry chemical extinguisher. Avoid breathing smoke; may release bisphenol A (BPA) and carbon monoxide.
- Disposal: Recycle via plastic recycling stream (resin code #7 – Other). Incinerate only in permitted facilities with energy recovery.

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