
Cast Acrylic Sheet (PMMA) – Technical Material Specification

1.0 Material Overview & Common Uses

Cast Acrylic Sheet, also known as PMMA (Polymethyl Methacrylate), is a transparent thermoplastic produced via cell casting between glass plates. This process yields a material with superior optical clarity, UV stability, and weatherability compared to extruded acrylic. It is commonly used as a lightweight, shatter-resistant alternative to glass in signage, retail displays, architectural glazing, skylights, aquariums, and protective barriers. Cast acrylic offers excellent machinability and can be polished to a high optical finish.

2.0 Core Technical Properties & Sizing

- Density: 1.19 g/cm³ (nominal)
- Tensile Strength: 70–80 MPa (ASTM D638)
- Flexural Modulus: 3.1 GPa (ASTM D790)
- Impact Strength (Izod notched): 16 J/m (ASTM D256)
- Light Transmission: 92% (visible spectrum, 3 mm thickness)
- Refractive Index: 1.49
- Melting Point: 160°C (softening begins at 100°C)
- Continuous Service Temperature: 80°C (max)
- Coefficient of Thermal Expansion: 70×10^{-6} /°C
- Standard Sheet Sizes: 1220 × 2440 mm (4×8 ft), 1525 × 3050 mm (5×10 ft)
- Thickness Tolerances: ±0.5 mm for 3–6 mm sheets; ±0.8 mm for 10–25 mm sheets (ASTM D4802)
- Hardness (Rockwell M): 90–100
- Water Absorption (24 hr): 0.3% (ASTM D570)

3.0 Processing, Machinability & Application

Cast acrylic is highly machinable but requires careful control of cutting speeds and feed rates to avoid heat buildup, which can cause melting, chipping, or stress cracking. Carbide-tipped tooling is recommended for all machining operations. Laser cutting produces a polished edge, while sawing and routing require secondary flame or diamond polishing for optical clarity. Drilling should use standard twist drills with a 118° point angle and a backing plate to prevent breakout. For bonding, use solvent cements such as methylene chloride or proprietary acrylic adhesives; allow 24 hours for full cure at 20°C. Bending requires localized heating to 150–170°C using a strip heater; avoid overheating to prevent bubbles. Threaded inserts can be installed using ultrasonic or heat-staking methods.

- Sawing: Use carbide-tipped circular saw blades with 60–80 teeth; feed rate 3–5 m/min.
- Routing: Use single-flute carbide bits; spindle speed 12,000–18,000 RPM; feed rate 2–4 m/min.
- Drilling: Use 118° point angle HSS or carbide drills; speed 500–1000 RPM; peck feed to clear chips.
- Laser Cutting: CO2 laser, 100–200 W; speed 10–30 mm/s depending on thickness; assist gas: compressed air.

- Edge Polishing: Flame polish using a hydrogen-oxygen torch; diamond buffing for high-gloss finish.
- Solvent Bonding: Apply methylene chloride or Weld-On 3; clamp for 30 minutes; full cure at 24 hours.
- Thermoforming: Heat to 160–180°C in a convection oven; form within 60 seconds; cool slowly to avoid stress.

4.0 Common Defects & Quality Control

- Reject if surface scratches exceed 0.1 mm depth visible under 5x magnification.
- Reject if internal bubbles or inclusions are larger than 0.5 mm in diameter.
- Reject if thickness variation exceeds ± 0.5 mm for sheets under 10 mm, or ± 0.8 mm for thicker sheets.
- Reject if sheet is out-of-square by more than 1.5 mm per 1000 mm of edge length.
- Reject if surface has orange peel texture or waviness exceeding 0.2 mm over 300 mm span.
- Reject if there is evidence of delamination or stress cracking at edges.
- Reject if yellowing or haze is visible under standard D65 lighting.
- Acceptable warp: less than 1 mm per 300 mm of sheet length when laid flat.

5.0 Storage, Handling & WHMIS Guidelines

- Store sheets vertically in a dry, clean area at 15–25°C and below 50% relative humidity.
- Remove protective masking within 6 months of receipt; prolonged exposure may cause adhesive residue.
- Use FIFO (First-In, First-Out) inventory rotation; shelf life is 2 years from manufacture date under proper storage.
- Avoid direct sunlight and UV sources during storage to prevent yellowing.
- WHMIS Classification: Not classified as hazardous under WHMIS 2015; combustible dust may form during machining.
- Mandatory PPE: Safety glasses with side shields, cut-resistant gloves (ANSI A2 or higher), and dust mask (N95) during sanding or sawing.
- Ensure local exhaust ventilation (LEV) is used during machining to control airborne particulates below 3 mg/m³ (8-hour TWA).
- In case of fire: Use water fog, foam, or dry chemical; acrylic burns with a sooty flame and may release methyl methacrylate vapor.
- Dispose of scrap in accordance with local municipal solid waste regulations; not classified as hazardous waste.

Regulatory Disclaimer: This document is a generic technical material specification provided for educational purposes. The end-user assumes all liability for reviewing, adapting, and validating all tolerances, properties, and safety protocols against specific OEM data sheets and local regulations before deployment.