

Extruded Acrylic Sheet (PMMA) – Technical Material Specification

1.0 Material Overview & Common Uses

Extruded Acrylic Sheet, also known as PMMA (Polymethyl Methacrylate), is a transparent thermoplastic produced via continuous extrusion. It offers excellent optical clarity, UV resistance, and weatherability, making it a cost-effective alternative to cast acrylic for many applications. It is commonly used in signage, point-of-purchase displays, glazing, skylights, protective barriers, and lighting diffusers. Extruded acrylic has a lower molecular weight than cast acrylic, which affects its chemical resistance and machinability.

2.0 Core Technical Properties & Sizing

- Density: 1.19 g/cm³ (nominal)
- Tensile Strength: 70 MPa (yield) per ASTM D638
- Flexural Modulus: 3.1 GPa per ASTM D790
- Impact Strength (Izod Notched): 16 J/m per ASTM D256
- Light Transmission: 92% (visible spectrum, 3 mm thickness)
- Refractive Index: 1.49
- Vicat Softening Point: 105°C per ASTM D1525
- Continuous Service Temperature: 80°C (max)
- Coefficient of Linear Thermal Expansion: $70 \times 10^{-6} / ^\circ\text{C}$
- Standard Sheet Sizes: 1220 x 2440 mm (4' x 8'), 1525 x 3050 mm (5' x 10')
- Standard Thicknesses: 1.5 mm, 2.0 mm, 3.0 mm, 4.5 mm, 6.0 mm, 9.5 mm, 12.7 mm
- Thickness Tolerance: $\pm 10\%$ of nominal thickness per ASTM D4802
- Flatness Tolerance: 3 mm per linear metre (max deviation)
- Hardness (Rockwell M): M-95

3.0 Processing, Machinability & Application

Extruded acrylic is softer and more prone to stress cracking than cast acrylic. Machining requires sharp tooling and adequate cooling to prevent melting and chipping. Cutting, drilling, and routing should be performed with carbide-tipped tools at moderate speeds. Laser cutting produces a clean, polished edge. For bonding, use solvent cements such as methylene chloride or commercial acrylic adhesives; avoid cyanoacrylates which can cause crazing. Thermoforming is possible at 150–180°C, but extruded acrylic has a narrower forming window than cast. Do not exceed 190°C to avoid bubbling.

- Saw Cutting: Use a carbide-tipped blade with 60–80 teeth, 0° rake angle, and 0.010–0.015 inch tooth set. Feed rate: 3–5 m/min.
- Drilling: Use a 118° point angle drill with a 0.010–0.015 inch lip clearance. Peck drilling recommended for depths > 3x diameter.
- Routing: Use a single-flute carbide router bit at 18,000–24,000 RPM. Feed rate: 2–4 m/min. Use compressed air or mist coolant to prevent melting.

- Laser Cutting: CO₂ laser at 100–150 W, speed 20–50 mm/s depending on thickness. Edge finish is flame-polished.
- Solvent Bonding: Apply methylene chloride or Weld-On #3 using a needle-tip applicator. Clamp for 30 seconds; full cure in 24 hours.
- Thermoforming: Preheat sheet at 160°C for 2–4 minutes per mm thickness. Use silicone or felt-covered molds. Cool slowly to avoid warpage.
- Annealing: Not typically required for extruded acrylic; stress relief can be done at 80°C for 1 hour per mm thickness if needed.

4.0 Common Defects & Quality Control

- Reject if surface scratches exceed 0.1 mm depth or are visible under normal lighting at 1 metre distance.
- Reject if internal bubbles or inclusions are larger than 0.5 mm in diameter.
- Reject if sheet exhibits waviness or distortion greater than 3 mm over a 1 metre straight edge.
- Reject if thickness variation exceeds $\pm 10\%$ of nominal at any point.
- Reject if there are visible cracks, crazing, or stress whitening along edges.
- Reject if protective masking is delaminated, wrinkled, or leaves adhesive residue upon removal.
- Reject if colour or haze deviates from approved standard by more than 2 Delta E (CIE Lab).
- Acceptable flatness: maximum 2 mm bow per 1 metre length when laid on a flat surface.

5.0 Storage, Handling & WHMIS Guidelines

- Store sheets vertically in a dry, clean area away from direct sunlight and heat sources. Temperature range: 10–30°C.
- Keep protective masking intact until fabrication. Remove masking immediately after machining to prevent adhesive bonding.
- Shelf life: 2 years from date of manufacture if stored properly. Use FIFO (First In, First Out) inventory rotation.
- WHMIS Classification: Not classified as a hazardous material under WHMIS 2015 in solid form. Dust and fumes from machining are hazardous.
- Hazards of Machining: Inhalation of acrylic dust or fumes may cause respiratory irritation. Methyl methacrylate monomer vapours are flammable and irritating.
- Mandatory PPE: Safety glasses with side shields, cut-resistant gloves (ANSI A2 or higher), and hearing protection when sawing or routing.
- Respiratory Protection: Use N95 respirator or local exhaust ventilation when generating dust. For solvent bonding, use organic vapour cartridge respirator.
- Fire Safety: Acrylic is combustible. Keep away from open flames and ignition sources. Use water fog, foam, or dry chemical extinguishers.
- Spill Procedure: Sweep up solid material; avoid generating dust. For liquid monomers, contain with inert absorbent and dispose per local regulations.
- Disposal: Non-hazardous solid waste can be recycled through acrylic recycling programs. Do not incinerate.

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.