

HDPE High Density Polyethylene Sheet – Technical Material Specification

1.0 Material Overview & Common Uses

HDPE (High Density Polyethylene) is a thermoplastic polymer produced from the monomer ethylene via a catalytic process. It has a linear molecular structure with minimal branching, resulting in a high density (0.941–0.967 g/cm³) and high crystallinity (typically 60–80%). This gives HDPE excellent tensile strength, impact resistance, and chemical resistance compared to low-density polyethylene (LDPE).

HDPE sheet is widely used in industrial applications requiring a durable, lightweight, and corrosion-resistant material. Common uses include cutting boards, chemical storage tanks, marine dock fenders, conveyor wear strips, food processing equipment, playground slides, and outdoor furniture. It is also used as a liner for landfills and ponds due to its impermeability and UV resistance when stabilized.

- Typical grades: General purpose (GP), UV-stabilized (UV), food-grade (FDA compliant), and antistatic (AS).
- Available in standard sheet sizes: 48" x 96" (1220 mm x 2440 mm) and 60" x 120" (1525 mm x 3050 mm).
- Thickness range: 1/16" (1.6 mm) to 4" (101.6 mm), with custom thicknesses available on request.

2.0 Core Technical Properties & Sizing

- Density: 0.941–0.967 g/cm³ (per ASTM D792).
- Tensile strength at yield: 26–33 MPa (per ASTM D638).
- Elongation at break: 500–700% (per ASTM D638).
- Flexural modulus: 0.8–1.2 GPa (per ASTM D790).
- Impact strength (Izod, notched): 20–200 J/m (per ASTM D256).
- Melting point: 130–137°C (266–279°F).
- Continuous service temperature: -40°C to 82°C (-40°F to 180°F).
- Coefficient of linear thermal expansion: 100–200 x 10⁻⁶ /°C (per ASTM D696).
- Water absorption (24 hours): <0.01% (per ASTM D570).
- Hardness: Shore D 60–70 (per ASTM D2240).
- Standard thickness tolerance: ±0.010" for sheets up to 1/2" thick; ±0.020" for sheets 1/2" to 1" thick; ±0.030" for sheets over 1" thick (per ASTM D4976).
- Standard flatness tolerance: 1/8" over 48" length (per ASTM D4812).
- Surface finish: Smooth on both sides (matte or gloss depending on manufacturing process).

3.0 Processing, Machinability & Application

HDPE is easily machined using standard woodworking and metalworking tools. It has a low coefficient of friction and excellent chip flow, but care must be taken to avoid melting due to heat buildup. Sharp tooling and proper cooling are essential for achieving tight tolerances and a smooth surface finish.

- **Cutting:** Use carbide-tipped saw blades with a triple-chip grind geometry. Recommended blade speed: 3000–4000 SFM (surface feet per minute). Feed rate: 0.005–0.010 inch per tooth.
- **Drilling:** Use high-speed steel (HSS) or carbide drill bits with a 118° point angle. Peck drilling recommended for holes deeper than 3x diameter to clear chips and prevent melting. Spindle speed: 2000–3000 RPM.
- **Milling:** Use single-flute or two-flute end mills with a 30° helix angle. Climb milling preferred to reduce heat. Depth of cut: 0.020–0.060 inch per pass. Spindle speed: 3000–5000 RPM.
- **Turning:** Use carbide inserts with a positive rake angle. Surface speed: 400–600 SFM. Feed rate: 0.005–0.015 inch per revolution.
- **Welding:** HDPE can be welded using hot gas welding, extrusion welding, or butt fusion. Hot gas welding temperature: 300–350°C (572–662°F). Use HDPE filler rod of matching grade. Butt fusion temperature: 200–220°C (392–428°F) with a fusion pressure of 0.1–0.3 MPa.
- **Gluing:** HDPE has low surface energy and is difficult to bond. Surface preparation (flame treatment, corona discharge, or plasma treatment) is required. Use cyanoacrylate or two-part epoxy adhesives designed for polyolefins. Clamp for 24 hours at room temperature.
- **Thermoforming:** HDPE can be vacuum formed at 150–180°C (302–356°F). Pre-drying is not required. Mold temperature: 50–70°C (122–158°F).
- **Laser cutting:** CO2 lasers (10.6 µm wavelength) cut HDPE cleanly. Recommended power: 150–300 W for 1/4" sheet. Edge quality may require secondary deburring.

4.0 Common Defects & Quality Control

- Reject if surface has visible pitting, voids, or bubbles exceeding 0.5 mm in diameter (per ASTM D4000).
- Reject if sheet is out-of-square by more than 1/16" over 48" length (per ASTM D4812).
- Reject if thickness variation exceeds ±0.015" for sheets up to 1/2" thick, or ±0.030" for thicker sheets (per ASTM D4976).
- Reject if sheet has warpage (bow or twist) greater than 1/8" over 48" length (per ASTM D4812).
- Reject if there are visible cracks, crazing, or stress whitening (per ASTM D256).
- Reject if surface has contamination (oil, dirt, mold release) that cannot be removed with isopropyl alcohol.
- Reject if color is inconsistent or has streaks (for colored sheets, Delta E > 2.0 per ASTM D2244).
- Reject if sheet fails impact test (Izod notched) below 20 J/m (per ASTM D256).
- Reject if sheet fails tensile test at yield below 26 MPa (per ASTM D638).
- Reject if sheet has edge damage (chips, cracks, or delamination) extending more than 1/8" from the edge.

5.0 Storage, Handling & WHMIS Guidelines

HDPE sheet is non-hazardous under WHMIS 2015 (GHS). It is not classified as a dangerous good. However, dust generated during machining may be a respiratory irritant. Follow standard industrial hygiene practices.

- Store sheets horizontally on a flat, level surface to prevent warping. Maximum stack height: 4 feet for sheets up to 1/2" thick; 2 feet for thicker sheets.
- Store in a dry, climate-controlled environment at 15–25°C (59–77°F) and 40–60% relative humidity. Avoid direct sunlight and UV exposure unless material is UV-stabilized.
- Shelf life: Indefinite under proper storage conditions. No FIFO requirement unless material is UV-stabilized (recommend use within 2 years of manufacture).
- Handling: Use clean, dry gloves (cotton or nitrile) to avoid leaving oils or fingerprints. For large sheets, use two-person lift or mechanical handling equipment to prevent bending or dropping.
- WHMIS classification: Not classified as hazardous. No WHMIS pictogram required. HDPE is not a controlled product.
- Machining dust: Use local exhaust ventilation (LEV) to capture airborne particles. If dust is generated, wear a NIOSH-

approved N95 respirator. Avoid creating airborne dust clouds.

- PPE: Safety glasses with side shields are mandatory during cutting, drilling, or sanding. Hearing protection recommended for sawing operations above 85 dBA. Cut-resistant gloves (ANSI A2 or higher) when handling sharp edges.
- Fire safety: HDPE is combustible (flash point > 340°C). Keep away from open flames and ignition sources. Use Class B extinguisher (CO2 or dry chemical) for small fires. In case of large fire, evacuate area and call emergency services.
- Disposal: HDPE is recyclable (resin code #2). Dispose of scrap and dust in accordance with local municipal regulations. Do not incinerate without proper emission controls.

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.