

Fabrication & Machining Guidelines - HDPE & Mach UHMPE Sheet

The following guidelines are presented as guidelines only, particularly to persons not familiar with machining polymer sheets. Experienced machinists may have developed higher efficiency or better cut qualities by tailoring machinery specifically for this material. Compared to metal, polymer sheets must be machined with less tolerance. Plastic being softer than metal makes it difficult, although not unachievable, to maintain a tolerance tighter than $\pm 0.005''$. Most machining processes aim for between $0.005''$ to $0.010''$ due to the high rate of thermal expansion and environmental changes.

IMPORTANT SAFETY NOTE:

- Always wear correct PPE (Personal Protective Equipment)
- Follow all safety rules for each tool utilized.
- Edges of plastic sheet can be sharp; wear gloves when handling sheets.
- Plastic sheet machines differently and mostly easier than wood and metal. Use caution to avoid injury or serious accidents.

Points to Remember regarding Plastic Sheet:

1. Thermal expansion is up to 10 times greater with polymer sheet than with Steel plates
2. Softening temperatures of plastic sheet are much lower than that of steel
3. Plastic sheet is more flexible/elastic than metal
4. Plastic sheet holds heat longer than steel, so avoid overheating.

Tooling Considerations:

1. Positive tool geometries are recommended
2. Carbide tooling with polished top surfaces are recommended for best surface finish.
3. Ensure material has solid support while machining; plastic is more flexible than steel.
4. Proactive chip clearance is key to prevent melting
5. Generally speaking, coolant fluids are not required
6. Keeping feed rates high, or RPM low to aid in chip clearance and reduce chance of melting
7. A sharp tool is important to obtain a good surface finish

Sawing:

Polymer sheet can be sawn using various methods. Circular saws, jig-saws, table saws, miter saws, panels saws, and band saws can all be utilized.

- Circular blades should use carbide tipped teeth and have minimum 1 tooth per inch. A hollow ground tooth without set will yield a very smooth finish. Feed rates will vary depending on the finish required. When “ripping” a 0° tooth rake and 3° to 10° tooth set are best to keep frictional heat low.
- Band saw blades should have a raker set, and positive rake angle. Feed rates will vary dependant on RPM and desired finish.

Drilling:

Drilling plastic sheet is different than steel. As it is softer it tends to pull the drill into the material quickly especially the larger diameters. Hand drills and machine drills may be used.

- Regular steel drill bits or brad point wood bits can be used to drill most holes. Use only sharp drill bits. A pilot hole is not required.
- If the hole is larger than 1/2" \varnothing it is recommended to use a spade bit, holes saw or radius cutting drill tool. A spade bit will generally work well up to 1.50" \varnothing . Due to the friction heat created when using a hole saw, it is recommended to cut slowly and stop occasionally. Large diameter circles can be cut using a radius drill apparatus.

Routing:

Hand routers, trim routers, and CNC routers are common place for machining polymer sheet. Whether it is edge finishes or complete profile machining, many fabricators use routers. Routers typically provide the best surface finish for large or small plastic sheet parts.

- Up-cut bits with carbide cutting edges are best for removing chips. It is important to keep plastic sheet secured to table to prevent lifting of sheet or parts.
- Feed rate and RPM will vary, dependant on the finish required. For heavy cuts, more than one pass may be required to prevent chattering of tool bit causing a rough finish.

Trouble shooting Guide

- **Melted Surface** – Tool is dull or feed rate is too slow
- **Cut fills up with melted plastic** – Tool is dull, feed rate is too slow.
- **Rough Finish** – Tool is dull or feed rate is too high. Cutting too deep in one pass could also cause this.
- **Spiral marks** – Tool rubs during its retreat. ie: Back side of circular blade rubs sheet edge as it follows the cutting edge. This could be a bent blade or a misaligned machine.
- **Dimension is different when I come back to check it** – Verify initial cutting dimensions. Higher or lower temperatures will change the length and width.