Plastics Processing

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Fabrication Guidelines

The following guidelines are presented for those machinists not familiar with the machining characteristics of plastics. They are intended as guidelines only, and may not represent the most optimum conditions for all parts. The troubleshooting quick reference guides in this section should be used to correct undesirable surface finishes or material responses during machining operations.

All Quadrant materials are stress relieved to ensure the highest degree of machinability and dimensional stability. However, the relative softness of plastics (compared to metals) generally results in greater difficulty maintaining tight tolerances during and after machining. A good rule of thumb for tolerances of plastic parts is +/-0.001” per inch of dimension although tighter tolerances are possible with very stable, reinforced materials.

When machining Plastic stock shapes, remember...

- Thermal expansion is up to 10 times greater with plastics than metals
- Plastics lose heat more slowly than metals, so avoid localized overheating
- Softening (and melting) temperatures of plastics are much lower than metals
- Plastics are much more elastic than metals

Because of these differences, you may wish to experiment with fixtures, tool materials, angles, speeds and feed rates to obtain optimum results.

Getting started

- Positive tool geometries with ground peripheries are recommended
- Plastics Carbide tooling with ground top surfaces is suggested for optimum tool life and surface finish. Polycrystalline diamond tooling provides optimum surface finish when machining Celazole® PBI.
- Use adequate chip clearance to prevent clogging
- Adequately support the material to restrict deflection away from the cutting tool

Coolants

Coolants are generally not required for most machining operations (not including drilling and parting off). However, for optimum surface finishes and close tolerances, non-aromatic, water soluble coolants are suggested. Spray mists and pressurized air are very effective means of cooling and cutting interface. General purpose petroleum based cutting fluids, although suitable for many metals and plastics, may contribute to stress cracking of amorphous plastics such as PC 1000 Polycarbonate, PSU 1000 Polysulfone, Ultem® 1000 PEI, and Radel® R PPSU.
Fabrication Guidelines

Machining Tips

- Coolants are strongly suggested during drilling operations, especially with notch sensitive materials such as Ertalyte® PET-P, Torlon® PAI, Celazole® PBI and glass or carbon reinforced products.
- In addition to minimizing localized heat-up, coolants prolong tool life. Two (flood) coolants suitable for most plastics are Trim 9106CS (Master Chemical Corp. - Perrysburg, OH) and Polycut (Tullco -Savannah, GA). A generally suitable mist coolant is Astro-Mist 2001A (Monroe Fluid Technology - Hilton, NY).

Threading and Tapping

Threading can also be completed on conventional machinery such as automatic or semi-automatic equipment, and self-opening dies with high-speed chasers. In general, lubricants or coolants are not needed but they can be of assistance on extremely high speed operations. A slightly oversized tap is recommended to overcome the tendency toward recovery, although this property may be used to produce a self-locking thread.

When threading long lengths of rod stock, a follow rest or support should be used to hold the work against the tool. When threading cast nylon on a lathe using conventional single-pointed tools, several successive cuts of .005 -.01" should be made. Finished cuts should not be less than .005" because of cast nylon's resilient nature.

Threading should be done by single point using a carbide insert and taking four to five 0.001" passes at the end. Coolant usage is suggested. For tapping, use the specified drill with a two flute tap. Remember to keep the tap clean of chip build-up. Use of a coolant during tapping is also suggested.

Reaming

Most of the engineering plastics can be reamed with either hand or collar reamers to produce holes with good finish and accurate dimensions. Expansion type reamers and standard .001-.002" oversize stub machine reamers can also be used. Helical flute reamers are recommended if there is an interruption in the I.D.. Cuts made with a fixed reamer tend to be undersized unless at least .005" is removed by the final reaming. With a .01-.02" per revolution feed rate and a .005-.01" depth of cut, reamer speeds of 250-450 fpm are recommended.

Reaming PTFE / TFE is generally not recommended. The operation causes the material to compress, especially if the reamer is not exceptionally sharp. Also, PTFE's elasticity will cause holes to "fall in" creating undersize holes. If necessary, special reamers with a primary relief (clearance) angle can produce accurate holes. The use of an oversized reamer can correct undersized holes. Where hole diameter permits, a single point boring tool is recommended to finish the hole to close tolerances.

Continued on next page ▶
Fabrication Guidelines

Saw Cutting
Band sawing is versatile for straight, continuous curves or irregular cuts. Table saws are convenient for straight cuts and can be used to cut multiple thicknesses and thicker cross sections up to 4” with adequate horsepower. Saw blades should be selected based upon material thickness and surface finish desired.

Engineering plastics can be cut with band and circular saws. Blades should be very sharp and have sufficient kerf to clear the cut and allow chips to evacuate. For best results, use high speed steel rip or combination type circular saw blades having a 0° rake angle and a 3-10 tooth set. A carbide blade is recommended for production sawing. Bimetaloy or skip tooth saw blades with 2-4 teeth per inch are recommended for band saws. Hook or claw tooth blades are not recommended.

- Rip and combination blades with a 0° tooth rake and 3° to 10° tooth set are best for general sawing in order to reduce frictional heat.
- Hollow ground circular saw blades without set will yield smooth cuts up to 3/4” thickness.
- Tungsten carbide blades wear well and provide optimum surface finishes.

Milling
Sufficient fixturing allows fast table travel and high spindle speeds when end milling plastics. When face milling, use positive geometry cutter bodies. Milling tip, climb milling is recommended over conventional milling.

Turning
A tool-geometry of 0-5° back rake angle, 15-20° end relief angle and end cutting edge, and a 2-20° side relief angle with a slight nose radius will give good turning results. Although a rake angle of 0-5° is recommended, it is sometimes necessary to vary the angle to 0-5°. Varying is done to balance the cutting tool pressure on the material and results in better finish and size control. Surface speeds from 200-500 fpm with feed rates of .002-.010”/revolution do not require flood coolants and are most appropriate for fine finish turning. Higher speeds can be used with very low feeds for rougher cuts if a coolant is used.

If a finishing cut is desired from a high speed operation, the feed must be dropped to a correspondingly lower value. Directing the chips/curl away from the work is often necessary to prevent it from restricting turning and boring operations. This can be accomplished by using an air jet or some other mechanical means. When turning a large diameter cast nylon, light cuts .625-.125” deep and light feeds .003-.007” per revolution are suggested. Satisfactory results can be obtained, however, using heavy cuts up to 3/8” deep and feed of .015” per revolution.

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Fabrication Guidelines

Drilling
When drilling engineering plastics, all drills, either twist or half-round, should have deep, highly polished flutes. Very sharp, high speed drills with a slow helix angle ground to a 90-118° point, a lip clearance angle of 9-15° and a 0° rake angle produce the best results. Carbide drills are recommended when doing a production lot. Heat build-up can be avoided if drills are kept sharp and the flutes are clear of chips.

Forward travel of the tools should be held at about .005-.009"/revolution. Results of both drilling and reaming are improved if a water soluble oil or mist spray is used to lubricate and cool the material. Drilling with an in-out motion can help dissipate heat into the coolant.

The insulating characteristics of plastics require consideration during drilling operations, especially when hole depths are greater than twice the diameter.

Small Diameter Holes (1/32" to 1"diameter)
High speed steel twist drills are generally sufficient for small holes. To improve swarf removal, frequent pull-out (peck drilling) is suggested. A slow spiral (low helix) drill will allow for better swarf removal.

Large Diameter Holes (1"diameter and larger)
A slow spiral (low helix) drill or general purpose drill bit ground to a 118° point angle with 9° to 15° lip clearance is recommended. The lip rake should be ground (dubbed off) and the web thinned. It is generally best to drill a pilot hole (maximum 1/2"diameter) using 600 to 1,000 rpm and a postive feed of 0.005" to 0.015" per revolution. Avoid hand feeding because of the drill grabbing which can result in microcracks forming. Secondary drilling at 400 to 500 rpm at 0.008" to 0.020" per revolution is required to expand the hole to larger diameters.

A two step process using both drilling and boring can be used on notch sensitive materials such as Ertalyte® PET-P and glass reinforced materials. This minimizes heat build-up and reduces the risk of cracking.
1. Drill a 1"diameter hole using an insert drill at 500 to 800 rpm with a feed rate of 0.005" to 0.015" per revolution.
2. Bore the hole to the final dimensions using a boring bar with carbide insert with 0.015" to 0.030" radii at 500 to 1,000 rpm and a feed rate of 0.0005" to 0.010" per revolution.

Continued on next page
Fabrication Guidelines

Post Annealing
If during the machining process significant material is removed, annealing is recommend-
ed to relieve machined-in-stress and minimize possibility of premature part failure.

Acrylic parts should be annealed at 175°F only after fabrication and polishing are com-
pleted. Anneal 10 hours for thicknesses up to .150", an additional 30 minutes for each
1/4" up to 1-1/2", and an additional hour for each 1/4" thereafter. Parts should be sup-
ported while annealing takes place in an air medium. Slow cooling is also highly recom-
manded.

Delrin® should be air annealed at 320°F for 30 minutes plus 5 minutes per 0.04" of wall
thickness. It is important that the parts be uniformly heated and the oven capable of
controlling the circulating air temperature to ±5°F. Oil annealing in an oil circulating bath
at 320°F will require 15-20 minutes to come up to temperature plus 5 minutes per 0.04"
of wall thickness. Uniform heating is important, and the parts should be restrained from
contact with each other and the walls of the bath.

Nylon should be annealed in the absence of air, preferably by immersion in a suitable
liquid. A temperature of 300°F is often used for general annealing. Annealing time is 15
minutes per 1/8" of cross-section. When removed from the bath, the material should be
allowed to cool in the absence of drafts. The choice liquid to be used as the heat transfer
medium should be based on the following considerations:

- Heat range and stability should be adequate
- Should not attack Nylon
- Should not give off noxious fumes or vapors
- Should not present a fire hazard
- High boiling hydrocarbons, such as oils and waxes, may be used

Adhesive Bonding
The non-stick and/or solvent resistant nature of acetal, nylon, cast nylon, and PTFE requires
that part surfaces be specially prepared before adhesive bonding can occur. The surfaces
can then adhere to like substrates or others such as wood, steel, and aluminum. Rough-
ing techniques such as "satinizing" and sanding with a 280A grit emery cloth have been
successful with acetal surfaces. "Satinizing" is a chemical etching process developed by
DuPont® for Delrin® acetal. In the process, a mildly acidic solution produces uniform anchor
points on the surface. Finishes or cements bond mechanically to these anchor points so
that strong adhesion is possible.

Nylon and cast nylon can be roughened with a medium grit emery cloth, but must also be
cleaned before and after roughening. Carbon tetrachloride* or methyl ethyl ketone solvents
are recommended for cleaning.

PTFE must be thoroughly cleaned with acetone or a similar solvent to remove grease and
or other contaminants. Next, a sodium acid or other etching solution is used. To eliminate
these steps toward bondability, Alro Plastics can provide PTFE sheet with one or both sides
already etched for bonding.

Parts of cast acrylic are easily cemented together or to other materials. Solvent type adhe-
sives are often used to bond cast acrylic because it is soluble in chlorinated and aromatic
hydrocarbons. When used properly, they produce strong and transparent cemented joints.
### Machining Guidelines

<table>
<thead>
<tr>
<th>Materials</th>
<th>Sawing (Circular)</th>
<th>Lathe (Turning)</th>
<th>Lathe (Cutoff)</th>
<th>Drilling</th>
<th>Milling</th>
<th>Reaming</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Polymers</strong></td>
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<td>Speed (sfpm)</td>
<td>4,000 to 6,000</td>
<td>Feed (in./rev.)</td>
<td>.0045 to .010</td>
<td>.003 to .004</td>
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<td>8,000 to 12,000</td>
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<td>.003 to .008</td>
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<td><strong>Milling</strong></td>
<td>Speed (sfpm)</td>
<td>1,650 to 5,000</td>
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<td>Speed (sfpm)</td>
<td>600 to 800</td>
<td>Feed (in./rev.)</td>
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<td>.003 to .004</td>
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<tr>
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<td>Clearance</td>
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<tr>
<td></td>
<td>Rake</td>
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<td>3° to 15° (positive)</td>
<td>0° to 5° (positive)</td>
<td>0° to 5° (negative)</td>
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<td>Set Point Angle (degrees)</td>
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<td>Dry, air jet, vapor</td>
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</tbody>
</table>

This information is designed as a guideline and is not to be construed as absolute. Because of the variety of work and diversity of finishes required, it may be necessary to depart from the suggestions in the table. A good practice to follow is to run a test workpiece before starting a production run.
## Trouble Shooting - Drilling

<table>
<thead>
<tr>
<th>DIFFICULTY</th>
<th>COMMON CAUSE</th>
</tr>
</thead>
</table>
| Tapered Hole                      | 1. Incorrectly sharpened drill  
                                  | 2. Insufficient clearance  
                                  | 3. Feed to heavy               |
| Burnt or Melted Surface           | 1. Wrong type drill  
                                  | 2. Incorrectly sharpened drill  
                                  | 3. Feed to light  
                                  | 4. Dull drill  
                                  | 5. Web too thick                  |
| Chipping of Surfaces              | 1. Feed to heavy  
                                  | 2. Clearance too great  
                                  | 3. Too much rake (thin web as descibed) |
| Chatter                           | 1. Too much clearance  
                                  | 2. Feed light  
                                  | 3. Drill overhang too great  
                                  | 4. Too much rake (thin web as descibed) |
| Feed marks or Spiral lines on Inside Diameter | 1. Feed too heavy  
                                  | 2. Drill not centered  
                                  | 3. Drill ground off-center     |
| Oversize Holes                    | 1. Drill ground off-center  
                                  | 2. Web too thick  
                                  | 3. Insufficient clearance  
                                  | 4. Feed rate to heavy  
                                  | 5. Point angle too great         |
| Undersize Holes                   | 1. Dull drill  
                                  | 2. Too much clearance  
                                  | 3. Point angle too small       |
| Holes Not Concentric              | 1. Feed to heavy  
                                  | 2. Spindle speed to slow  
                                  | 3. Drill enters next piece too far  
                                  | 4. Cut-off tool leaves nib, which deflects drill  
                                  | 5. Web too thick  
                                  | 6. Drill speed to heavy at start  
                                  | 7. Drill not mounted on center  
                                  | 8. Drill not sharpened correctly |
| Burr at Cut-off                   | 1. Dull cut-off tool  
                                  | 2. Drill does not pass completely through piece                               |
| Rapid Dulling of Drill            | 1. Feed too light of drill  
                                  | 2. Spindle speed to fast  
                                  | 3. Insufficient lubrication from coolant |
### Trouble Shooting - Turning & Boring

<table>
<thead>
<tr>
<th>DIFFICULTY</th>
<th>COMMON CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melted Surface</td>
<td>1. Tool dull or heel rubbing</td>
</tr>
<tr>
<td></td>
<td>2. Insufficient side clearance</td>
</tr>
<tr>
<td></td>
<td>3. Feed rate to slow</td>
</tr>
<tr>
<td></td>
<td>4. Spindle speed to fast</td>
</tr>
<tr>
<td>Rough Finish</td>
<td>1. Feed to heavy</td>
</tr>
<tr>
<td></td>
<td>2. Incorrect clearance angles</td>
</tr>
<tr>
<td></td>
<td>3. Sharp point on tool (slight nose radius required)</td>
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<tr>
<td></td>
<td>4. Tool not mounted on center</td>
</tr>
<tr>
<td>Burrs at Edge of Cut</td>
<td>1. No chamfer provided at sharp corners</td>
</tr>
<tr>
<td></td>
<td>2. Dull tool</td>
</tr>
<tr>
<td></td>
<td>3. Insufficient side clearance</td>
</tr>
<tr>
<td></td>
<td>4. Lead angle not provided on tool (tool should ease out of cut gradually, not suddenly)</td>
</tr>
<tr>
<td>Cracking or Chipping of Corners</td>
<td>1. Too much positive rake on tool</td>
</tr>
<tr>
<td></td>
<td>2. Tool not eased into cut (tool suddenly hits work)</td>
</tr>
<tr>
<td></td>
<td>3. Dull tool</td>
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<tr>
<td></td>
<td>4. Tool mounted below center</td>
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<tr>
<td></td>
<td>5. Sharp point on tool (slight nose radius required)</td>
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<tr>
<td>Chatter</td>
<td>1. Too much nose radius on tool</td>
</tr>
<tr>
<td></td>
<td>2. Tool not mounted solidly</td>
</tr>
<tr>
<td></td>
<td>3. Material not supported properly</td>
</tr>
<tr>
<td></td>
<td>4. Width of cut too wide (use 2 cuts)</td>
</tr>
</tbody>
</table>

### Trouble Shooting - Cutting Off

<table>
<thead>
<tr>
<th>DIFFICULTY</th>
<th>COMMON CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melted Surface</td>
<td>1. Dull tool</td>
</tr>
<tr>
<td></td>
<td>2. Insufficient side clearance</td>
</tr>
<tr>
<td></td>
<td>3. Insufficient coolant supply</td>
</tr>
<tr>
<td>Rough Finish</td>
<td>1. Feed to heavy</td>
</tr>
<tr>
<td></td>
<td>2. Tool improperly sharpened</td>
</tr>
<tr>
<td></td>
<td>3. Cutting edge not honed</td>
</tr>
<tr>
<td>Spiral Marks</td>
<td>1. Tool rubs during its retreat</td>
</tr>
<tr>
<td></td>
<td>2. Burr on point of tool</td>
</tr>
<tr>
<td>Concave or Convex Surfaces</td>
<td>1. Point angle to great</td>
</tr>
<tr>
<td></td>
<td>2. Tool not perpendicular to spindle</td>
</tr>
<tr>
<td></td>
<td>3. Tool deflecting</td>
</tr>
<tr>
<td></td>
<td>4. Feed to heavy</td>
</tr>
<tr>
<td></td>
<td>5. Tool mounted above/below center</td>
</tr>
<tr>
<td>Nibs or Burrs at Cut-off Point</td>
<td>1. Point angle not great enough</td>
</tr>
<tr>
<td></td>
<td>2. Tool dull</td>
</tr>
<tr>
<td></td>
<td>3. Feed too heavy</td>
</tr>
<tr>
<td>Burrs on Outside Diameter</td>
<td>1. No chamber before cut-off diameter</td>
</tr>
<tr>
<td></td>
<td>2. Dull tool</td>
</tr>
</tbody>
</table>
Saw Cutting - Kerf Line

Whenever you cut up a full sheet of material into smaller pieces you lose some material due to the thickness of the blade. When the saw enters the material it chews up the material it is cutting through. This is referred to as the "Kerf Line" or wasted material. In order to properly yield out the correct amount of pieces one can expect from a full sheet you need to know how much Kerf to account for. The majority of our blades for our CNC Saws are .187" thick. You also need to factor in the cut tolerance as well, our standard cut tolerance is +1/16" / -0". With tolerances you want to shoot for the middle of the tolerance, so you have some flexibility either way.

Saw Blade (.187"thk) + Tolerance (.063") = .250" KERF Line.

We would then take the Kerf Line and add that number to each of our cut dimensions. For example, say our finished size is 7" x 11", and we will be cutting these out of 48" x 96" full sheets. So if you take the cut sizes and add the Kerf line you can then properly figure out the best possible yield from a full sheet of material.

7.00" + .250" = 7.250" and 11.00" + .250" = 11.250"

Now we take our full sheet sizes and divide them by the cut pieces with Kerf factored in to figure out the best possible yield.

48" / 7.250" = 6 pcs and 96" / 11.250" = 8 pcs. Full sheet yield = 48 pcs
48" / 11.250" = 4 pcs and 96" / 7.250" = 13 pcs. Full sheet yield = 52 pcs.

So the best yield is the second example, we could get 52 pcs from one full sheet of material if we cut it this way. If the total job was for 200 pcs, then we would need 4 sheets of material in order to get the 200+ pcs required. This is the same method we use when we are quoting our customers on any cut-to-size job.

The "kerf" line can be seen in the above photo. Notice the faint line following the blade, that is the kerf line, where the blade cut through the sheet of plastic material.
Standard Edge Finishes

**CHAMFERED EDGE CUT**
Generally called out as 1/8” x 45 degrees or 1/8” x 1/8”. The typical chamfer cut uses a 45 degree bit, but some prints do call out different degrees. The chamfer dimension is generally called out from the surface of the material down to the specific size.

**ROUND OVER EDGE**
Usually used to break a sharp edge leftover from machining the part. By going back thru and rounding over the edges it reduces the chance of getting your hand cut or sliced. Ideal for work surfaces or some machine guards. Generally called out by the size of the Radius needed, ex. 1/8” Radius.

**REVERSE RADIUS EDGE**
Not as common as the others, more for decoration than anything else. Basically just come by with a ball-end cutter and drop it down to the desired depth. May have seen these on a picture frame or something similar.

**FINGERNAIL EDGE CUT**
Similar to the Full Radius (below), it is a little less round. The radius is always larger than half the thickness of the material. So the radius does not blend into the thickness smoothly, it ends abruptly. Still leaves a nice rounded edge to reduce any sharp corners. This cut is a lot easier to do than the Full Radius.

**FULL RADIUSED EDGE**
In the case of the Full Radius, the radius is exactly half the size of the thickness of the material or the diameter and thickness are the same size. This allows the radius to flow perfectly and smoothly into the thickness of the material. This is a very hard cut for most Plastics, since the thickness of the material can vary as much as +/-10% on some Plastics.
Plastic Processing Services
An overview of value-added services from Alro Plastics

No matter what your quantity, size or shape requirements are, simply provide Alro Plastics with your cut-to-size dimensions or a blue print of your fabricated part and let us do the rest. At Alro Plastics we are big believers in adding value to anything we do. Whether it is blanket orders, hold for release orders, or stocking programs we can help. We also offer cut-to-size pieces of sheet and rod, just give us the sizes you require and let us cut them for you.

We also have various pieces of processing equipment and deal with some of the best fabricators in the industry. We can help with any per print items that you may have as well. Simply submit a drawing or print of your item and fax it over to us. Or if you have electronic drawings, feel free to e-mail us your prints directly at plastics@alro.com. We have invested in various CAD software packages so we can read any print formatted in either .dwg, .dxf, or .iges.
Processing - **CNC Saw Cutting**

Every Alro Plastics location has a CNC Saw for cutting plastics to the desired sizes. Our CNC production saws are capable of holding tight tolerances while cutting material up to 8" thick and 14 feet wide/long. These saws are all computer controlled and built to handle a heavy workload on a daily basis.

With these heavy duty CNC saws we are able to cut thru a single block of 8" thick Nylon in one pass or we can stack multiple sheets of 1/4" thick Acrylic and cut them in one, efficient step. These high precision CNC saws are designed to fast and productive.

We pride ourselves on cutting and shipping the same day as ordered in most cases. With a few of our locations running two and even three shifts we are able to turnaround custom cut orders in a hurry. Along with our huge inventory of materials Alro Plastics can promise some of the fastest lead times in the industry. Give us a try on your next cut-to-size order and see what Alro can do for you!

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**CNC Saw Cutting**

- Quantities: 1 pc - 50,000 pcs
- Thickness: 1/16" up to 8" thick
- Length/Width: 1/2" up to 168" wide/long
- Standard Cut Tolerance: +1/16" / -0"
- Custom tolerances available by request
- Multiple shifts for shortest lead times
Processing - Rod & Tube Cutting

Alro Plastics also offers same day cutting and shipping on our Rod and Tube stock. We stock up to 12" diameter in some materials and have the capabilities to cut up to 18" diameter in house. These saws can quickly cut a few pieces or be programmed to cut a production run. Our standard cut tolerance is always on the plus side so the pieces will never come in undersized. We also have the ability to cut U-channel, angle and various other profiles shapes on these saws.

We also drop tag and bin locate all of our cut off pieces to offer our customers smaller minimum orders. This is helpful to customers looking for just a few pieces for a prototype run. Give your Alro representative the length you are looking for and they will check the drops to see if any will work for your job.

Rod & Tube Cutting

- Quantities: 1 pc - 10,000 pcs
- Diameter: 1/8" up to 18" diameter
- Length/Width: 1" up to 20 feet long
- Standard Cut Tolerance: +1/4" / -0"
- Custom tolerances available by request
- Solid rounds and hollow rounds
Processing - Waterjet Cutting

With plastic sheets and slabs being offered in thicker sizes every year and the growing number of materials that are challenging to cut with traditional methods, Alro Plastics offers Waterjet cutting. The Waterjet is capable of cutting sheets up to 10" thick in a single pass to precise tolerances. This capability allows us to offer cut-to-size pieces beyond what our CNC saws can perform.

Another advantage to Waterjet cutting is the ability to cut a wide range of challenging materials with ease. Materials like fiberglass, G10, glass-filled plastics, urethane, neoprene, rubber and even foam can be cut on the Waterjet. These materials were difficult to cut in the past but with the Waterjet Alro Plastics is able to offer cut-to-size pieces in all these materials.

This 5-axis machine can also do bevels and 3D cutting as well as "per print" cutting. We can upload drawings and prints to the Waterjet and cut out an assortment of shapes and contours as well as cut out holes and other shapes. This versatile machine allows us to offer even more unique services to our customers.

5-Axis Waterjet Cutting

- Quantities: 1 pc - 20,000 pcs
- Thickness: 1/32" up to 10" thick
- Width: 1/2" up to 78" wide
- Length: 1/2" up to 157" long
- Standard Cut Tolerance: +/- .015"
- Custom tolerances available by request
- Fiberglass, G10, glass-filled materials, rubber, urethane, foam and more
Processing - **CAD/CAM Programming**

Alro Plastics utilizes the latest CAD/CAM programming software to run our CNC equipment. We can accept customer supplied files in .DWG and .DXF formats and import the data directly into our machines. This software allows us to test run the program in the virtual world before wasting any material or labor time. Our customers can email us CAD data and prints to plastics@alro.com.

We are also ISO certified, which means you can bank on receiving a high quality inspected, finished part from Alro Plastics.

**CAD/CAM Programming**

- **Email**: plastics@alro.com
- **File Types**: .DWG, .DXF, .IGES
- Virtual test runs to prevent errors
- Able to upload customer files directly
- Store files electronically for repeat orders
Processing - **CNC Routing**

Alro has multiple CNC Routers to machine custom plastic parts per print. These machines are capable of extremely close tolerances for milled, drilled and routed parts up to 120" wide x 144" long and up to 4" thick can be achieved. Arcs, curves, slotted tracks, machine guards and conveyor parts are just a handful of the many parts we are capable of producing. E-mail us your drawings at plastics@alro.com, we accept .dwg, .dxf, and .iges files.

We take pride in being ISO certified and do everything in our power to meet the most demanding lead times. Our goal is to keep our lead times on CNC routered parts to 2 weeks or less from stock material. Give us a shot on your next fabricated plastic part and see if we can exceed your expectations.

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**CNC Routing**

- Quantities: 1 pc - 50,000 pcs
- Thickness: 1/16" up to 4" thick
- Width: 1/2" up to 120" wide
- Length: 1/2" up to 144" long
- Standard Cut Tolerance: +/- .015"
- Custom tolerances available by request
- Multi-Table Routers for production runs
- Automatic tool changers, up to 32 tools
Processing - CNC Milling

Alro Plastics has also invested in a Haas VMC (Vertical Machining Center) to give us the ability to machine small, intricate parts per print. The VMC is able to machine parts from 1/16” up to 6” thick. It also has a 32” wide x 60” long table surface to hold a wide variety of parts. With its automatic tool change and ease of programming, we are able to machine complicated parts to print in a single operation. The rapid travel of the tool change process shaves time off the process enabling us to reduce run time and turn our more parts per cycle. The ease of programming allows us to quickly set up small run jobs and prototype runs with minimal cost and lead time.

- Quantities: 1 pc - 10,000 pcs
- Thickness: 1/16" up to 6" thick
- Width: 1" up to 32" wide
- Length: 1" up to 60" long
- Ideal for prototypes and small, complex parts
- Custom tolerances available by request
Processing - **Drilling & Tapping**

Our FlexArm equipment allows Alro Plastics to offer in house capability of part tapping and Helicoil inserts. The FlexArm keeps the Helicoil insertion tool perpendicular to the work piece. The depth control ability offers consistency from part to part whether tapping or inserting helicoils. A FlexArm Tapping Machine will take care of prep work such as reaming, chamfering and deburring.

### Drilling & Tapping

- Quantities: 1 pc - 10,000 pcs
- Thickness: 1/4" up to 4" thick
- Length/Width: 1" up to 120" wide/long
- Helicoil Sizes:
  - Standard: 8-32, 10-24, 10-32, 1/4-20, 3/8-20 and 1/2-13
  - Metric: M3-0.5, M4-0.7, M5-0.8, M6 x 1.0, M8 x 1.25 and M10 x 1.50
When most people hear the word welding they immediately think of steel and metal welding. Well, did you know that some plastics can also be welded? Polypropylene, polyethylene, PVC, PVDF, ABS and certain thermoplastics can all be welded.

Alro Plastics has invested the time and resources to become very good at plastic welding and we offer this service to all of our customers. From the simple task of butt-welding two sheets together to make one longer sheet, to the complex process of creating custom fabricated tanks to print, we can do it all.

- Hot gas and modified extrusion welding
- Done in house, better control of lead times
- Pieces machined on routers for best finish
- Experienced welders specializing in plastics
- Many plastics can be welded
Alro Plastics also offers our customers custom fabricated bent and glued parts to print. Some of our thinner gage plastics can be heat bent or cold formed on a press break, mostly our “See-through” materials like Acrylic, Plexiglas, Polycarbonate and PETG.

We can also CNC Saw Cut and Router these parts and assemble them together on custom fabricated jobs. ISO certified to ensure high quality finished parts in a timely manner. Please email us at plastics@alro.com for a quote!
Plastic Processing Services
An overview of value-added services from Alro Plastics

While our main focus is distribution and cutting to size, we also offer various other services that may be beneficial to your company. From standard routing and drilling to heat bending, flame polishing and assembly we can do it all. We can also supply turned parts to print, from small prototype runs all the way up to large screw machine production runs. At Alro we want to be your one stop shop for all your plastic items. Give Alro Plastics a try on your next processing job and let us exceed your expectations!

Alro Plastics
Your Source for Engineering Plastics
Sheet • Rod • Tube • Film • Profiles • Machined Parts