

GEP PLASTICS MACHINING

Introduction:

As with many other facets of plastics, the machining of plastics is taken to be simple, easy and just plain everyday tooling will suffice. There are however specific tool requirements to improve finishes and achieve tight dimensional tolerances and these guidelines will provide some important considerations to be applied.

1. Thermal expansion of plastics is up to 10 times greater than metals. Softening (and melting) temperatures of plastics are much lower than metals and plastics are much more elastic than metals. Because of these differences, it may be necessary to develop jigs, fixtures, tool materials, angles, speeds and feed rates to obtain optimum results. Selected guidelines follow.
2. Most quality stock shape materials are also stress-relieved to ensure the highest degree of machining quality and dimensional stability. Confirm stress-relieved and the best plastic type and grades for the service in question. Consult with leading knowledgeable suppliers.
3. Plastics lose heat more slowly than metals, so avoid localized overheating. Follow the cooling and other machining guidelines below on the appropriate critical machining parameters.
4. Coolants are generally not required for most plastic 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 the cutting interface. General purpose petroleum based cutting fluids although suitable for metals and some plastics, may contribute to stress cracking of amorphous plastics such as Acrylic, Polycarbonate, Polysulfone, and selected others.
5. The memory of plastics materials needs careful consideration. Memory allows recovery to occur both during and after machining. If correct cooling is not employed, the heat generation will result in poor tolerance finishes. For these reasons, adequate cutting tool clearances and correct tool geometry are essential.
Allowances of 0.2% are generally required. This allowance will vary according to the mass of the finished component, i.e. greater tolerance will be required on a machine turned part having a thin section than on parts of equivalent size which have heavier sections.
6. Maintaining machining tolerances. 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 +/- .001 per inch of dimension although tighter tolerances are possible with very stable, reinforced materials.
7. When close tolerances are required, it may be necessary to machine to within 0.25 to 0.75mm and then allow to stand before finish machining using allowances above.
8. Threading and tapping. 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.

9. For female threads in a plastic face or part that will see much bolting and un-bolting, it is preferable to place a metal insert in the plastic with its own threaded socket to ensure metal in metal fitting of the bolt-on arrangement.
10. For milling applications sufficient fixtures allow fast table travel and high spindle speeds, especially when end milling plastics. When face milling, use either high positive or high shear geometry cutter bodies.
11. 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 100mm (4") with adequate motor power. Saw blades should be selected based upon material thickness and surface finish desired.

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 20mm thickness. Tungsten carbide blades wear well and provide optimized surface finishes.

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