

Fabricating

BONDING

Using adhesives and solvents to bond plastics offers many advantages over traditional assembly methods, including reduced weight, assembly costs, cycle times, and safety concerns.

Adhesive Bonding

Adhesive bonding connects pieces together by adhering itself to the pieces being joined. This provides a solid bridge between the parts and can be used on both similar and dissimilar types of plastics.

MACHINING

Plastics stock shapes may be easily machined. However, the tool geometry and speed must be adjusted for optimum performance with a specific material.

The tolerances for plastics should normally be **LARGER** than those applied to metals. The tolerances must be larger because:

- Plastics expand and contract more than most metals do
- Plastics can change shape do to the relaxation of internal stresses within the material

In critical applications, it may be necessary to pre-machine the part to slightly oversize and stress relieve, or anneal the part before taking final cuts. (*Annealing is the baking of the material without melting or distorting the part to relax the internal stresses. The internal stresses are usually caused by uneven cooling*).

Plastics are good thermal insulators (varies by material). However, caution must be taken when machining not to heat the area being cut to high. To prevent damage from cutting, heating, and melting it may be necessary to use coolant. The type of material, tool, depth of cut, feed rate, and tool speed may require coolant.

TOLERANCES

Tolerance is the allowable variation in a dimension on a profile or part.

Many part designs will have a tolerance of +/- .005", because that tolerance is common for metal parts. It is important to understand how the part will be used, and to discuss the tolerance with the buyer and/or engineer.

The **LOOSER** tolerance you can achieve, the cheaper it will be to manufacture the part.

TIGHTER tolerances, +/- .002" to +/- .0005" will dramatically increase the fabrication costs. Some tolerances may not even be possible to hold on some materials.

- The thickness of a **penny** is **.062"** (Very loose)
- The thickness of a **file folder** is **.010"** (Normal for plastic)
- The thickness of **copy paper** is **.004"** (tight)
- The thickness of **human hair** is **.0015"** (very tight)
- The thickness of a **can of Coke** is **.0012"** (very tight)

Tolerance is also effected by the size of the part, and the type of machine it will be fabricated on.

- **Lathes and Mills** provide the best tolerances
- **CNC Routers** will provide the next best tolerance
- **Hand work and Thermoforming** will need the largest allowable variance

FORMING

Forming is the ability to give something shape or form.

Thermoforming

Thermoforming is one of the simplest, and most economical plastic forming processes. The process starts by building a form. The plastic material is then heated, and laid upon the form. The plastic takes the shape of the form and cools while holding the shape of the form.

Thermoforming provides significant time and labor savings when producing large parts in smaller quantities. Disadvantages: Part manufacturing starts with more expensive finished sheet, rather than resin. This becomes a two-step process.

Vacuum Forming

Vacuum forming requires a thermoplastic sheet to be inserted into a forming clamp area, heating it until it reaches a forming temperature, then using a vacuum to form around the mold. The mold can be made of wood, fiberglass/epoxy, or aluminum and can be single-surface.