Performance Punched Parts

A Penn Fibre Company

To Punch or Not to Punch

Every year, hundreds of millions of plastic parts are produced by stamping or die cutting. Many, if not most part users are unfamiliar with the process and when to use it as the process of choice. This is the first in a three part series designed for engineers to understand the strengths and weakness of this process.

We will explore cost benefits, unique materials, and design concepts. If you have more questions please contact us at sales@performancepunchedparts.com

The punching or stamping process for plastic parts compete with injection molding. If a part is flat, it can often be made using either process. On a regular basis we are asked when it makes economic sense to stamp verses molding a part. THE ANSWER depends largely on not only the part configuration, but the material cost.

Punching is an extremely high speed (50-1500 parts/minute) process with very low cost tooling (500-1500 dollars is typical). However it also has relatively high material scrap rates (low yield), especially if the geometry has large open areas that turn into scrap. The part below on the right will have a lower material yield than the part on the left, while if molded, the yields would be about the same.

Therefore, material value (resin price) has a greater influence on determining the final cost of a stamped part then an injection molded part. The break even point of the two processes; injection molding vs. stamping is highly dependant on material value. This is especially true if the scrap can not be reprocessed as in the case of thermosetting resins such as rubber or epoxies or materials like vulcanized fibre.

In the two graphs in figure 1 below we have done a break even cost analysis for stamping vs. injection molding of a simple 1" X .080" washer. The graphs include total production costs at two production volumes and include material yield, tooling costs and machine hourly rates. The tooling costs are estimates and machine hourly rates are from published information for 2008 from Modern Plastics.

In the first graph the production volume is 25K pieces/month, while the second graph is for 500K parts/month. Tooling is included in the cost and amortized over one year. The costs for injection molding go down as more cavities are added to the tool, and thus the process becomes more competitive. It

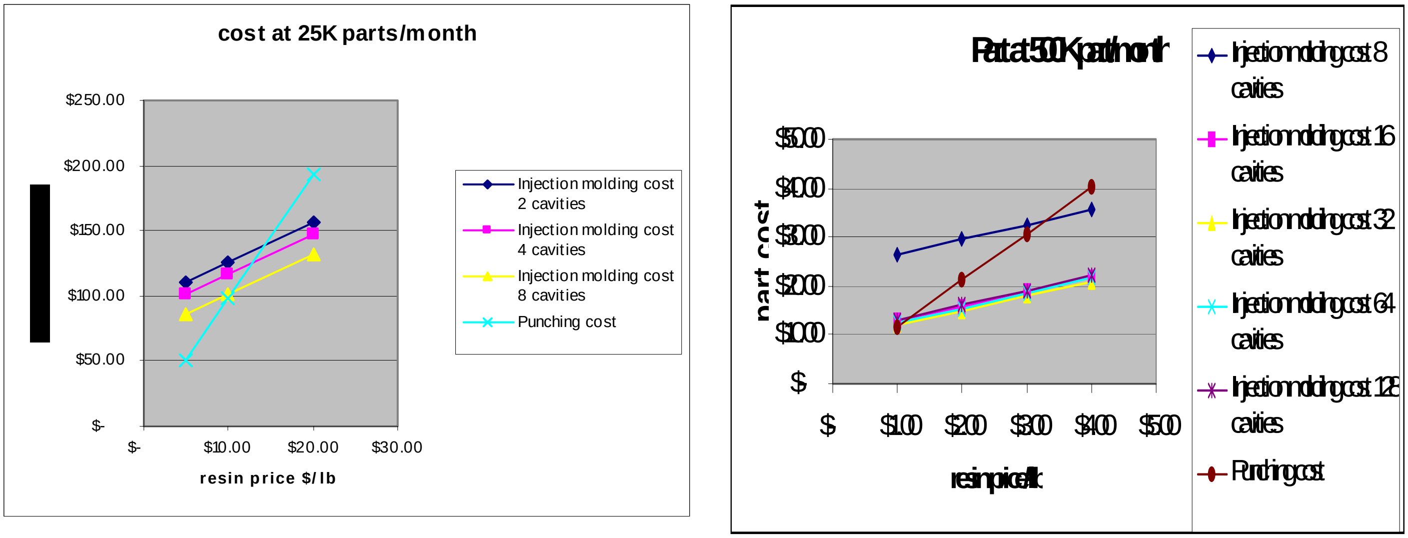


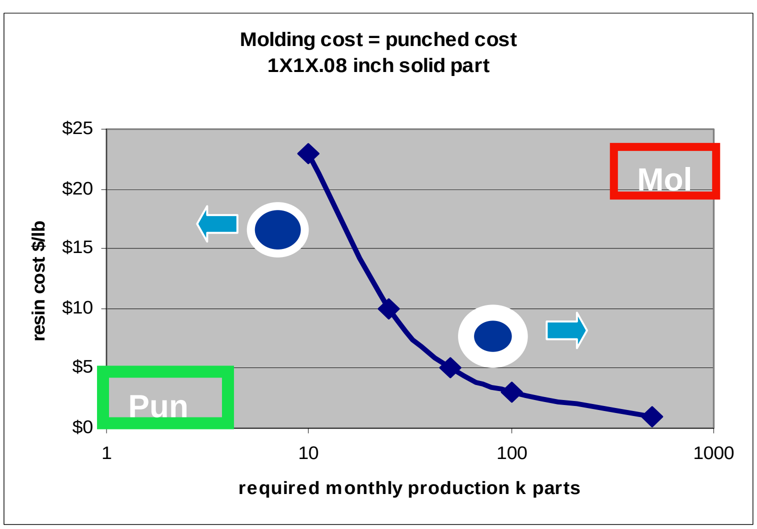
Figure 1. The breakeven costs for injection molding and stamping vs. material cost at 25K and 500K part/month production levels.

requires high cavitations for injection molding to make up for its higher tooling costs and slower cycle rates, but at high enough material costs it generally becomes competitive with punching.

In Figure 2 below we have plotted the breakeven results at the (log value of) monthly volume requirements using the highest cavitation levels (lowest injection molding costs) with respect to resin material costs. It is clear that when one is punching less then 10K pieces/month, the material costs would have to be in excess of 20$/lb before injection molding is competitive. On the other hand, when volumes reach 100K parts/month, resin cost must be at less then 2.50 $/lb for punching to be competitive. At a million pieces/month stamping can only compete with injection molding in only the lowest cost commodity resins that are typically less then 1 $/lb.

Note that higher yield parts (i.e. as solid disk) would tend to shift this curve to the right while a lower yield part such as the example shown would shift it to the left.

Figure 2 Injection molding vs. punching breakeven points with respect to volumes and material cost



Punching also requires the part to be flat from a geometric standpoint. Shoulder washers or beveled holes and edges would require subsequent machining. Parts of this nature are simply not competitive from a punching perspective. While there is some leeway depending on the material, in general punching requires the parts OD minus its ID to be greater then twice the thickness.

Generally tolerances are on the order of the following table, although it may be possible to be slightly tighter depending on the material and volumes required. The OD/ID tolerances shown here are a worse case scenario. The thickness tolerances are pretty much the best that is available due to the control of the sheet extrusion process. Some materials such as vulcanized fibre may not be as tight in thicker parts.

Part thickness (inch)	**.010**	**.015**	**.020**	**.025**	**.030**	**.040**	**.047**	**.062**	**.080**	**.093**	**.125**
+/- Thickness	.002	.002	.002	.003	.003	.003	.004	.005	.005	.005	.005
+/- ID and OD	.005	.005	.005	.005	.005	.005	.005	.005	.005	.01	.01

Want to know more?

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