Improving Part Quality and Cost through Better Tooling



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1. Introduction

Injection mold tooling is an important asset to your company. Proper tooling ensures that your supplier can reliably fabricate parts to specification and meet your project timelines. From tool design and build to preventative maintenance, there are various factors that can affect the quality and cost of your molded parts. Working with your supplier as a strategic partner, and involving them early in the design process, can help decrease costs and improve quality long-term.





Design optimization

The complexity of your plastic part has a major impact on the design and cost of your tool. Work with your supplier early in the design process in order to optimize for quality and cost.

2. Design for Cost

When Empire begins working with a customer on a tooling project for production, their goals are to achieve the best cost per part and the best ROI on tooling. Several factors affect tooling cost:

1. Part complexity

The design and complexity of the molded part often has a greater impact on cost than the design of the tool itself. Intricate part designs require more complex and therefore more expensive molds, while simple part designs require less complexity and cost in the mold design. However, spending a bit more on adequate tooling up front can often reduce the long-term cost of the program.

2. Yearly output

High-volume projects need higher quality tools to reliably produce more parts per hour, which increases the cost of the tool. Large volume projects also require a tool with more cavities, which also increases manufacturing costs. But while a high-cavitation tool might cost more initially, ultimately the high volume of production will bring part costs down.

3. Material selection

Choosing plastic that is volatile or corrosive, requires high mold temperatures, or contains abrasive materials such as mineral, glass, or carbon fiber can cause the cost of the tool to increase. These factors can also impact the maintenance cost of the mold.

4. Part tolerance

Parts with tight tolerances will require additional mold manufacturing steps, which increases both manufacturing costs and tool maintenance costs.

5. Cycle time

Uniform cooling throughout the cavity impression (and from cavity to cavity in multi-cavity tools) is important to achieving fast machine cycles. This requires well designed tooling and a higher precision build, both of which increase the tool build cost and potentially the maintenance cost.

6. Gate location

Proper gate location is critical to part quality, but tools that do not have gates at the side of the part require construction techniques that increase tool cost. Additionally, the use of hot manifold systems increases the tool price but frequently lowers the part price.

7. Mold cooling

The mold functions like a heat exchanger, drawing heat from the molten plastic. Uniform cooling throughout the cavity impression will yield the highest quality part and the fastest cycle time. Different cooling strategies will impact the tooling manufacturing cost.



Hot-runner mold

In a hot-runner mold, plastic flows through a channel within the tool. The plastic is kept to a temperature above its melting point and then gated into the part or into a sub-runner system. This style of runner system is commonly used to mold high volumes, keeping part costs low.

Design for Manufacturability

Can the part be redesigned to make it easier to mold? If engaged early enough in the part development process, your supplier's engineering team can often answer "yes" to this question. Understanding secondary operations, final assembly, and other factors can help your supplier determine how to make the part cost-effectively. **The complexity of the part design will then drive the tool design**.

Empire can employ other methods to make tooling and molding less expensive, such as:

- Selecting the right mold type: The two main types of plastic injection molds are cold-runner and hot-runner molds. Cold-runner mold designs are usually simpler, and the tool is less expensive; however, the cost per part is often higher. Hot-runner mold designs are typically more complex and more expensive, but the part cost is lower.
- 2. Changing the cooling method: Choosing the right cooling method is the key to reducing cycle time and being able to mold a quality part. Empire reviews all options for cooling, including but not limited to standard mold cooling, hot steam or oil, and conformal cooling options. The geometry of the part and the resin being used play a large role in what method is chosen.
- **3. Threading:** Adding internal or external threads to your parts can drive the overall cost of your part and finished assembly. We work closely with the customer to determine the need for the threads and to determine if anything else can be done to keep the finished part cost as competitive as possible.
- 4. Other changes to parts to reduce secondary operations, such as inmold labeling, 2-shot molding, and insert molding.

Making the part easier to manufacture is one of the best ways to lower the overall cost of production.

Design for Longevity

A well-designed tool is easier to set up and to start, has lower rejection rates and a predictable cycle time, and will perform beyond its required life expectancy. This allows your supplier to provide reliable quality, cost, and delivery for your program. On the other hand, an unreliable tool impedes production and requires extra money, time, and effort to repair.

Empire strives to understand all aspects of your project up front in order to achieve the lowest cost, even if we're only building the tool and not producing the part. This information helps us increase the longevity of the tool and avoid *residual* costs, such as repair expenses, that can crop up through continued use of the tool.



Troubleshoot your tooling

Empire has effectively transferred more than 1,500 tools, and we can help with yours.

Sign up for a **free evaluation of your quality issue** at: injectionmolding.empireprecision.com/ troubleshoot-tooling

3. Design for Quality

A correctly built tool is imperative for high quality injection molded parts, and many of the same factors that impact tool cost can also affect quality. The plastic material used for the part, for example, can determine the type of steel used to build the tool. The intended application of the part can influence the kind of surface finish needed or the type of cooling used. A knowledgeable supplier will collaborate with you in order to make the best decisions based on your particular part design and program needs.

4. Injection Mold Maintenance

Tool longevity is just as important to part cost and quality as the design and build. Preventative maintenance (PM) is vital to improving longevity, but it is a process that is often overlooked. Many customers would prefer to just keep running the part, but that causes wear on the tool which can cause serious part problems if left unchecked. It is better to perform the necessary maintenance and stop issues before they happen.

It's like owning a car. If you keep driving your car and never change the tires, you will eventually have a flat tire.

- John Meabon, Empire's Tooling & Manufacturing Manager

Empire designs molds to make the PM process easier on the customer. We establish a unique PM cycle for every mold depending on the specific part design, industry, material, and other factors. From parting line details to extra inserts, we work with companies to make sure PM doesn't interrupt the part production schedule.

Another way Empire saves maintenance time and preserves tool longevity is by building mold components so that they can be removed individually without having to disassemble the whole tool.



Strategic partnerships

The best value for a program is often achieved when a supplier works closely with you as a strategic partner. Whether you require tooling services only or tooling for full production, Empire's experienced team can help you make the most of your tooling investment.

5. Three Tips for Better Outsourced Tooling

Whether you are constructing a tool for high-volume production or smallbatch runs, it is important to choose a vendor with experienced designers and tool builders on their team. Here are three other tips to consider:

1. Get your supplier involved early

Choose an injection molding partner with design expertise, and involve them in product development as soon as possible. When engaged early, your supplier can first make sure that the part will work, and then they can provide input to make the part easier and less expensive to mold. Empire has resources in-house to consult on the design for manufacturability of your parts; we'll also ensure that your part is compatible with your assembly or applications and find ways to make your parts faster and at a lower cost. For tooling-only customers, early involvement helps our design team increase tool robustness and longevity.

2. Be aware of tooling costs

Tool design and tool cost are determined largely by part complexity. A more complex tool for an intricate part might cost more initially, but it will make part production easier and reduce the total program cost in the long run.

3. Understand tooling and production timelines

Customers are often confused about the length of time it takes to go to mold. Empire provides project timelines, usually of 12-16 weeks, so that customers know what will be ready when. We also give weekly updates so you know that your program is on track.

Contact Empire Precision at 1.800.541.7135 or info@empireprecision. com to speak with an expert who can who can guide you through multiple considerations for improved tooling cost and performance.

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