Guidelines for Mold Purchase

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Guidelines to Simplify the Mold Buying Process

Buying a mold sounds like a complex and tedious process; a few guidelines, however, can help make the process easier.

1. Make your RFQ as detailed as you can.

Over-communication is always better than under-communication. Be specific about the type of mold you need, the number of cavities, the steel, the life of the mold, and the guarantees. If you need any suggestions ask your mold maker. The more exact the description in the RFQ, the more accurate will be the mold maker's quote.

2. Mention the reason for requesting a quote.

Let the mold maker know if the RFQ is for a 'Bid' or a 'Buy'. If you just need an estimated pricing, let them know so they can save the time that will be required for a thorough engineering evaluation. If the RFQ is for a 'Buy', mention the estimated timeline for the purchase and the related qualification process. Quoting takes significant engineering time, and mold makers always appreciate a candid request regarding this from customers.

3. Respect the confidential information provided by the mold maker.

Any suggestions or recommendations made by a mold maker, during a quote process, should not be shared with other competitive mold makers. Mold makers may vary in their skill sets and may have invested much of their engineering resources in making the recommendations; these should be considered their intellectual property and should be kept confidential.

4. An open communication with the mold maker(s) is helpful.

Involve the mold makers early on in your project if you can; work with them on your costing goals and budgets, the life of the project and part quantity expectations. The best purchasing is done by those who truly know their suppliers and work with them as a team, openly and honestly, to the benefit of both companies.

5. Expect the mold makers to submit a schedule and keep you updated on a regular basis.

Most mold makers provide Gantt charts or other types of progress reports. Knowing where the mold build stands and whether it is on schedule are important; therefore, ask for schedule information from the beginning so that the mold makers know what you expect.

6. Changes to the part design can mean changes to the mold.

The more changes you make during the mold build, the less likely you are to get a mold in the lead time or at the price quoted. Understand that when you require part design changes, it often leads to changes in the mold design, which can add both time and cost to the mold build. Verify if your mold maker is equipped to do a mold-flow analysis and submit a report to you before he starts building the mold.

7. Describe upfront when the mold will be considered complete.

For the final payment to be made, the mold must be complete. Usually, a mold is complete when it is capable of producing the parts, according to the specifications and dimensions on the part drawing. When the part meets the drawing specifications and dimensions, the mold is complete. Changes are suggested via an engineering change order (ECO), and are priced accordingly.

8**. Consider the Total Cost of Ownership.**

You may find a mold maker, who quotes very low prices on a job but eventually is unable to deliver as required. Invest in a careful qualification process by considering all aspects.

It is extremely important for you to have a good quality mold. Remember, your molded components are only as good as the mold they come from. Therefore, be sure your mold is the optimum one to mold the parts you need for the life of the program.

What to Look for in a Mold Supplier

When Engineering comes to Purchasing with a requirement for a mold for a new plastic component or a group of components for a new product, often the purchasing person does not have enough knowledge about where to purchase these molds. In some companies, the project or product engineers are in charge of finding a mold manufacturer. Even so, there are questions about what to look for in a mold supplier.

Most mold shops have similar machine tool capabilities and CAD/CAM software systems. The differences come into play in the mold types in which different shops specialize. Some of the types of molds include:

- Insert Molds: Molds that accommodate inserts in which the plastic is molded around to eliminate secondary or post-molding operations.
- Over-molding Molds: Molds that accommodate placement of a substrate part over which another material is molded, that is, an ABS substrate with a thermoplastic elastomer (TPE) molded over it.
- Two-shot Molds: Molds that are built to accommodate multi-material molding or multicolor molding, such as an automotive tail light, which might require both red and orange polycarbonate material to be molded to make a complete tail light.
- Rotary Stack Molds: Molds that produce multiple parts through multiple processes. The mold is built in a ‘cube’; after each process, the mold rotates 90 degrees for the next process.
- Unscrewing Molds: Molds that accommodate threaded parts such as screws, caps and closures, and generally have either ‘id’ or ‘od’ threads.

Some mold manufacturers specialize in very large-sized molds such as those that are used for bumpers on cars or trucks. Some specialize in very small molds, or in micro-molding. Most manufacturers fall somewhere in between, and can generally handle molds that fit up to a 500-ton injection molding press.

Mold manufacturers develop certain areas of expertise over their years in business, and generally are more successful when they stick to those areas of expertise. It is best to find a mold manufacturing company that has a track record in building the type of mold that you require.

Mold manufacturers do not have 'standardized' pricing; therefore, if you ask for bids from different mold companies, you will probably get different prices that can range all over the map. Much of this price variable has to do with the expertise of the mold manufacturer in designing and building the type of mold you require. It also has to do with their shop rates, which can vary depending on the size of the shop or where the shop is located, and other variables.

If you get quotes that are very wide in price, go talk to each mold maker and ask for a detailed explanation of the quote and how they arrived at that price. Make sure your RFQ contained all the detailed information about the requirements for the mold and that the mold maker did not miss something that might have added to the cost of the mold.

Finding a good mold manufacturer, onshore or offshore, who can meet your needs with a high-quality mold that will give you high quality parts, is not difficult or impossible, but doing your homework is important.

When to Use Hot Runner Systems

Hot runner (runner-less) systems, as compared to a cold runner systems, are seeing more demand in today's high-speed, high-volume molding operations due to higher material prices, a need to reduce cycle time, reduce scrap rates, and to increase overall productivity and optimize manufacturing costs.

In applications in which regrind cannot be introduced (virgin resin only applications) back into the material to produce the parts, in particular, hot runner systems have an advantage in reducing the amount of material used as well as the amount of scrap created by the runner system.

Hot runner technology is becoming a fully-accepted and indeed the preferred method of gating many multi-cavity molds. This is increasingly replacing the older runner methods, especially the 3-plate systems. In fact, the older 3-plate molds is quite easily rebuilt into hot runner molds.

Whereas hot runner systems are typically used on large, multi-cavity molds (32-cavity and more), many companies are choosing to put hot runner systems on smaller multi-cavity molds (8- or 16-cavity) because of the increased productivity and reduced scrap.

Advantages of a hot runner system vs a cold runner system

- No runners to separate from the molded parts.
- No runners to either dispose of or regrind and reprocess, with the possibility of introducing contamination into virgin material.
- Hot drops carry consistent heat at processing temperature directly into the cavity.
- Cooling time for thin sectioned parts is shorter due to the absence of thicker, longer cycle dependent runners.
- No need to provide robotics for runner removal.
- Plasticized material (shot size) is reduced by the runner weight.
- Lower injection pressures may be realized during packing stages due to heated gate areas in hot runner systems.
- Less clamping pressure required as compared to two plate cold runner molds
- Sprue sticking and nozzle freeze-off, associated with cold runners, are eliminated.
- Cleaner molding room, without the regrind, particularly in clean-room molding environments.

There are, however, some molds for which a switch to the 3-runner system cannot be justified economically, especially for low production items. In these cases, the older systems, especially cold runner 2-plate molds, are still much in use.

If you believe that you have an application that might be suitable for a hot runner system, you should consult with a mold manufacturer experienced in producing molds with hot runner systems.

Getting the Mold Maker Involved Early

A successful mold manufacturing program involves strategic planning. One of the most important aspects of that plan is getting the mold manufacturer involved in the process early in the game. Most mold manufacturing companies today are fully staffed with engineering personnel, who are knowledgeable in plastic part design and mold design, including design for manufacturability.

Many OEMs are not aware of the knowledge base that exists in mold companies, which they can utilize to design and develop optimum parts and molds that will, in the long run, save time and money. In fact, the mold manufacturer can become a part of the OEM's manufacturing team.

It does not matter how good your part design is if it cannot be molded. Your first step must be to review your concept model (3-D computer model or 2-D drawings) with your mold maker's engineering team and get inputs on the part design.

Is this part moldable? If so, what type of molding process is optimum? Injection molding or thermoforming? Blow-molded or rotationally molded? Are there design issues that will make this part more ideal for one process than the others? Are there design issues that will increase the cost of the mold? Can those design issues be resolved in some way to reduce the cost of the mold?

Working from the outset with the mold maker can save you a lot of money and time. Some OEMs work directly with the molder, and the molder then works with the mold maker. In some cases, the molder has in-house mold making capabilities, ensuring that the entire project is undertaken under one roof. This has its benefits. If, however, the molder does not have mold manufacturing capabilities and must sub-contract the mold making, the molder becomes a 'middleman' in the project. This often adds a layer of complexity to the process of managing the project.

Minor Changes in a Part Design Could Result in Major Cost Increases

Sometimes, changes in the part design and/or mold design are an inevitable part of the mold development and build process. Rarely is an engineering data file cast complete from the outset; this is why a good collaboration between the mold maker and the OEM's or the molding company's engineering team is required for a successful program. However, the OEM or the molder for the OEM cannot expect to make many changes to the quoted part/mold design and not expect changes to the cost of the mold.

What may seem like a minor change to the OEM may in actuality be a major change to the mold maker, resulting in a significant cost increase. Depending on what stage the mold build is in, the change could result in either no cost increase, minor cost increase or a major cost increase. Therefore, it is increasingly critical to have the CAD file as accurate and close to the desired end product as possible.

If an OEM begins to make a lot of changes, the mold maker may be forced to put the project on hold until all the changes are worked through and finalized on the part design before actually cutting steel. Once the mold manufacturer begins cutting steel, any changes to the part design may incur more costs, depending on how far the mold maker has progressed in the build process.

Changes that require re-cutting steel or re-burning electrodes often mean major delays, and the mold making is then put on hold until the new changes are approved of by the customer. When the customers drag their feet in approving part designs, mold designs, or changes to part or mold design, they risk delaying delivery of the mold and increasing the price.

In some cases, the molder or the OEM might change the manufacturing process and this may require an engineering change. Changes during or after the mold build to accommodate different processing parameters or the use of automation are often costly.

Selecting the Optimum Type of Mold for Your Part

When OEMs consider a new plastic product or component part that requires a mold, one of the first things to consider is the cost of the mold. However, the cost of the mold is not the first consideration that a company should make; instead, more important is what type of mold will reduce the overall cost to manufacture while improving quality and efficiency.

Part cost will vary depending on the type of mold. And the type of mold chosen is based on a number of factors, including:

- The number of parts required annually. This figure should be an accurate figure, not something pulled out of the air or a guess. If you need 3 million parts annually, you will need a mold capable of running 3 million parts per year comfortably so you can meet your manufacturing schedule without downtime.
- Whether a secondary operation is required for the part. If so, there are various technologies that can reduce costs such as inline operations or even in-mold technology that can significantly reduce the cycle time and the manual handling of parts that will improve quality.
- The selection of material. Certain filled engineering thermoplastics cause more wear and tear on the mold; therefore, you will want a hardened steel mold for many applications in which glass filled or other filled materials are required.
- Part cost. Do you know your target part cost? If so, talk to your mold supplier about that cost because he can help you get to that target by designing an appropriate mold for the part.
- Design of the part. All plastic parts must be designed for easy manufacturability. Whereas a part design may look good on paper, it may not be manufactured easily. Or it may be manufacturable at a very high cost in both mold and piece-part price.

There are many different types of molds and the best thing an OEM purchasing agent or engineer can do is to educate him/herself about these various types of molds.

1) Conventional or Standard Mold

A standard mold with an ejector-plate assembly is generally used when parting line runners are acceptable, and ejector pins, sleeves, or blades are adequate to remove the molded parts from the mold. A standard mold is sometimes referred to as a two-plate mold and comprises a cavity and a core side.

2) Slide-core Mold Base

When an undercut or coring feature is required, which cannot be formed and ejected through a standard mold opening, a slide-core mold base is usually used. The slide core is used to form the feature and is withdrawn prior to ejection of the part.

3) Stripper-plate Mold

When ejector pins or blades are inadequate or objectionable in removing parts from a mold, a stripper-plate mold is generally used. Caps and closures with internal threads are examples of parts that might be molded in this way.

4) Three-plate Mold

When placing a gate at the side or edge of a part is objectionable because this could cause fill problems, a three-plate mold permits a central fill point that allows for uniform filling without part-weakening weld lines.

5) Thread-forming (unscrewing) Mold

When a part requires internal threads and cannot be ejected by a stripper-plate mold without damaging the threads, a thread-forming mold generally is used. Thread-forming molds are used in producing plastic nuts, bolts, certain gears and caps and closures for the food and beverage industry.

6) Family Mold

Multiple components of a product, all made of the same resin, can be molded in a family mold cavity. Family molds are extremely complex and must be carefully designed in order for them to be balanced and permit optimum molding.

7) Stack Mold

Essentially, a stack mold is two molds stacked back-to-back that share a common plate. A stack mold doubles the cavitations without the need to increase press size, and are typically used for flat parts such as food container lids, coffee-can lids or thin-walled shallow food containers.

8) Rotating Stack Mold

Rotating stack molds or 'cube' molds are also being used over the past decade. This is generally a multi-cavity mold, which combines a number of processing technologies, including in-mold labeling, in-mold painting, in-mold assembly, etc., through the use of a 'cube' mold.

9) Two-component Molds

For molding parts that have two different materials (a thermoplastic substrate with an over-molded thermoplastic elastomer, for example) or two different colors (such as a red and orange tail light assembly), a two-component or 'two-shot' mold is ideal. Doing both materials and both colors in one mold saves time of having to remove the first component from the mold and placing it into a second mold for the second shot.

Whereas you do not need to know all the details about all the types of molds available, you should be familiar with a few of the options before you send out a request for quote. This ensures that you can get the best mold for your money—one that will meet your needs and provide optimum manufacturing in a cost-effective manner. The more you know about your own requirements, the better your mold supplier can assist you with making the right decision.

Choose the Right Mold Materials

There are many types and grades of mold materials to choose from when specifying your mold. So how do you know which is best? Generally, your mold manufacturer can help you make that decision when you sit down to discuss the criteria that will impact which mold material is suitable for your requirements.

Some of the considerations that are critical to the choice of mold material are:

- **Program life**. Do you expect the program for the particular components to last one year? Five years? Or longer? If you anticipate a long program life, you need a mold that will be extremely durable to provide the most trouble-free molding operation.

- **Plastic material.** What type of material will be used to mold the parts? This also weighs heavily on the type of mold material you will choose. A glass-filled material and unfilled commodity-grade material require different mold material to achieve the required mold life.

- **Number of parts required.** How many parts will you require per month? Per year? If the number is low—100,000 parts or less annually—you can probably get away with a softer mold material. However, if you require five million parts annually, you might want to look at hardened tool steels to meet these requirements.

There are a number of different types of mold materials.

A) P-20: This is a pre-hardened chrome-moly tool steel made specifically for machined cavities. Usually no heat treating is required. Many times, P-20 will be chosen for a common mold life.

B) H-13: This is a chromium-based mold steel designed for increased production and longer mold life. It is thermal shock and fatigue resistant, and offers superior machinability and polishability.

C) S-7. This is a versatile grade recommended for applications demanding high degrees of toughness and moderate wear resistance.

As is typical when processing plastic parts, no matter what the process—injection molding, thermoforming, or blow molding—there are many variables involved that impact the choice of mold material. The best way to make an optimum selection is to consult your mold manufacturer, who usually understands the availability and advantages/disadvantages of various grades of steel and the related costs. The mold maker can provide you with spec sheets and other information on the suitability of the various materials for the mold and molded parts requirements.

What Constitutes a Good, High-Production Mold?

Building high production, high cavitation molds requires a mold manufacturer whose expertise is in this arena. Whereas every mold the OEM builds needs to be a well-built mold, made to specifications and able to make a conforming part, building molds for high production requires special diligence and careful choice of the mold manufacturer.

Early involvement with the mold manufacturer is always the key, and you need to crunch the numbers to make sure that the mold you buy is really the one you need. Often, OEMs will estimate a greater number of parts required than they actually need when they start production. It is not uncommon for an OEM to ask a mold manufacturer to quote a mold that will make 500,000 parts per month, only to find out that the product isn't taking off as marketing anticipated or the ramp-up was slower to happen.

In estimating the number of parts high-production molds make, there is the actual part production in one hour vs part production in one hour at 85% efficiency. For a part running at a five-second cycle in a 32-cavity mold, the actual number of parts is 23,040. For that same part running at 85% efficiency, will give 19,584 parts per hour. That translates to 171,555,840 parts in one year.

Many high-cavitation molds can be seen running with several cavities blocked off because those cavities were not making conforming parts. For molders—whether custom molders or OEMs' in-house molding operations—sometimes it is easier to block off the non-conforming cavity and keep running that to stop the press, take the mold out and fix it. The best productivity is not achieved from a high-cavitation mold—say 32 cavities—if only half of these are running.

Part cost and productivity go hand-in-hand. Realize, however, that only a well-built, precision mold will provide you with the productivity required to reduce cycle time and thus part costs. Those considerations need to be made upfront, with a mold manufacturer, who is qualified to build high-production molds that run in a high-volume setting.

Determining the Number of Cavities in a Mold

Determining the number of cavities in a mold requires more than just an educated guess. It is critical to the productivity and efficiency of the mold and to your own inventory needs to have the appropriate number of cavities.

The number of cavities in a mold is a function of the number of parts required annually. A mold with too few cavities will not be able to meet your requirements or will be able to meet it only if the press runs 24 hours a day, seven days a week, 52 weeks a year. Since that is nearly impossible and there is always some downtime to consider for mold maintenance, repairs, or other unexpected interruptions, estimating the number of cavities is critical to meeting your demand for parts.

Typically, those in the industry say mold buyers do not define their targets with respect to manufacturing goals. The more cavities you have, the larger the mold must be to accommodate these. With a large part, more than one cavity means a mold with a footprint of several square feet, and it might be better to choose a one-cavity mold. Smaller

parts are more easily accommodated in a multi-cavity mold.

Volume is another consideration. Mold buyers with large-volume requirements, such as several million parts annually, often prefer to buy a large multi-cavity mold.

Small components such as disposable medical parts or caps for soda bottles, or milk or water jugs, or lids for food containers are often molded in large, multi-cavity molds that require presses with larger tonnage. Some of these molds have more than 200 cavities! That's a lot of parts, but then, companies that produce millions of bottles annually need a lot of bottle caps!

Some mold buyers with high-volume requirements prefer several smaller, multi-cavity molds. The strategy of using smaller molds means that the molds have a smaller footprint, and run in smaller presses that cost less to operate, and can often reduce overall costs to manufacture. Although the piece part price is exponentially less with a higher cavitation mold, the fact that the mold must run in a larger press that costs more to operate often offsets any real savings in piece part price. Smaller molds are easier to move in and out of the press, and easier to maintain.

In making a decision as to size and number of cavities, the prudent approach is to work with a mold maker to evaluate the number of parts required weighed against the cost-effectiveness of large vs small multi-cavity molds.

Ten Pointers for Better Mold Production

Although the criteria and the technology used to produce molds have changed dramatically in recent years, the basic rules for developing a mold that meets the original design criteria, and functions effectively, have not changed at all. These tips are based on more than 30 years of experience in the field of mold manufacturing. Many of these tips talk about communication. As any mold maker will tell you, all too often there is incomplete information available at the onset of a program. This is like having only half the map; the chances of getting to the final destination on time are very slim.

1. **Design with specified cost and time criteria.**
2. **Make sure your design specifications can be produced using existing technology.**
3. **Share your company's design philosophy with your mold maker and allow the mold maker's design team the opportunity to contribute.**
4. **Set clear guidelines on the required minimum tool life and the capacity before manufacturing starts.**
5. **Have the mold maker establish a production timetable that allows reasonable time for bench testing, prior to delivery.**
6. **Set up a weekly progress report call/e-mail/Skype with your sales representative during the manufacturing process.**

7. **Get the mold maker to try out the mold and submit relevant samples and reports before shipping the mold to you.**

8. **Ask the mold maker for clear guidelines on how to maintain the mold once it is installed.**

9. **Remember that the design and manufacture of a mold or die is a collaborative effort.**

10. **Do not cut corners! There is a reasonable price to pay for a mold.**

Purchasing molds from a 'qualified mold maker' makes sense whether the mold maker is onshore or in China

An increased number of OEMs are purchasing molds from China to save on costs. The cost of making a mold in China is usually 30-50% less (even after adding the freight costs) than the cost of making it in the U.S. or Europe. The lead times are shorter in China, which makes up for the transit time. An increased number of mold makers in China are investing in the latest equipment/know-how to produce the finest quality of molds. They employ highly skilled and well-trained staff, who are able to understand customer-needs and meet all requirements. Communication across time-zones is not a problem any longer.