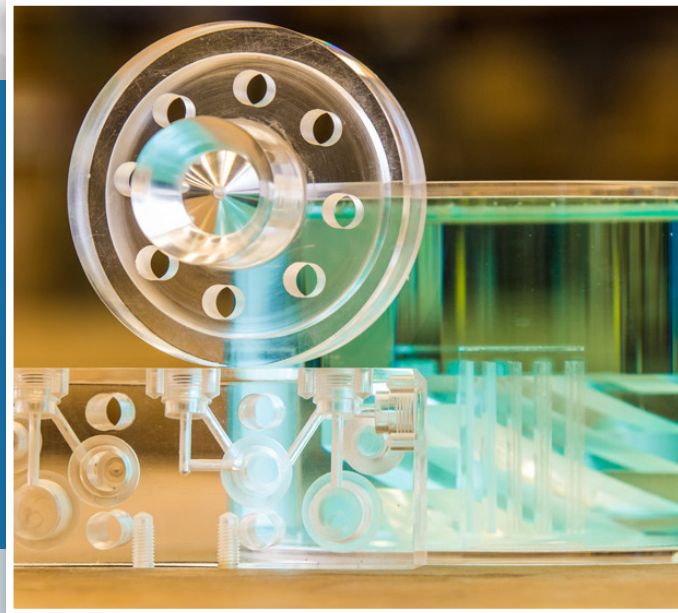


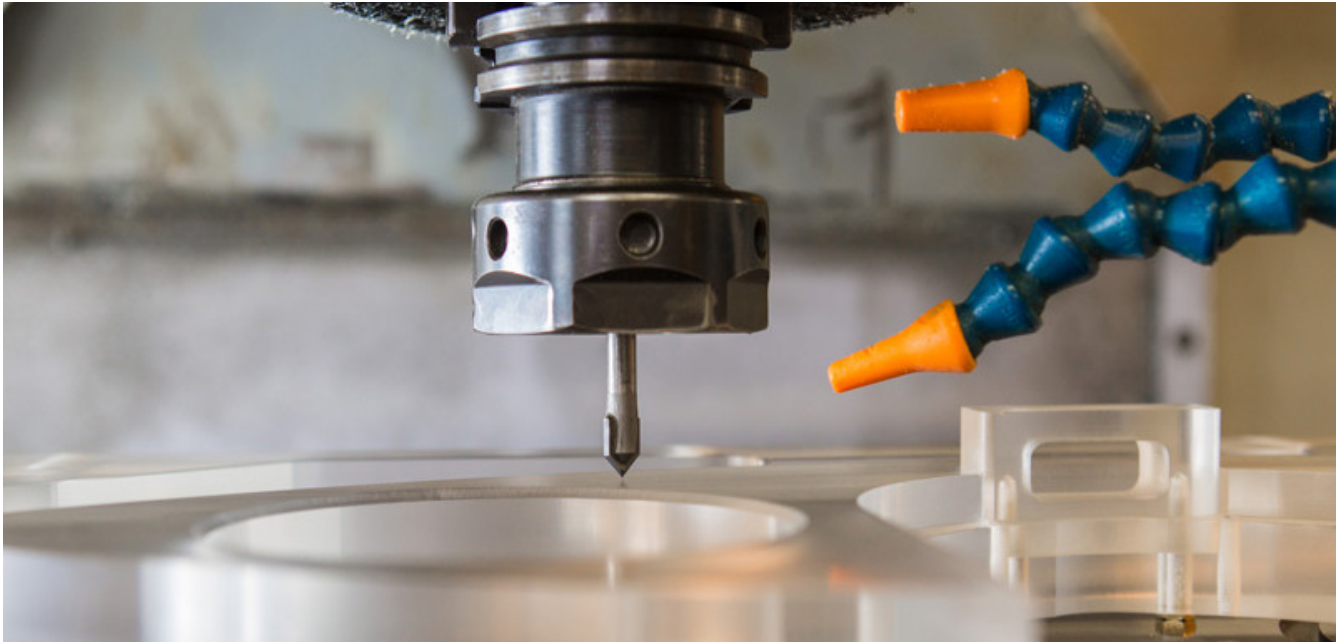


DESIGN GUIDE

*Design Considerations for
Precision-Machined Plastics Fabrication*



Introduction to Custom Plastic Fabrication



Computer Numerical Control (CNC) machining of plastics is a process that can create incredibly complex shapes that would be difficult or impossible to create using other methods. CNC machining works by cutting away material from a sheet, rod, or tube of material (known as a workpiece) to create the desired configuration. Using CAD software, a computer controls the movements of the cutting tools, which can include mills, routers, and lathes – to tolerances as low as .005". The optimal set-up, speed, and accuracy of CNC milling also make it well-suited for creating prototypes or low-volume runs of parts, in addition to traditional large-volume runs.

Once the part has been machined, additional assembly steps may be involved. These assembly processes require an abundance of experience and craftsmanship and a deep understanding of materials and how they work together. When used in conjunction with CNC machining, custom parts and finished products that meet your requirements for form and functionality are achieved.

When designing plastic parts for custom fabrication, there are a few things to keep in mind in order to get the outcome and part performance you need. Quality and accuracy, materials used, environmental conditions, aesthetics, and cost are among the top factors for engineers to consider in their designs. This guide is intended to help you understand your options for custom plastic fabrication so you can use that knowledge to produce more efficient and cost-effective designs.



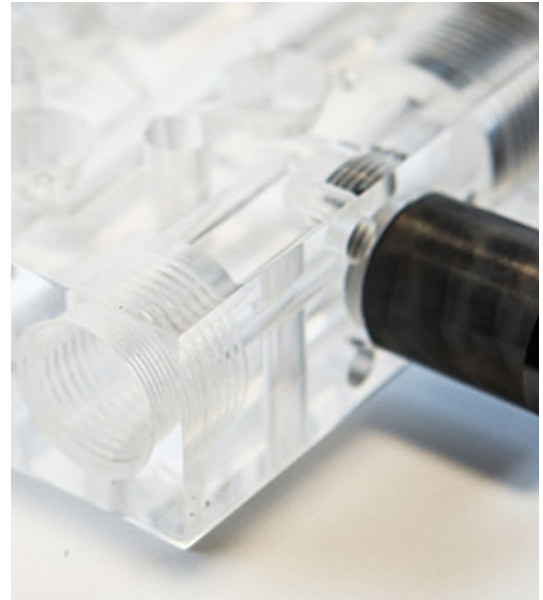
Advantages of Plastic Over Metal

When choosing between plastic and metal components for your design, plastic materials have several advantages over metal.

Plastics can be machined into very intricate shapes and configurations; this allows for more creativity and flexibility in new product design. The lighter weight is ideal for applications where weight is a major consideration, such as aerospace. Whether a finished product or part of a larger assembly, the lighter weight of plastics makes installation and handling easier while also reducing the cost of shipping your products.

Many plastics outperform metals for durability and service life. Their resistance to wear, bending, and breakage decreases downtime between replacement or scheduled maintenance. Plastics are also well-known for their resistance to rust and corrosion and most often do not require any paints or special coatings to protect against degradation.

Safety is also a key advantage of plastic over metal. Plastics are less likely to conduct heat or electricity, protecting workers and other components. Plastics usually are also less expensive than their metal counterparts, which makes them a more cost-effective material choice.



Selecting the Right Plastic Materials for Your Custom Assembly

Mechanical and design engineers in the industrial, medical, electronics, and aerospace industries are very knowledgeable in their specific fields. Still, they may not be aware of the inherent properties of plastics and their suitability for a particular application.

It is of utmost importance that you work with a plastics fabricator with a deep understanding of the materials available and their performance properties. Engaging a full-service supplier early in the design process will make sure your design meets all of its intended uses and requirements from the start. An experienced fabricator can help guide you on material selection, alternative material recommendation, or design elements to save you money and time.

And if sustainability is a factor in your design or customer requirements, a sophisticated fabricator can offer non-virgin material option or put sustainability agreements in place to reduce the impact of non-recyclable materials.



Custom Plastic Fabrication Finishes

For many companies, the aesthetics of the plastic components are as important as the configuration, performance, and materials used in the design. Custom coatings and finishes are used to protect or enhance the appearance of the fabricated product.



Opacity / Clarity

Depending on the application, you may choose to go with opaque or transparent plastic material. In applications such as guarding, clarity is an important feature, as it enables the operator to see beyond the protective cover to discourage contact with moving parts. On the other hand, opaque materials may be preferred in applications where light needs to be restricted or minor imperfections hidden.



Polishing

Plastics are a viable alternative to glass or quartz in applications requiring the clearest optics and smoothest surfaces. Flame polishing, buffing, and machining, combined with the heat resistance, light weight, and durability of plastic, enables greater flexibility in machine and component design. However, not every polymer is well-suited for polishing; so, it's important to work with a qualified fabricator.



Colors

Fortunately, plastics offer a wide range of colors from which to choose, with semi-transparent to fully opaque options. Tints can be added to the resins to match any Pantone® or custom color. Given that these applications typically require a high volume to be cost-effective, many designers choose paints as a way to color match. It's vitally important that your supplier provides repeatability in any paint color you select to avoid variations from batch to batch or order to order.



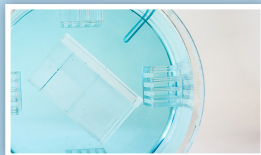
Coatings

The types of coatings in plastic fabrications include paint, powder coating, static dissipative and scratch resistance. Paint is generally preferred for its wide range of colors and textures. Powder coating adds durability, while static dissipative and scratch resistant coatings are used in electrical environments where a unique technology is used to coat the sheet to prevent an electrical charge generation. Today, plastics with scratch resistance coatings are becoming increasingly popular when there is a need for added scratch resistancy.



Laser Engraving & Silk Screening

Plastics are especially receptive to engraving or silk screening. Silk screening is ideal for product labeling and branding, as it doesn't fade, tear or peel away. Laser engraving is perfect in applications where product serialization, lot numbers or other important product identifiers are required.



Physical Characteristics and Exposures

With plastic finishing, you need to consider thickness, texture, and wear properties, as well as conditions if operating in harsh environments. An experienced fabricator will help you choose the best options for your application.

Design Considerations for Harsh Environments

Plastics are widely used in harsh environments where other materials would not be able to withstand the conditions. Resistance to extreme temperatures, moisture, corrosion, and wear make plastics optimal for many applications. As you design your product, it's important to know the following information:

Operating Temperatures

Is your product exposed to extremely high or low temperatures? If so, design with these thoughts in mind:

- Is the extreme temperature continuous or intermittent?
- What are the tolerances for expansion and contraction of your part?
- What is the surface area exposed to the extreme temperature?

Wet/Humid Environments

If your part is used where humidity or water is present, consider the following:

- Is the component used to insulate or protect electrical components? If so, what voltage is in play?
- What is the anticipated contact time of the moisture?
- Is appearance an important aspect of this product?

Chemical Exposure

If your product is exposed to greases, solvents, alkalis or acids, it's important to know the following:

- At a minimum, you should know the name of the chemical coming into contact with the plastic. A qualified fabricator will be able to help you choose the right polymer.
- Certain foods contain alkalis and acids that can harm plastics. If your application is in the food sector, it's important to know the ingredients of processed products.



Wear/Abrasion

Plastics are extremely durable, but each type of polymer has different tolerance levels to wear, impact, and abrasion. If your part is moving or in contact with other moving parts, design with these things in mind:

- What is the run time of the moving or contact parts?
- What is the run force of the moving part?
- What is the PSI and surface area affected if impact or pressure is involved?
- If another moving part is coming into contact with your product, what is the material used in the other part?
- Some foods contain salts and sugars that can abrade plastic. Knowing the ingredients of the processed foods can prevent unwanted downtime and contamination from plastic abrasion.

Special Requirements

Your plastic component may need to be ESD safe, FDA approved, biologically stable, radioresistant, non-scratch, UV resistant, or more depending on your application. When discussing your application with your custom fabrication provider, be sure to come prepared with the details that will ensure your finished product meets your regulatory and performance requirements.

Design Ideas for Reducing Cost

As an engineer, it's easy to become enveloped in the performance and features of a product design with less concern for cost. New product development teams know the acceptable price point of any new product going to market, so it's important to know where to save money on your design.

The variety of engineered polymers available today brings much broader material selections with similar performance properties. Unless the material type must be specified, as with medical applications, keep an open mind when it comes to using alternative, lower-cost materials in your design. You do not need to be a plastics expert to achieve your design goals when working with an experienced fabrication partner.

Another consideration for alternative materials is not to use less expensive materials but to use more sophisticated plastics that increase the life and value of your finished design. These products can generally command a higher price point, thereby increasing your profitability.

Simple design tweaks, such as eliminating unnecessary thicknesses or surfaces can save on the cost of material and lighten the load for shipping.

Feature elimination may sound frightening, but a custom plastics fabricator with experience in a range of industries and products can bring great value to your finished design. If they have milled or assembled similar components for other clients, you can take advantage of that knowledge for your design.

A final consideration is the use of non-virgin material. In applications where color consistency is not required, using plastics with recycled content can lower your material cost.



Ensuring Fabrication Quality



With all the effort you put into product design, you only want to work with suppliers that can bring your product to life with the utmost quality.

CNC machining is an inherently accurate automation process but requires experienced operators and set-up technicians to ensure your design parameters are met. And when it comes to assembly, only the most skilled craftsman will do. Be sure to ask your fabricator about the tenure and skills of its operators and assemblers.

Technology, such as Coordinate Measuring Machines (CMMs), measures an object's geometry using mechanical, optical, laser, and white-light probes. Once your part has been produced, CMM inspection guarantees your product is made to your exacting specifications and tolerances. A robust fabricator will have CMM equipment in place to create a quality finished product. Once your part is in production, you should require the plastic fabricator to supply First Article Inspections (FAIRs).

Finally, a custom plastics fabricator that can provide you with full BOM (Bill of Material) traceability and Certificates of Conformance, as well as REACH and RoHS compliance for any components being used, adds confidence to your finished product quality.

Why Choose HP Manufacturing for Your Custom Plastics Fabrication?

As an engineer, it's easy to become enveloped in the performance and features of a product design with less concern for cost. New product development teams know the acceptable price point of any new product going to market, so it's important to know where to save money on your design.

The variety of engineered polymers available today brings much broader material selections with similar performance properties. Unless the material type must be specified, as with medical applications, keep an open mind when it comes to using alternative, lower-cost materials in your design. You do not need to be a plastics expert to achieve your design goals when working with an experienced fabrication partner.

Another consideration for alternative materials is not to use less expensive materials but to use more sophisticated plastics that increase the life and value of your finished design. These products can generally command a higher price point, thereby increasing your profitability.

Simple design tweaks, such as eliminating unnecessary thicknesses or surfaces can save on the cost of material and lighten the load for shipping.

Feature elimination may sound frightening, but a custom plastics fabricator with experience in a range of industries and products can bring great value to your finished design. If they have milled or assembled similar components for other clients, you can take advantage of that knowledge for your design.

A final consideration is the use of non-virgin material. In applications where color consistency is not required, using plastics with recycled content can lower your material cost.



For more information, read our **Buyer's Guide for Plastics Fabrication**

[DOWNLOAD NOW](#)



*Fabrication and distribution of custom
precision machined plastic components,
assemblies, and displays.*

3705 Carnegie Avenue
Cleveland, Ohio 44115

.....
Web: hpmanufacturing.com

Tel: (216) 361-6500

Fax: (216) 361-6508

E-Mail: info@hpmanufacturing.com