

HOW TO ENGINEER OPTIMAL PLASTIC PARTS

Creating competitive differences is a constant in business. Designers, buyers and engineers work with breakneck speed under challenging conditions to help their businesses become more profitable, creating products that customers love manufactured in the most efficient and cost-effective way. Knowledge about resistant materials is a key part of decision-making. Unique properties such as superior wear, high stiffness-to-weight ratios, resistance to chemicals and stress cracking are sought after in combination with aesthetically pleasing finishes, clears and bright colours. Requirements for such advantageous versatility often leads to the selection of plastic parts and components as solutions to meet criteria essential for a wide variation of competitive products, typically at a fraction of the cost of products made using traditional industrial materials.

While plastic parts are engineered for long life even in the most challenging conditions and are often sought for their resistance to substances, extreme temperatures, aggressive chemicals, humidity and UV light how designers, buyers and engineers go about specifying and have them manufactured varies. Often a review of similar existing applications is undertaken to learn which materials, processes, and designs have worked successfully. Specifiers often select a familiar grade of plastic from a similar application. Polymers chosen this way may be adequate but are rarely optimal.

Key to designing and manufacturing a plastic part for optimal performance in its given application involves many important factors that touch on all areas of part design, tooling, material selection and production. The relationship between design and manufacturing is key to developing a plastic part which performs well in its application. Discussing the application

with experienced manufacturers and materials suppliers for their recommendations will bring significant value. Temperature, length of exposure, presence of internal and external stresses, the mating surface and the presence of water or concentration of chemical(s) all affect the longevity of plastic parts. An ideal plastic part will have a value for each strength property just sufficient to perform properly, reliably and safely in a given application and no higher. An ideal plastic part is usually made from a polymer chosen not because it has the highest values in any single category but because it usually represents a trade-off among satisfactory properties, ease of processing, and cost.

Keeping purpose and design intent in mind, here are 9 important factors to consider to ensure any plastic part you commission performs as required:

1. **Operating temperature and humidity range:** temperature changes affect plastics. As temperatures increase plastic softens, chemical resistance declines (chemicals are more aggressive at elevated temperature) and plastic begins to oxidize from the surface inward, again reducing properties. As temperatures decrease, properties also change, especially impact resistance. Understanding the operating temperature range is one of the most important considerations to ensure plastic parts are manufactured to perform well in their intended application.
2. **Time and stresses:** the longer plastic is exposed to external stresses, the greater the stress on plastic. Understanding the thermal, chemical, electrical or mechanical stresses that any plastic part will be subject to is a very important design consideration to ensure most the suitable plastic is chosen for manufacturing
3. **Friction and wear:** a desire to improve wear properties and manage wear rates to acceptable levels is often a key design criteria. Parts made from low friction polymers can help products last longer with less maintenance. Wear is a complex behavior that may include adhesion, abrasion, erosion and/or fatigue. A particular

plastic may have excellent wear characteristics under one set of conditions, and poor wear behavior under other conditions. Understanding the intended purpose and use of the plastic part enables the right polymeric compound to be selected to thwart wear and friction problems.

4. **Load:** understanding all types of imposed loading on plastic parts (for example short term static loads to vibrational loads) is another important factor to ensuring that the part performs as intended throughout its expected lifetime. Polymer selection can be made to deliver improved strength to weight ratios.

5. **Agency approvals:** if plastic parts must pass any governmental regulations or private standards it is important to know the specifics so the appropriate compliance requirements can be considered and met. For example, for properties such as heat resistance, flammability, and electrical and mechanical capabilities. It is beneficial to work with a plastics specialist with experience working with a variety of resins and applications including resins that are compliant with FDA, RoHS, REACH and NSF.

6. **Assembly:** along with the plastic's cooperation with all assembly steps like bonding, mechanical fasteners and welding, the ability of fabrication and assembly to condense the number of parts, improve efficiencies, structural components and speed to market can also assist with design and engineering efficiencies. It is common to fasten plastic parts to other non-plastic components and any fusion of two or more materials requires accommodation of their different co-efficiencies of thermal expansion.

7. **Appearance:** The appearance of a plastic part can be an important design element. Plastic parts can be manufactured to produce the desired finish such as gloss, smoothness and other appearance values. Most designers and engineers establish color specifications, codes and tolerances. Descriptions of lighting and viewing conditions, gloss levels and part texture are all other key factors to consider in developing specifications for appearance.

8. **Cost:** in preparing cost calculations for plastic parts alongside the polymer pricing consider the cost calculations for manufacturing and assembly to reduce labour, tooling, maintenance, finishing and other costs.

9. **Availability:** choosing the right plastic material is one of the most important factors in creating optimal plastic parts; the advances in polymer science have contributed to the development of a large selection of polymers from which to choose. Coupled with this is selection of a specialist plastic manufacturer with capacity to reliably deliver as required.

Plastic parts which perform well in their applications have usually been manufactured in a manner compatible with their design with the most economical polymer chosen to satisfy a combination of mechanical, thermal, and electrical requirements which will perform satisfactorily and be suitably attractive. Setting realistic requirements for each of these areas is of key.

For help and advice for your application contact our experienced plastic professionals at Barkston Ltd.