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Plastics, Metals, Silicone/Rubber **Molded, machined or formed**



Polymers - Thermoplastics And Thermosetting Plastics

Thermoplastics materials are those that take the hardened form of plastic when cool but are converted to liquid when heated. This process of heating and melting can usually be completed many times. Each time, a new shape or form is possible.



Thermosets take a hardened form after they have been heated and allowed to cool. A major difference is that thermosets **cannot** be melted down and reformed.

For this reason, thermoset materials are typically considered to be non-recyclables. For many people, this is a major disadvantage. There are many factors about thermosets, however, that can be seen as advantages. This includes their strength and durability.



Sales topics to cover in the quote process:

1. Molded parts run anywhere from a few pennies to several dollars with volume quantities starting in the 20k eau range.
2. Aesthetics (color matching, surface finish, etc.) as well as secondary operations for a complete component or assembly.
3. Tooling will start at approximately \$2000 to \$50,000 per tool and can run into the \$100,000's depending on the number of molds needed for the customers' final product. Customers with significantly less volume can possibly reduce tooling costs.
4. Most tools are designed to produce 1 million shots (guarantee) for plastics. It's important to understand the customers' life expectancy of the product in (quantity and years) order to quote the appropriate tooling.
5. Tool maintenance responsibilities regarding maintenance before and after shot guarantee.

Files needed for any Injection Mold projects.

If at all possible, please get any CAD drawings for metals or plastics in one of the following formats (sorted descending best to ok):

- Inventor ipt, iam
- STEP stp, ste, step
- IGES igs, ige, iges
- SolidWorks sldprt, sldasm
- Pro-Engineer ... prt, asm

* When requesting one of the above, please also get a "pdf" version of the same drawing so that those of us with limited software can have a visual for discussion purposes.

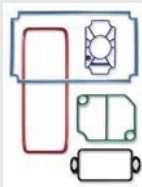
Elastomers (Rubber/Silicone)



Liquid silicone rubber (LSR) molding is a thermoset process that mixes a two-component compound together, which is then heat cured in the mold with a platinum catalyst to produce

a final part.

Electronic products that use rubber for vibration cushions, handheld devices that can withstand being dropped, seals, liquid resistant. Generally, liquid silicone is favored over other materials for these applications because of its flexibility, viscosity, strength, versatility, and lower costs.



Shock/Vibration Isolation mounts, gaskets /seals /membranes, to complex designs such as an oxygen masks.

Rubber Versus Plastic:



- Rubber is a better material for dynamic sealing applications
- Plastic is a lower cost material for high volume production
- Rubber has a wider

hardness range, and can be very soft or very hard

- Plastic is a better material for many retail or commercial applications
- Rubber is an excellent solution for a range of different temperatures
- Plastic does not perform well in extreme heat or cold
- Rubber works well with bonding agents for bonding rubber to metal or plastic substrates
- Plastic is a better option when you need a very hard or rigid material
- Rubber is a better option when you need a flexible material
- Rubber is a high performance material when acoustic or vibration absorbing properties are important.

Metals



Metal injection molding (MIM) is a process by which metal is powdered, mixed, and placed into a mold to create solid parts and pieces of equipment. The mixture of powdered metal and binding material, known as the feedstock, is limited in quantity, making metal injection molding ideal for small, detailed parts. Applications of this process include machinery parts, dental tools, and firearm equipment, and they all generally involve small and complex parts.

Parts previously small die-cast or machined parts have been replaced by MIM.



MIM vs. Machining

- MIM designs save material and weight
- MIM provides cost savings through better material utilization—sprues and runners can be reground and reused as feedstock with no compromise to final properties
- Molding from a single tool eliminates multiple set-up operations
- Difficult-to-machine materials can be molded into a net shape

MIM vs. Investment Casting

- MIM can produce thinner wall sections, sharper cutting points
- MIM produces better surface finish
- MIM is better for small-diameter blind and through holes
- MIM greatly reduces requirements for finish machining
- MIM produces high volumes of small components at a lower cost, faster lead times

Metalworking (Sheet Metal):



Sheet metal fabrication service providers manufacture components by cutting, bending, rolling, forming, stamping and/or welding sheet metal. Components

manufactured through sheet metal fabrication services are used in a variety of applications such as computer enclosures, network equipment, HVAC components, medical and sanitary equipment, industrial lighting and other industrial applications.

Sheet metal cutting -

services includes a number of techniques used to cut metal into smaller pieces so that it can be molded or formed into components. Common types of sheet

metal cutting involve shearing, electrical discharge machining (EDM), sheet metal laser cutting, water jet and abrasive cutting.



Sheet metal forming - processes include those actions used fashion metal into specific shapes or semi-finished pieces. Common techniques include bending and forming, rolling, stamping, punching, welding, and hardware and fastener creation. Bending and forming processes are used to shape the sheet metal to its final shape.

In the rolling process, a series of roll stands is used to progressively shape or bend a strip of flat-rolled metal to a desired cross section.

Stamping is the process of impressing surface definition and three-dimensional designs onto materials with pressurized tools and dies.



Punching is the process of punching holes in the sheet metal.

Welding is the joining of metals and metal parts by melting and re-forming a metal bond between materials, with or without additional filler metal.

Metalworking (CNC-Machining):



CNC Machining is a process used in manufacturing that involves the use of computers to control machine

tools. Tools that can be controlled in this manner include lathes, mills, routers and grinders. The CNC in CNC Machining stands for Computer Numerical Control.



The process is more precise than manual machining, and can be repeated in exactly the same manner over and over again. Because of the precision possible with CNC Machining, this process can produce complex shapes that would be almost impossible to achieve with manual machining. Various metals and plastics can be machined to exact specifications.



A mold for a plastic injection part being produced.

Die casting is a metal casting process that is characterized by forcing molten metal under high pressure into a mold cavity. The mold cavity is created using two hardened tool steel dies which have been machined into shape and work similarly to an injection mold during the process. Most die castings are made from non-ferrous metals, specifically zinc, copper, aluminum, magnesium, lead, pewter and tin based alloys.

Zinc: the easiest metal to cast; high ductility; high impact strength; easily plated; economical for small parts; promotes long die life.



Aluminum: lightweight; high dimensional stability for complex shapes and thin walls; good corrosion

resistance; good mechanical properties; high thermal and electrical conductivity; retains strength at high temperatures.

Magnesium: the easiest metal to machine; excellent strength-to-weight ratio; lightest alloy commonly die cast.

Copper: high hardness; high corrosion resistance; highest mechanical properties of alloys die cast; excellent wear resistance; excellent dimensional stability; strength approaching that of steel parts.

Lead and tin: high density; extremely close dimensional accuracy; used for special forms of corrosion resistance.



Aluminum Die Casting Parts vs Plastic Injection Molded Parts.

Plastic Injection molding and aluminum die casting are similar in a lot of ways:

- Both require a mold or tool to produce parts.
- The tooling cost is very similar in both industries.
- Both processes inject material into a mold to make parts.
- Both processes can make hundreds or thousands of parts every day.

Plastic Injection Molded Parts

Advantages

- Plastic parts are produced at a lower temperature than aluminum parts, plastic melts at only a few hundred degrees Fahrenheit
- Plastic Parts weigh less than aluminum die casting parts.

Disadvantages:

- Plastic is not typically biodegradable
- Plastic parts require metal inserts to hold a thread for screws.
- Plastic does not block EMI/RF waves
- Plastic Parts are not as strong.

Aluminum Die Casting Parts

Advantages

- Aluminum naturally shields EMI/RF waves.
- Holes can be directly threaded into the parts.
- Features can be machined into aluminum.
- Aluminum has great thermal transference properties.
- Aluminum is a natural conductor of electricity.
- Aluminum material is environmentally friendly and can be recycled easily when done.
- All aluminum alloys (360, 380, 383, and 413) are made from recycled materials.
- Aluminum parts are stronger than plastic

Disadvantages

- Aluminum parts weigh more than plastic.
- Aluminum parts are produced in only one color and need paint or powder coat for color.