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KEYS TO DESIGNING CUSTOM MOLDED RUBBER PRODUCTS

By: Modus™ Technical Team

Custom molded rubber products protect machines and the people who operate them.

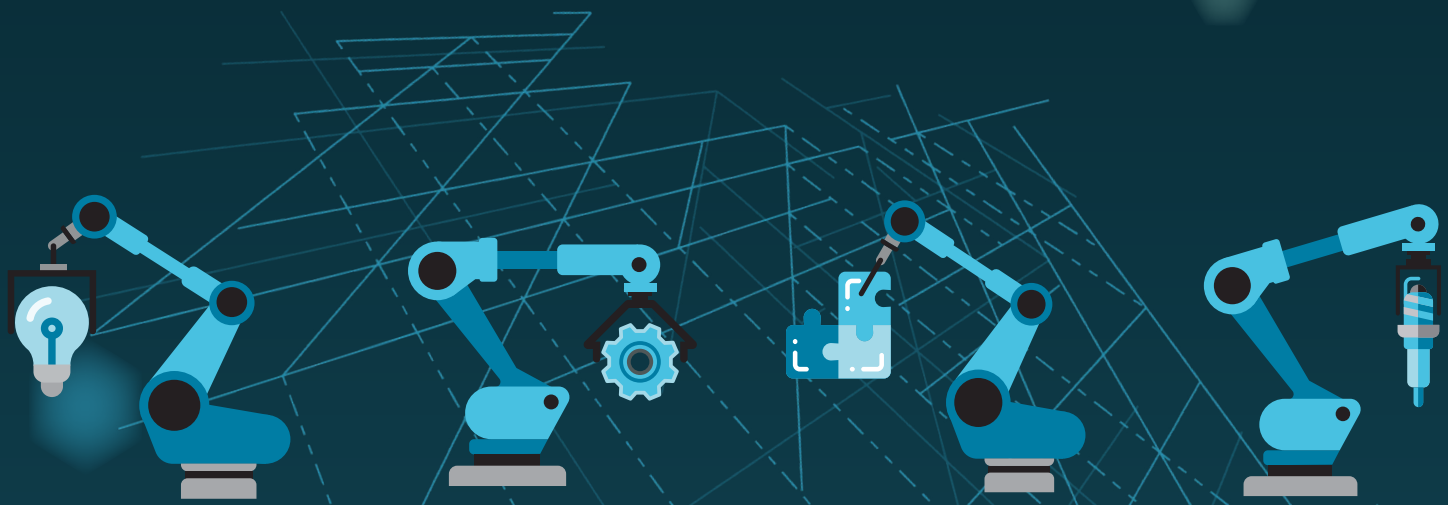
Rubber's inherent properties make it the natural choice for design engineers looking to create an environmental seal or gasket, deal with noise, vibration and harshness (NVH) and even conduct electricity where EMI shielding gaskets are needed. While there are a variety of rubber manufacturing methods, the focus of this guide is custom molded rubber parts.

For the purposes of this guide, the term "rubber" refers to a family of softer polymers. Modern chemistry has given us many compound choices, allowing for the design of high performance parts made from natural rubber, silicone and other synthetic materials.

Custom molded rubber products are used in everything from home appliances to life saving medical equipment. This guide will provide basic info for the manufacturing methods, material types and properties of custom rubber parts.

HOW WE TAKE YOUR IDEA TO IGNITION

- **IDEA: You design the perfect part**
- **ENGINEERING: You specify the best material**
- **SOLUTION: We strategically plan**
- **IGNITION: We produce and deliver**



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Why Should You Consider a Custom Molded Rubber Part?

There are many occasions in which a local home improvement store or industrial distributor doesn't stock the exact part required. OEMs and any businesses that use heavy equipment or precision machinery will need custom solutions at some point. This ensures optimal use, personnel protection and an extended life for valuable assets. Where on-shelf options fail, custom solutions can provide tailor-made materials that fit your exact specifications.

THE GENERAL PROCESS FOR DESIGNING AND MANUFACTURING CUSTOM MOLDED RUBBER PARTS WILL FOLLOW THESE STEPS:

1. **Start with a CAD model and print.**
2. **Mold makers use 3D models to design the mold needed to make your part.**
3. **To be safe, check with your custom molding company to determine the best file type. Typically, an IGES file will suffice. In addition to a 3D model, it's a good idea to include a print detailing notes, specifications, tolerances and other essential information to ensure your vision is fully realized. A PDF is preferable, but most companies accept other formats.**

A professional custom rubber molding company will encourage an abundance of communication as the project starts to take shape. They will want to discuss everything from performance requirements to annual usage forecasts.

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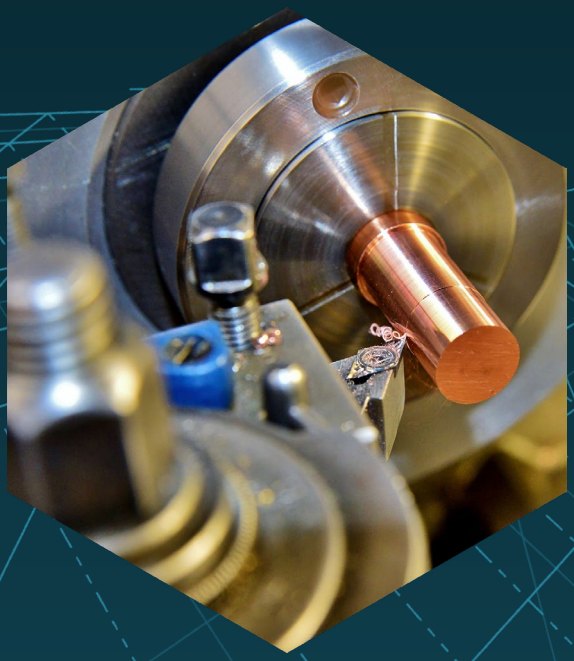
Performance Requirements

Performance requirements will drive rubber compound selection. There are several to choose from, as rubber and rubber compounds have varying tolerances for friction, chemicals and heat.

While it might be tempting to pick the lowest cost rubber compound, failure to pick the right compound could have devastating effects down the road. For example, selecting a rubber compound that worked well in your last application sealing an outdoor enclosure could lead to premature failure if the seal needs to protect against oil or other chemicals in the new application.

Annual Usage/Volume Considerations

Volume considerations will determine the appropriate number of cavities for the mold. While there isn't always a direct correlation between the number of cavities in the mold and the cost of the part, more cavities can lead to cost reduction. As would be expected, the tradeoff for more cavities is typically a more expensive mold. Your rubber manufacturing partner can help make a cavity decision based on expected annual volumes.



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Custom Molded Rubber Applications

When it comes to molding custom rubber gaskets, seals and performance parts, there are a lot of variables to consider. For example, silicone compounds are resistant to extreme temperatures and can meet the most stringent UL flame ratings, but silicone is also going to be more expensive.

Defaulting to a high performance polymer may or may not be the best option.

Consider price versus performance when selecting the best rubber compound for your environmental seal, performance part and EMI shielding.

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Environmental Seals

When selecting a material to protect sensitive electronics in an outdoor enclosure, what's the first material that comes to mind? Most designers would probably say rubber. Rubber, or rubber like materials, are commonly used to create environmental seals.

Rubber's natural ability to conform and compress make it the ideal choice for sealing. Rubber is used to seal water, dust and even harsh chemicals in applications ranging from battery compartment seals in off road vehicles to wire organizers in digital equipment.

Designing custom molded environmental gaskets or custom seals is not an easy task. When it comes to sealing out the environment, engineers use compression. The general rule of thumb is to design environmental seals to compress ten to thirty percent. Ideal compression characteristics of the rubber can be accomplished with a combination of design features and by selecting the appropriate hardness or durometer.

Innovative design features such as flaps, male / female channel locks and pseudo cavities can help accomplish the goal of keeping the environment out.

The physical design of the part is critical, but so is selecting the appropriate rubber compound being used to seal out the harsh effects of the environment.

Consider the classic example of what a typical rubber band made from natural rubber looks like after being left outside for a period of time. Exposure to UV light, ozone and temperature fluctuations results in hardening, cracking and general loss of attractive physical properties. The way to combat degradation is to specify the appropriate compound for the application.

Silicone and EPDM are both excellent choices for outdoor sealing. Both materials are resistant to the harmful effects of the natural environment and can be easily molded into unique shapes.

Silicone snorkeling and diving masks are great examples of using the correct rubber compound for the application. Lower durometer silicone serves the dual purpose of sealing against the diver's face and being impervious to the natural environment.

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Performance Parts

Performance parts are just as challenging to design as custom molded environmental gaskets.

Since custom molded performance parts are typically designed for use in dynamic environments, the rubber used is expected to perform a specific job without failing prematurely.

We mentioned the price versus performance decision previously. That also applies to performance parts. Some of the variables at play are the chemical resistance of the rubber compound, the rubber to metal bonding process (if required), tensile strength and the ability of the rubber to handle heat as it performs its function. Yes, rubber will heat up when cycled thousands of times while doing its job as a vibration isolator supporting a diesel engine.

If your application requires the rubber to perform a specific function, it's important to fully define the requirements of the application. Your professional custom molding partner should be able to help define some of the specifications, including testing requirements based on an understanding of the application.

You will want to be prepared to answer questions regarding temperature range, the potential for oil or other chemicals to come in contact with the rubber and generally how the part will be used. Partners with years of experience in the custom molded rubber industry should be able to draw on their applications experience to help advance your project to a successful conclusion.

Experience matters when it comes to manufacturing performance parts. At the very least, look for a partner who has a documented manufacturing process and a quality system certified to the ISO9001 or AS9100 standards. We've seen catastrophic equipment failure pinned on performance rubber parts that somehow didn't meet the required specification after being in production for six months.

In other words, something went wrong in the manufacturing process. The result? Defective parts being installed on the equipment. The failure can cost the customer thousands of dollars in downtime cost per machine. A professional rubber molding partner will follow a documented process and add multiple quality checks into the process to ensure parts meet the required specifications.

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Performance Parts Managing Noise, Vibration and Harshness in Heavy Equipment

Mechanical equipment is used to make life easier for us all. Here are some examples:

Off-Highway Equipment

Dozers, wheel loaders, excavators and vibratory compactors that are used in the construction industry.

Farming Equipment

Tractors, sprayers and harvesters.

Forestry Equipment

Feller bunchers and skidders.

Anyone who has operated these types of equipment knows that the quieter and smoother the equipment operates, the better their day will go. Unwanted noise or vibration is not only annoying but can damage the equipment and cause harm to the operator.

Performance Parts - Rubber Vibration Isolators

Equipment manufacturers know operator comfort and reliability is key. They plan ahead by using custom molded rubber products in their equipment design to help accomplish performance goals.

- **Rubber mounts are used to isolate engines, pumps, compressors and auxiliary equipment for vibration isolation.**
- **Flexible couplings are used in the driveline to minimize shift shock and to protect the driveline components.**
- **The cabs are isolated to provide operator comfort.**
- **Isolated seat suspensions can be designed into equipment to even further keep vibration from reaching the operator.**

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Performance Parts – Modifying Standard Vibration Isolators

There are many standard rubber isolators, such as plateform mounts, center-bonded mounts, two-piece mounts, conical mounts, bushings and sandwich mounts. These all work well and are readily available for use. In many cases, though, new equipment is designed that requires something beyond standard parts. In these cases, a custom isolator may be required.

VARIATIONS OF STANDARD ISOLATORS ARE USED ALL THE TIME:

- **A metal component can be redesigned to have a tapped hole instead of a through hole or to be made longer or shorter.**
- **A softer or stiffer version of the rubber can be used or even a different rubber compound altogether.**
- **Sometimes new equipment designs require the construction of a completely new type of vibration isolator or custom part.**

The earlier in the design process that this is considered, the better the results will be. The important thing to keep in mind is that noise, vibration and harshness can become a big problem if not handled properly.

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Performance Parts for Electronics - Custom Molded EMI Shielding Gaskets

Rubber is a basic material that's used in millions of different ways. One of the more unique, niche applications is EMI shielding. The basic job of an EMI shielding type rubber is to conduct electricity. Custom molded EMI shielding gaskets are commonly used in telecommunications equipment, automotive electronics, military gear and medical equipment applications.

EMI shielding materials often contain electrically conductive fillers such as silver, copper, aluminum or nickel / graphite. The metal particles are mixed with silicone to form a rubber/metal material. The resulting materials—when installed in specific applications—prevent "electronic noise" from exiting and entering a protected electronic box or enclosure.

Stray electronic signals entering a piece of sensitive medical equipment could cause the unit to become unreliable or completely malfunction. The right EMI shielding prevents damage both to the equipment itself and machine operators.

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Types of Rubber

Two broad categories of rubber are solid and sponge. Both can be custom molded, are resilient and have properties unique to rubber.

Custom Molded Solid Rubber

Solid rubber is dense, rigid and impact resistant while still maintaining its resilient/elastic characteristics. This gives the material the ability to resist abrasion and permanent indentation. Because of its inherent low creep and compression set properties, solid rubber withstands extreme force. This makes it a reliable material for high pressure and/or load bearing applications.

As previously discussed, solid rubber can be manufactured into custom molded products and is literally used in hundreds of thousands of applications from vibration isolators to EMI shielding.

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Open Cell

Open cell rubber is created with interconnected open pockets, allowing air, moisture or chemicals to penetrate the material when not compressed. The ability of this porous product to regain its compression set while permitting maximum absorption and circulation of gases and fluids makes it an excellent solution for insulation (thermal and weather), shock absorption, sound-proofing, vibration dampening and filtering.

Closed Cell

Closed cell rubber (expanded) consists of gaseous pockets which are not interconnected and do not allow moisture or oils to enter the cellular structure. This creates a buoyant, oil resistant/water-proof material which has a higher compression set and tear/tensile strength than open cell rubber (greater bounce back). It is highly flexible; resistant to fuels and hydraulic fluids; making it a great solution for high and low temperature environments, outdoors, electrical insulation and environmental insulation.

RESISTANCE CHART

RUBBER TYPE	OIL RESISTANCE	ELECTRICAL RESISTIVITY	FLAME RESISTANCE	IMPACT RESISTANCE	ABRASION RESISTANCE	TEAR RESISTANCE	WEATHER RESISTANCE	OXIDATION RESISTANCE	OZONE RESISTANCE	MAJOR ATTRIBUTES
Buna-N (Nitrile)	E	P	P	G	G	F	P	G	F	Excellent resistance to mineral and vegetable oils.
EPDM (Ethylene-Propylene-Diene-Methylene)	P	E	P	G	G	G	VG	E	E	General purpose rubber with excellent weather resistance.
Neoprene	G	VG	G	G	E	G	VG	E	E	General purpose abrasion-resistance rubber with good oil resistance.
Polyurethane	E	E	F	G	E	E	G	E	E	Resists abrasion, tearing, and cold. Good load bearing qualities.
Santoprene	G	E	G	G	F	G	E	E	E	Good oil, solvent, and chemical resistance. Weathers well.
Silicone	F	G	F	F	P	P	E	E	E	Resistant to chemicals and to high and low temperatures.
Fluorelastomer	E	G	G	VG	G	P	VG	E	E	Resists oil and chemicals at low and high temperatures.

E - Excellent VG - Very Good G - Good F - Fair P - Poor

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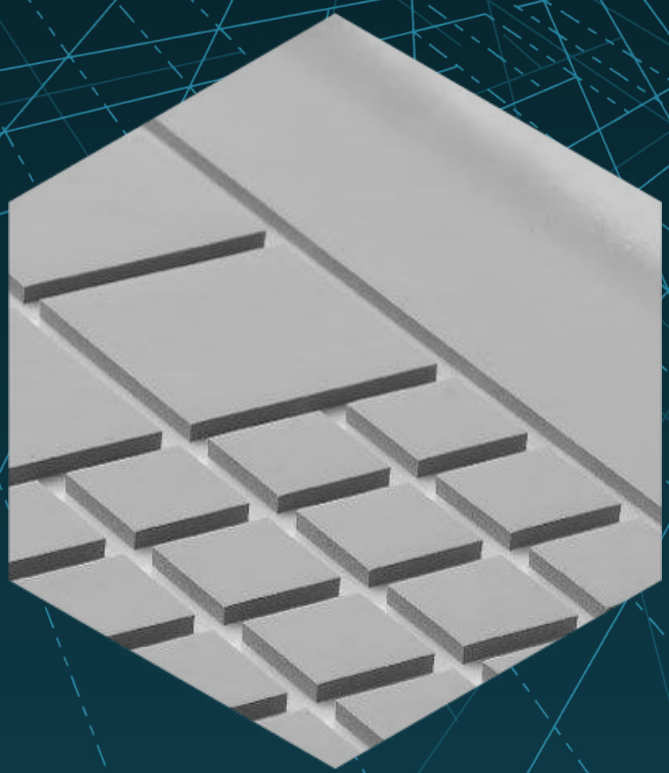
Solid and Sponge Properties

As you have learned, solid rubber and sponge rubber (open cell and closed cell) have unique characteristics that are inherent to the material and therefore transfer to their application. When it becomes necessary to enhance the base material, it's easy to do by adding additional materials such as metal particles for EMI/RFI or UV inhibitors to rubber compounds for outdoor use.

Consider other extreme application requirements; i.e., flame resistance, acids and chemical resistance, puncture resistance, stretch resistance. Both solid and sponge rubber products can be enhanced for specific use by adding additional particles or different types of rubber or chemicals to the batch of raw material.



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Common Custom Molded Rubber Manufacturing Methods

There are numerous methods whereby rubber is molded to create custom parts.

Injection Molding

The injection molding process is used to produce parts made entirely of rubber and parts that require bonding rubber to a metallic or non-metallic component.

EXAMPLES OF INJECTION MOLDED RUBBER PARTS INCLUDE:

- **Impellers used in the water pump housings of outboard motors**
- **Torsion bushings used for high end office furniture**
- **Track pad fasteners used under the tracks of subway lines**

A basic injection mold consists of a nozzle plate, runner plate, cavity plate, and a base plate with an ejector system (used to eject the parts after molding).

In injection molding, a continuous strip of uncured rubber is automatically fed into the injection molding machine. Once in the heated barrel, the uncured rubber is then pushed by a screw-type plunger through an injection nozzle. The rubber flows into the nozzle plate, is routed through the runner plate, passes through gates and then into the mold cavities.

When the cavities have been filled, the heated mold is kept closed under pressure for the specific period required to cure the rubber being used. In cases where the rubber is bonded to metallic or non-metallic components, the components are loaded—either by hand or using a loading fixture—into the heated mold cavities.

The mold is then closed and the injection molding cycle can begin.

After curing is completed, the mold is opened and parts are removed.

The cured rubber in the runner is removed, cured rubber in the injection nozzle is purged, and the mold cavities are cleaned in preparation for the next molding cycle.

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Transfer Molding

The transfer molding process is also used to produce parts made entirely of rubber and parts that require bonding rubber to a metallic or non-metallic component.

EXAMPLES OF PARTS THAT ARE TRANSFER MOLDED CAN INCLUDE:

- **Vibration isolators like sandwich mounts used on vibratory compactors or for shock isolation**
- **Center-bonded and two-piece mounts used to isolate engines**
- **Transmissions and auxiliary components**
- **Conical mounts used for cab isolation**

A basic transfer mold consists of a piston, well pot, sprue plate, cavity plate and a base plate with a knock-out system used to eject the parts after molding.

In the transfer molding process, uncured rubber pellets are loaded manually into the well pot of the mold. A heated piston forces the rubber through sprues in the sprue plate and into the mold cavities which are located directly under the well pot of the mold. When the cavities have been filled, the heated mold is kept closed under pressure for the period required to cure the rubber.

In cases where the rubber is bonded to metallic or non-metallic components, the components are loaded into a heated mold either by hand or using a loading fixture. After the components have been loaded, uncured rubber pellets are loaded into the heated well pot of the transfer mold. The mold closes and rubber is then transferred through sprues into the mold cavities.

After curing, the mold is opened and parts are removed. The cull pad, which is the cured rubber left in the well pot, is removed and the mold cavities are cleaned in preparation for the next molding cycle.

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Compression Molding

The compression molding process is normally used to produce rubber parts that do not require bonding rubber to a metallic or non-metallic component.

EXAMPLES OF PARTS THAT ARE COMPRESSION MOLDED ARE:

- **“O” rings**
- **Seals**
- **Gaskets**

A basic compression mold used to make a rubber product is usually a two-piece construction consisting of a top plate and a bottom plate. Half of the part cavity is cut into each plate of the mold. Overflow grooves are then cut around each cavity to provide a trim area and to allow excess rubber to flow out of the cavity.

Compression molds are normally used between heated platens in a press. Uncured rubber preforms are loaded in the bottom cavities of the compression mold and the top plate is then placed into position. The press is then closed, allowing the rubber to compress and flow into the cavity.

The mold is kept closed until the rubber is cured or at least partially cured. Parts normally come out of the mold interconnected and usually require a trim operation to separate the parts from the overflow groove. Partially cured parts need an additional bake cycle in an oven to be fully cured.

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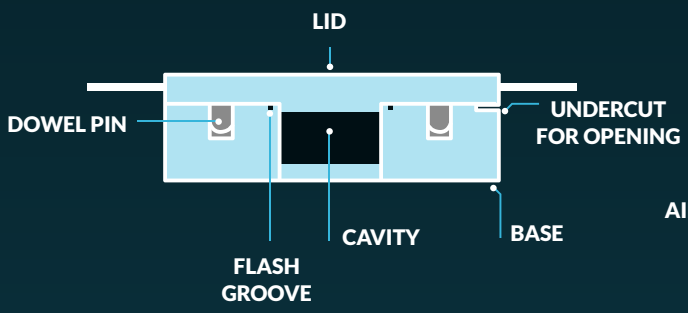
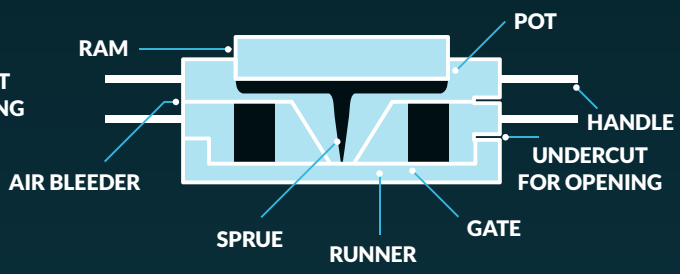
Why Choose One Method Over The Other?

In most cases, if a rubber part can be injection molded, it can also be transfer molded. This is not the case with compression molding parts. The compression molding process is great for producing parts that are all-rubber and have a low profile. Parts like this can be produced efficiently and in high quantities in a compression mold. If a metallic or non-metallic component needs to be bonded into the part, or if the part must have a cored-out area, injection or transfer molding is preferred.

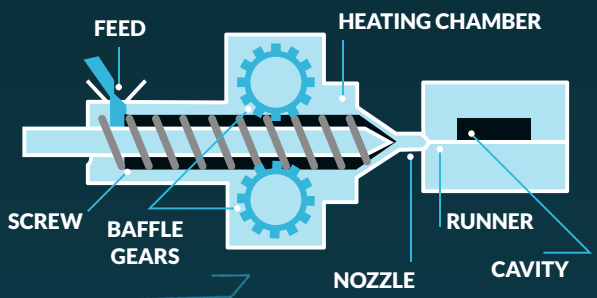
COMPRESSION MOLD (SEMI-POSITIVE TYPE)



TRANSFER MOLD



INJECTION MOLD



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Which Method Is The Most Cost Effective?

As a rough guideline, higher production quantities tend to be produced by injection molding. Lower production quantities tend to be produced by transfer molding. A basic rubber injection mold normally costs more to build than a basic rubber transfer mold. Injection molds normally have an intricate runner system that must be machined into the runner plate.

The ejector system of a rubber injection mold is typically more complex than those used in transfer molding. This may not always be the case though. Deciding whether a part should be transfer molded or injection molded usually comes down to a matter of economics.
Manufacturing facilities equipped with mostly transfer molding presses will tend to produce parts by transfer molding. Manufacturing facilities equipped with mostly injection molding presses will tend to produce parts by injection molding. Using the injection molding process or the transfer molding process should be determined on a case-to-case basis.

A basic compression mold is normally the least expensive to build compared to an injection mold or a transfer mold since it is normally just two plates and does not require runners or an ejection system. It is often more labor intensive to operate compared to an injection or transfer mold.

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INECTION, TRANSFER AND COMPRESSION MOLDING COMPARISON

CATEGORY	INJECTION	TRANSFER	COMPRESSION
Basic mold construction	Complex	Moderately Complex	Simple
Manufacturing parts made entirely of rubber	Good	Good	Good
Manufacturing rubber parts with bonded metallic or non-metallic components	Good	Good	Poor
Manufacturing rubber parts with cored-out areas	Good	Good	Not recommended
Loading rubber into the mold	Strip Rubber - Automatic Feed into Injection Molding Machine	Pellet Rubber - Manual feed into the Well Pot of the mold	Perform rubber - Manually loaded into each cavity
Filling the mold cavity	Injected through a runner system	Transferred through sprues	Compressed into the cavity
Removing cured parts	Ejector system	Ejector system	Manual
Operations required before the next molding cycle	Remove cured runners, purge cured rubber from injection nozzle, clean mold cavities	Remove cured cull pad from well pot, clean mold cavities	Trim flash from parts, clean mold cavities

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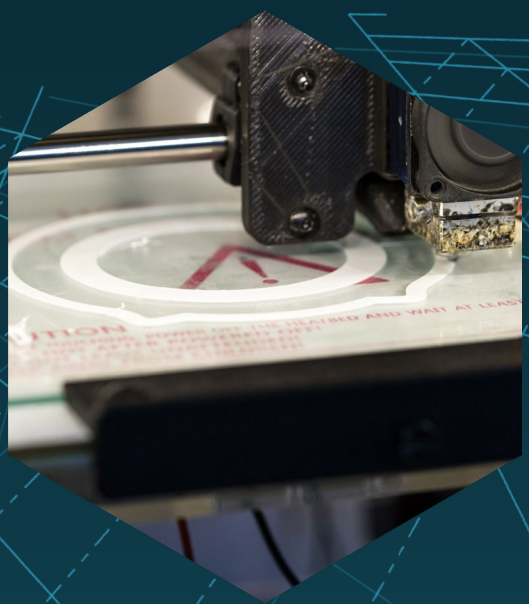
3D Printing Of Silicone – The Latest Manufacturing Technique

Another, more recent, processing method is 3D printing, also referred to as additive manufacturing. This mold-free process dispenses silicone in layers to build up a three-dimensional object.

Wacker Silicones is leading the industry with technological advancements in silicone 3D printing. They've accomplished this by creating a specific silicone material which is dispensed as a liquid in small lineal drops by a printing nozzle onto a specialty glass printing bed. The silicone remains solid as it is applied and is then vulcanized using UV light. This advanced technology allows engineers opportunities to create never before seen designs using a material already popular for its superior properties.

The main benefits of this process are a result of not needing to design and manufacture a mold. This opens the door to more accessible prototype production, more flexibility for smaller production runs, and a quicker turnaround time.

Industries from automotive to aerospace will no doubt benefit from silicone 3D printing. The medical industry forecasts efficient production of biocompatible implantable medical devices using this method. It will be fascinating to see how this revolutionary process will change the custom molded rubber industry.



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Custom Molded Rubber Tolerances

Creating custom molded rubber products that conform to customers' unique, and often intricate, designs is no easy feat. Working with rubber materials requires manufacturing mastery as the rubber needs to be compressible and resilient to reliably perform its function. Because compressibility is key in determining which types of rubber bodes best with certain applications, working with the QA and engineering departments to interpret design drawings is standard practice.

With their expertise, a manufacturing team will effectively communicate with their clients to compare and choose the best material combination with the correct tolerances. This ideally will satisfy product designs, reduce inaccuracies, and maintain budgetary requirements.

From a quality standpoint, adhering to the originally slated product design specification is probably the most challenging part of customization. To achieve precision, material selection must be considered before processing occurs. And since the material is intended to be compressed, it is important to note that enough material needs to remain after compression to fill the gap between the border surfaces.

Sponges and foams are softer and therefore have greater thickness tolerances than a firm, compressed sheet. Referring to the documented thickness tolerances helps gauge accuracy.

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1. Use the Correct Tolerances on the Print

The Rubber Manufacturers Association (RMA) publishes tolerance tables used by many custom molded rubber part manufacturers. Given the quality of today's mold making equipment and the desire of most companies to "exceed your expectations", we recommend specifying RMA commercial tolerances on the print and then asking the molding company to shoot for RMA precision. The suggestion might seem a little odd, but the process has helped contribute to a better than 99% quality rating at Modus Advanced, Inc. while still meeting customer requirements.

INECTION, TRANSFER AND COMPRESSION MOLDING COMPARISON

Dimensional Tolerance Table for Molded Rubber Products
Drawing Designation "A3" Commercial

SIZED (MILLIMETERS)	FIXED	CLOSURE	SIZED (INCHES)	FIXED	CLOSURE
0 - 10	± 0.20	± 0.32	0 - 0.40	± 0.008	± 0.013
10 - 16	0.25	0.40	0.40 - 0.63	0.010	0.016
16 - 25	0.32	0.50	0 .63 - 1.00	0.013	0.020
25 - 40	0.40	0.63	1.00 - 1.60	0.016	0.025
40 - 63	0.50	0.80	1.60 - 2.50	0.020	0.032
63 - 100	0.63	1.00	2.50 - 4.00	0.025	0.040
100 - 160	0.80	1.25	4.00 - 6.30	0.032	0.050
160 - & over multiply by	0.005	0.008	6.30 - & multiply by	0.004	0.008

2. Think About Fit, Form and Function Prior to Releasing the Drawing

Adjustments or enhancements to a design could affect the type of material, cost of the material, manufacturing capability and how the end product will ultimately function. It is important to consider the material and any compliances upfront and then modify the drawing to reflect product updates before manufacturing begins.

This prevents added costs and potential product cycle delays and saves valuable QA time and headache. At Modus Advanced, Inc., we've had great success prototyping with rubber-like 3D printing. Soft, rubber-like materials are an inexpensive alternative to making a mold and then trying to make modifications.

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3. Coordinate With Your Custom Molder Regarding Inspection Points, Techniques and Acceptable Quality Levels (AQL)

The manufacturing organization you work with should uphold the highest quality standards and accept nothing less. AQL sampling is a method used to accept or reject materials that have been inspected.

Cross-functional collaboration is also essential for quality adherence and overall sound manufacturing practices. Cross-functional means assessing every segment of the manufacturing process through effective communication-from the first quote and design draft to engineering, purchasing and QA.

The product is carefully tracked throughout the entirety of its production cycle and signed off only after passing each step in the cross-functional chain. Having a clear vantage point is an advantage when it comes to ensuring quality, reliability and precision. An experienced team on hand, thorough inspection and relentless process monitoring ensures efficiency and prevents costly mistakes.

Sustaining the Rubber Supply Chain

Natural rubber production depends on a multitude of factors, including proximity to flourishing rubber plant growing areas as well as economic and even political demands. Since natural rubber is a commodity, where it comes from is something that should be carefully analyzed.

Asia is a large cultivator of rubber, with China's natural rubber consumption at the top of the scale. China produces natural rubber and also imports a substantial amount of it from Thailand, Indonesia and Malaysia to sustain its supply chain.

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Sourcing Overseas

The U.S. commonly sees imported custom molded rubber parts made in China, but companies are also sourcing from India and Vietnam. Cost effectiveness is definitely something to consider when contemplating the rubber supply chain overseas.

You can do your own research regarding labor costs for various countries, but unless you are intent on buying from India or Vietnam, China will usually provide the best value when it comes to risk and reward. China has been able to build an incredible infrastructure over the last several decades.

For example, Apple has made a point of stressing the importance of their supply chain in China. International businesses intent on leveraging China's lower labor costs have literally transformed the country into a manufacturing powerhouse by asking Chinese suppliers to integrate international quality standards into their manufacturing practices.

Chinese rubber component suppliers have certainly evolved over the years. When sourcing parts from China, you will be pleasantly surprised to find that not only are parts less expensive, but suppliers are extremely anxious to do business with you.

Finding a professional corporation with values that mirror those of your company is the key to building a solid and long-lasting business relationship. Cultivating partnerships with overseas suppliers has proven extremely beneficial for both suppliers and customers.

Over time, Modus Advanced, Inc. has successfully built a 10-year relationship with a rubber supplier in China and is now able to deliver custom molded rubber parts to customers in less than four weeks with near perfect quality. Although there are factors that favor fostering an international supply chain, specifically costs, sourcing parts overseas can be complex and does not come without risks. Therefore, it is imperative for managers to carefully consider all aspects of the international supply chain through accurate sales forecasting and superior supplier communications.

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Domestic Production

Domestic sourcing is very much alive and kicking and custom molded parts are still made in the USA. In fact, many of the parts made in the USA are molded on presses made in China and other Asian countries.

There are advantages of sourcing domestically.

At Modus, we look at a number of project parameters before deciding to source internationally or mold parts at our Livermore, CA facility.

THESE INCLUDE:

- **Estimated annual volume of parts (larger volumes typically go to China)**
- **ITAR requirements (made in the USA)**
- **Required delivery (depends on the actual requirement)**
- **Part complexity (our factory in China loves to make complex parts)**
- **Type of material (electrically conductive products are typically made in the USA)**

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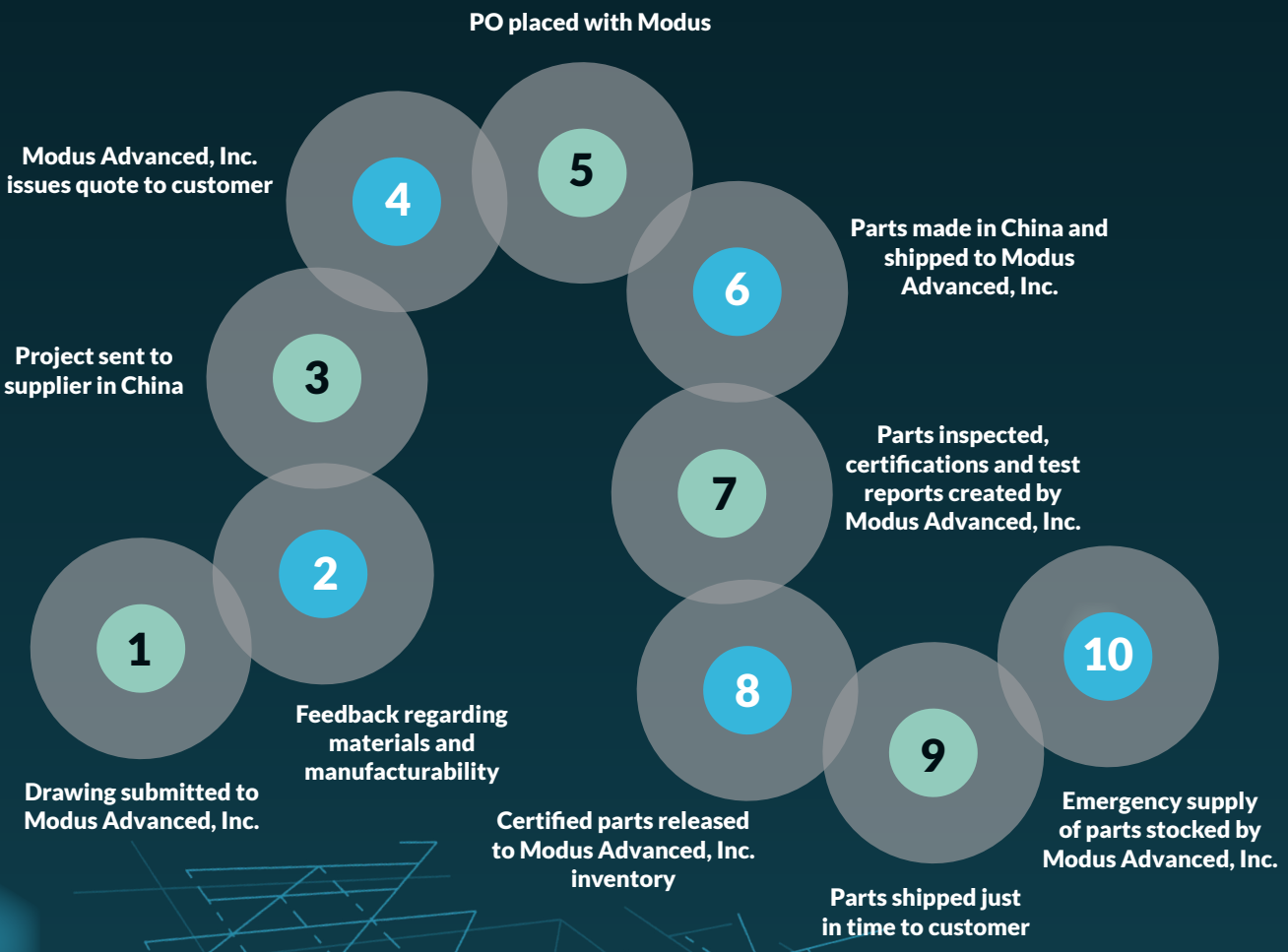
Hybrid Distribution

Unless there's a good reason to make the parts in the USA, a Chinese supply chain makes a lot of sense. The hybrid distribution model is paramount in both worlds, marrying the best of international sourcing with domestic engineering, inventory, service and support. This model also allows the customer to leverage local relationships and services while still benefiting from Chinese pricing.

HOW THE HYBRID MODEL WORKS



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To Sum it All Up

Design engineers rely on rubber's natural characteristics as an ideal material choice when creating environmental seals or gaskets, EMI shielding gaskets, and products that deal with noise, vibration and harshness.

Customizing rubber allows for a variety of design ranges and functionality. Adding one or more of the many distinct manufacturing methods even further enhances the product's ultimate precision and performance.

Depending on your design and budget requirements, the choices and combinations are endless.

We hope that this guide provided you with a solid resource when selecting custom molded rubber parts.

For more information, please contact one of our experts at Modus Advanced, Inc. at www.modusadvanced.com.

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