Rubber Molding Material Selection Guide

Allstates Rubber & Tool Corp.

Rubber Molding Material Selection Guide

The two biggest decisions in any rubber molding project are selecting the final design and choosing the appropriate material to achieve the desired functionality of the component. We trust your engineering team has been working hard on the design side. The team at Allstates Rubber & Tool Corp. can be a valuable asset in helping with the second part of the equation. As there is a wide range of rubber molding materials to choose from, we have tried to give you an overview of the most commonly requested products and their corresponding strengths and weaknesses. This guide should help you narrow down your material options by excluding those base polymers that are not suitable. This will provide a good starting point for pricing and performance discussions of compounds around the most applicable polymers. If you have very specific material needs, please contact us directly to aid in the custom formulation of your desired properties.

*Note: All "Trade Names" are designated with a registered trademark symbol and referenced to the owner of that registered trade mark. We have done our best to cite the proper owner of each "Trade Name". If you see a discrepancy, please alert us immediately and we will be happy to adjust the references appropriately.

Nitrile

Legend

Excellent ● Very Good ◒ Good ○ Fair ◒ Poor ●

Chemical Name:
Acrylonitrile-butadiene

Common Names:
Buna-N

ASTM D1418, Rubber Nomenclature:
NBR

ASTM D2000 / SAE J200, Automotive Classification:
BF, BG, BK, CH

ISO/DIN 1629, Rubber Nomenclature:
NBR

MIL-STD-417, Classification of Elastomeric Materials:
SB

Material Overview:
Nitrile is the workhorse of the rubber molding world. As the most popular material, it has good resistance to water, hydraulic fluid, oil and solvents. Buna-N also has strong abrasion and tear resistance with good compression set properties. It is the first option that most projects review as a mold material as it has an affordable price point.

Advantages:
Keeping costs down while delivering a strong product with resistance to oils and fuels. Strong mechanical properties and wear resistance. It retains its elastomeric properties well in cold temperatures.

Generally Resistant to:
Oils, Fuels, Fats, Greases, Hydraulic Fluids, Chemicals, and Solvents.

Disadvantages:
Susceptible to weather, and sunlight/ozone aging. It is also not a good choice when dealing with an application with flame.

Temperature Range F	-40F to 250F
Temperature Range C	-40C to 121C
Durometer Range (Shore A)	20-95
Tensile Strength (PSI)	200-3000
Maximum Elongation (%)	600
Economical Price	●
Tear Resistance	○
Metal Adhesion	◒
Compression Set	○
Rebound	○
Abrasion Resistance	●
Solvent Resistance	◒
Oil/Grease Resistance	◒
Weather/Sunlight Resistance	◒
Ozone Resistance	◒
Electrical Resistance	○
Permeability to Gases	◒
Water Resistance	○
Heat Resistance	○
Flame Resistance	●
Low Temperature Resistance	◒

"Nitrile is great for seals, o-rings, and gaskets. It is a great choice any time you have oils or fuels near an application. It will not swell like other elastomers and retains good sealing properties."

EPDM

Legend

Excellent ● Very Good ◒ Good ○ Fair ◒ Poor ●

Chemical Name:
Ethylene-propylene

Common Names:
EPDM, EP, EPT, EPR

ASTM D1418, Rubber Nomenclature:
EPDM

ASTM D2000 / SAE J200, Automotive Classification:
BA, CA, DA

ISO/DIN 1629, Rubber Nomenclature:
EPDM

MIL-STD-417, Classification of Elastomeric Materials:
RS

Material Overview:
EPDM is another commonly specified material for rubber molded products. It is frequently used in steam systems, seals for vehicles doors and engine compartments, and brake lines due to its resistance to glycol based brake fluid. It is an natural choice for automotive applications due to its large temperature range. Smooth flow makes it easy to extrude without imperfections.

Advantages:
Economical price and excellent for outdoor use with exposure to the elements. Its wide temperature range makes it a great choice for applications ranging from cold weather to high temperature steam.

Generally Resistant to:
Superb against weather, ozone, water, and heat aging. It is also very good for cold weather applications.

Disadvantages:
Not for use with aromatic or aliphatic hydrocarbons, breaks down in petroleum based oils and fuels.

Temperature Range F	-60F to 300F
Temperature Range C	-51C to 149C
Durometer Range (Shore A)	30-90
Tensile Strength (PSI)	500-3000
Maximum Elongation (%)	600
Economical Price	◒
Tear Resistance	◒
Metal Adhesion	◒
Compression Set	○
Rebound	○
Abrasion Resistance	○
Solvent Resistance	●
Oil/Grease Resistance	●
Weather/Sunlight Resistance	●
Ozone Resistance	●
Electrical Resistance	◒
Permeability to Gases	◒
Water Resistance	●
Heat Resistance	●
Flame Resistance	●
Low Temperature Resistance	●

"I find EPDM to be highly useful in energy, military, transportation and automotive projects as the exposure to varying temperatures and weather climates will not impact the function of the part. Great both in customer molded parts and extrusions."

Silicone

Legend

Excellent ● Very Good ◒ Good ○ Fair ◒ Poor ●

Chemical Name:
Polysiloxane

Common Names:
Silicone, VMQ, PVMQ

ASTM D1418, Rubber Nomenclature:
VMQ

ASTM D2000 / SAE J200, Automotive Classification:
FC, FE, GE

ISO/DIN 1629, Rubber Nomenclature:
VMQ

MIL-STD-417, Classification of Elastomeric Materials:
TA

Material Overview:
Silicone should be used as the material for a rubber molded part when temperature resistance is the most important factor in component performance. The added advantage of flexibility and weather resistance allow for additional deployment considerations. Typical use cases include medical devices and food applications. As a semi-organic elastomer, VMQ can be easily torn and is not an option for high wear applications.

Advantages:
Large functional temperature range, highly flexible, excellent electrical resistance and conductivity properties. Silicone stays flexible to seal in extreme cold.

Generally Resistant to:
High and low temperatures, weather, ozone, and electrical.

Disadvantages:
Not for use in high abrasion applications and components with possible tear failures.

Temperature Range F	-100F to 450F
Temperature Range C	-73C to 232C
Durometer Range (Shore A)	30-90
Tensile Strength (PSI)	200-1500
Maximum Elongation (%)	700
Economical Price	○
Tear Resistance	●
Metal Adhesion	○
Compression Set	◒
Rebound	○
Abrasion Resistance	◒
Solvent Resistance	●
Oil/Grease Resistance	◒
Weather/Sunlight Resistance	●
Ozone Resistance	●
Electrical Resistance	●
Permeability to Gases	●
Water Resistance	◒
Heat Resistance	●
Flame Resistance	○
Low Temperature Resistance	●

"Silicone is frequently the material of choice for the medical industry; or to battle extreme temperatures."

Neoprene

Legend

Excellent ● Very Good ◒ Good ○ Fair ◒ Poor ●

Temperature Range F	-50F to 250F
Temperature Range C	-46C to 121C
Durometer Range (Shore A)	20-95
Tensile Strength (PSI)	500-3000
Maximum Elongation (%)	600
Economical Price	◒
Tear Resistance	○
Metal Adhesion	◒
Compression Set	◒
Rebound	●
Abrasion Resistance	●
Solvent Resistance	◒
Oil/Grease Resistance	●
Weather/Sunlight Resistance	●
Ozone Resistance	◒
Electrical Resistance	◒
Permeability to Gases	○
Water Resistance	◒
Heat Resistance	○
Flame Resistance	●
Low Temperature Resistance	◒

Chemical Name:
Polychloropene

Common Names:
Neoprene

ASTM D1418, Rubber Nomenclature:
CR

ASTM D2000 / SAE J200, Automotive Classification:
BC, BE

ISO/DIN 1629, Rubber Nomenclature:
SC

MIL-STD-417, Classification of Elastomeric Materials:
CR

Material Overview:
Neoprene is a strong all-purpose material applicable for many uses rubber molding uses. Frequently it is used in mass transit and transportation as it meets, or exceeds, the Flame-Smoke-Toxicity requirements of ASTM C1166 (flame propagation), ASTM E162 (flammability), and SMP800C (toxic gas). Additionally, the transportation industry frequently uses neoprene for constant velocity joint (CVJ) boots, hose covers, vibration mounts, shock absorbers, and window seals and gaskets.

Advantages:
Excellent abrasion resistanceand high tensile strength. Neoprene is resistant to ozone and weather aging. Additionally, it can be batched to be flame retardant. Its strong internal molecular bonding makes neoprene a great choice for metal insert bonding.

Generally Resistant to:
Abrasion, weather, lubricating oils, and flame.

Disadvantages:
Should not be specified for exposure to strong oxidizing acids, solvents, and oxygenated hydrocarbons. Also it is not good in cold temperature applicationscomponents with possible tear failures.

"We frequently use neoprene in custom rubber molded shock absorbers and motor mounts for the transportation, agricultural, and military industries. Its tight molecular bonding allows it to take a pounding without breaking down."

Natural Rubber

Legend

Excellent ● Very Good ◒ Good ○ Fair ◒ Poor ●

Chemical Name:
Polyisoprene

Common Names:
Natural Rubber

ASTM D1418, Rubber Nomenclature:
NR

ASTM D2000 / SAE J200, Automotive Classification:
AA

ISO/DIN 1629, Rubber Nomenclature:
NR

MIL-STD-417, Classification of Elastomeric Materials:
RN

Material Overview:
Natural rubber is the "granddaddy" of all rubber molding materials. Originally created from the milky latex of the rubber tree (hevea brasiliensis), it can now be produced synthetically. With its strong resilience, abrasion, and surface friction properties it is ideal for vibration isolators, mounting pads, diaphragms, seals and o-rings. Unfortunately, natural rubber has very poor resistance to UV rays, ozone, and petroleum based products. Special care should be taken to avoid prolonged interaction with these conditions.

Advantages:
The strong dynamic properties of natural rubber make it ideal for use cases requiring high tensile strength, low compression set, strong rebound, with tear, and abrasion resistance. Natural rubber is commonly specified when adherence to a metal component is critical.

Generally Resistant to:
Abrasion, tear, alcohols, water, and electrical conductivity.

Disadvantages:
Highly susceptible to petroleum based products, sunlight and ozone.

Temperature Range F	-60F to 175F
Temperature Range C	-51C to 79C
Durometer Range (Shore A)	20-100
Tensile Strength (PSI)	500-3500
Maximum Elongation (%)	700
Economical Price	◒
Tear Resistance	●
Metal Adhesion	●
Compression Set	●
Rebound	●
Abrasion Resistance	●
Solvent Resistance	●
Oil/Grease Resistance	●
Weather/Sunlight Resistance	●
Ozone Resistance	●
Electrical Resistance	◒
Permeability to Gases	◒
Water Resistance	○
Heat Resistance	○
Flame Resistance	●
Low Temperature Resistance	◒

"Natural rubber has been approved by the FDA for seals used on food and beverage containers!"

SBR

Legend

Excellent ● Very Good ◒ Good ○ Fair ◒ Poor ●

Temperature Range F	-50F to 225F
Temperature Range C	-46C to 107C
Durometer Range (Shore A)	30-100
Tensile Strength (PSI)	500-3000
Maximum Elongation (%)	600
Economical Price	●
Tear Resistance	○
Metal Adhesion	●
Compression Set	○
Rebound	○
Abrasion Resistance	●
Solvent Resistance	●
Oil/Grease Resistance	●
Weather/Sunlight Resistance	●
Ozone Resistance	●
Electrical Resistance	○
Permeability to Gases	○
Water Resistance	◒
Heat Resistance	○
Flame Resistance	●
Low Temperature Resistance	◒

Chemical Name:
Styrene butadiene

Common Names:
SBR, GRS

ASTM D1418, Rubber Nomenclature:
SBR

ASTM D2000 / SAE J200, Automotive Classification:
AA, BA

ISO/DIN 1629, Rubber Nomenclature:
SBR

MIL-STD-417, Classification of Elastomeric Materials:
RS

Material Overview:
SBR is a cost effective polymer for your basic rubber molding needs. This material can be found in pneumatic tires, diaphragms, seals and gaskets. It is our material of choice for off-the-shelf rubber parts. This is an excellent material to use for water based applications. Care should be taken when specifying SBR as prolonged exposure to most petroleum based fluids and solvents will cause the molded part to break down.

Advantages:
Very durable material that is resistant to emulsifying in damp conditions. Good abrasion resistance. Also, good for bonding to inserts.

Generally Resistant to:
Abrasion, water, wet or dry organic acids.

Disadvantages:
Poor resistance to oils, greases, fats, solvents, strong acids, and most hydrocarbons.

"You can use SBR as a lower cost alternative to natural rubber in many cases as they share many of the same properties!"

Fluorocarbon

Legend

Excellent ● Very Good ◒ Good ○ Fair ◒ Poor ●

Chemical Name:
Fluorocarbon

Common Names:
Viton®, Fluorel®

ASTM D1418, Rubber Nomenclature:
FKM

ASTM D2000 / SAE J200, Automotive Classification:
HK

ISO/DIN 1629, Rubber Nomenclature:
FPM

MIL-STD-417, Classification of Elastomeric Materials:
TB

Material Overview:
Viton® is known as "the universal o-ring". This fluorocarbon combines the widest range of chemical resistance with the most advantageous high temperature properties. As the leading material requested for hoses, o-rings, gaskets, and fuel system seals it is relied upon heavily to extend the lifespan of a rubber molded component far beyond the capabilities of other materials. Viton® can perform reliably with prolonged exposure to gasoline, as well as the corrosive environment of down-hole drilling operations. Aircraft engine seals are also frequently made from this material.

Advantages:
Excellent heat and chemical resistance allow for use in high performance to reduce risk and reduce failure.

Generally Resistant to:
Gasoline, oil, fuels, acids, UV light, ozone.

Disadvantages:
Limited low temperature flexibility, and poor resistance to hot water and steam. Viton's great resistance to a variety of materials comes with a high price tag.

**Viton® and Fluorel® are registered trademarks of Dupont.*

Temperature Range F	-25F to 400F
Temperature Range C	-32C to 204C
Durometer Range (Shore A)	50-95
Tensile Strength (PSI)	1450
Maximum Elongation (%)	300
Economical Price	○
Tear Resistance	○
Metal Adhesion	○
Compression Set	●
Rebound	◒
Abrasion Resistance	◒
Solvent Resistance	●
Oil/Grease Resistance	●
Weather/Sunlight Resistance	●
Ozone Resistance	●
Electrical Resistance	○
Permeability to Gases	○
Water Resistance	●
Heat Resistance	●
Flame Resistance	◒
Low Temperature Resistance	◒

"Use Viton® for oil/gas mining seals and automotive fuel handling systems to achieve maximum dependability at high temperatures."

Hydrogenated Nitrile

Legend

Excellent ● Very Good ◒ Good ○ Fair ◒ Poor ●

Temperature Range F	-30F to 330F
Temperature Range C	-34C to 166C
Durometer Range (Shore A)	50-90
Tensile Strength (PSI)	1500-3500
Maximum Elongation (%)	350
Economical Price	◒
Tear Resistance	◒
Metal Adhesion	◒
Compression Set	◒
Rebound	○
Abrasion Resistance	◒
Solvent Resistance	●
Oil/Grease Resistance	●
Weather/Sunlight Resistance	◒
Ozone Resistance	◒
Electrical Resistance	○
Permeability to Gases	○
Water Resistance	●
Heat Resistance	◒
Flame Resistance	●
Low Temperature Resistance	◒

Chemical Name:
Hydrogenated Acrylonitrile-butadiene

Common Names:
HNBR

ASTM D1418, Rubber Nomenclature:
HNBR

ASTM D2000 / SAE J200, Automotive Classification:
DH

ISO/DIN 1629, Rubber Nomenclature:
HNBR

Material Overview:
By hydrogenating standard nitrile, the resistance to fuel and ozone is increased almost 5x. This new polymer is highly adopted by the automotive, marine and aircraft industries for use in seals for air conditioning, engine, suspension, and fuel systems. HNBR is sought after due to its inherent strength and retention of its properties after prolonged exposure to oil and heat. For this reason, HNBR rubber molded products such as grommets, gaskets, and O-rings are popular as well.

Advantages:
Outstanding heat and oil resistance. Better wear and abrasion resistance over standard Nitrile. Larger temperature range than NBR.

Generally Resistant to:
Oil, heat, fuel, weather, and ozone.

Disadvantages:
Should not be exposed to solvents. Cost is quite high relative to regular nitrile.

"HNBR is popular in the automotive industry, but is also great for seals exposed to heat aging. Have you ever noticed that your windshield gets a film on it on hot summer days? That's because your dashboard releases gases to protect itself from heat aging. HNBR works the same way."

Butyl

Legend

Excellent ● Very Good ◒ Good ○ Fair ◒ Poor ●

Temperature Range F	-60F to 250F
Temperature Range C	-51C to 121C
Durometer Range (Shore A)	40-90
Tensile Strength (PSI)	500-3000
Maximum Elongation (%)	850
Economical Price	○
Tear Resistance	○
Metal Adhesion	○
Compression Set	○
Rebound	◒
Abrasion Resistance	◒
Solvent Resistance	◒
Oil/Grease Resistance	◒
Weather/Sunlight Resistance	●
Ozone Resistance	●
Electrical Resistance	●
Permeability to Gases	●
Water Resistance	●
Heat Resistance	○
Flame Resistance	●
Low Temperature Resistance	●

Chemical Name:
Isobutylene Isoprene

Common Names:
Butyl

ASTM D1418, Rubber Nomenclature:
IIR

ASTM D2000 / SAE J200, Automotive Classification:
AA, BA

ISO/DIN 1629, Rubber Nomenclature:
IIR

MIL-STD-417, Classification of Elastomeric Materials:
RS

Material Overview:
Butyl is commonly used in rubber molded products where high resistance to gas permeability is of the most critical concern. For this reason it is frequently specified as the material for use in seals for high pressure gas and vacuum systems. Additionally, Butyl is often used in sound dampening products. Butyl is more expensive than other materials, but the added cost delivers properties that cannot be achieved by less costly polymers.

Advantages:
Butyl should be used when the gases in a system or container cannot be allowed to pass through the rubber molded part; also when meeting extreme weather conditions.

Generally Resistant to:
Gas permeation, weather, ozone, water, and electrical.

Disadvantages:
Should not be used for contact with petroleum solvents, coal tar, hydrocarbons, lubricating oils or flame. Also not good in high friction or abrasion applications.

"Butyl is a great selection for many medical pharmaceutical stoppers used to seal vials and bottles. Also, Butyl is great for when heavy exposure to ozone and sunlight is expected"

Fluorosilicone

Legend

Excellent ● Very Good ◒ Good ○ Fair ◒ Poor ●

Temperature Range F	-100F to 395F
Temperature Range C	-73C to 202C
Durometer Range (Shore A)	50-80
Tensile Strength (PSI)	500-800
Maximum Elongation (%)	300
Economical Price	◒
Tear Resistance	●
Metal Adhesion	◒
Compression Set	◒
Rebound	◒
Abrasion Resistance	●
Solvent Resistance	◒
Oil/Grease Resistance	○
Weather/Sunlight Resistance	●
Ozone Resistance	●
Electrical Resistance	●
Permeability to Gases	●
Water Resistance	○
Heat Resistance	●
Flame Resistance	◒
Low Temperature Resistance	●

Chemical Name:
Fluorovinyl Methyl Silioxane

Common Names:
Fluorosilicone

ASTM D1418, Rubber Nomenclature:
FVMQ

ASTM D2000 / SAE J200, Automotive Classification:
FK

ISO/DIN 1629, Rubber Nomenclature:
FVMQ

Material Overview:
Fluorosilicone is a considerably more expensive option than traditional silicone. It is ideal for gasketing applications that require a broad temperature range, age resistance, and exposure to fuels, oils, and coolants that would normally cause rapid damage to traditional silicone. Aerospace companies have turned to rubber molding components out of fluorosilicone due to its resistance of many branded cooling fluids used in engine systems. It is primarily for static sealing applications as it has poor physical strength and low abrasion resistance.

Advantages:
Fluorosilicone combines the temperature range advantages of silicone with the resistance to oil, fuel, and solvents of fluorocarbons.

Generally Resistant to:
High/low temperatures, fuel, oil, solvents.

Disadvantages:
Poor abrasion resistance and friction qualities. Should not be exposed to brake fluids, hydrazine.

"Due to its large functional temperature range and fuel resistance, Fluorosilicone can be used in rubber molded seals for aircraft systems!"

Urethane

Legend

Excellent ● Very Good ◒ Good ○ Fair ◒ Poor ●

Chemical Name:
Urethane, Polyester Urethane

Common Names:
Urethane, Polyurethane

ASTM D1418, Rubber Nomenclature:
AU

ASTM D2000 / SAE J200, Automotive Classification:
BG

ISO/DIN 1629, Rubber Nomenclature:
AU

MIL-STD-417, Classification of Elastomeric Materials:
SB

Material Overview:
Urethane is commonly used in applications requiring excellent abrasion resistance and tensile strength. Systems subjected to high pressure and repeated shock loads can take advantage of these inherent properties of urethane. If you have a custom rubber molded component that continually wears out before its expected lifespan, consider specifying urethane moving forward. Urethane has performance characteristics similar to nitrile when temperatures are below 175F. So, it is possible to consider this as an alternative to nitrile in certain applications.

Advantages:
Strong resistance to abrasion and capable of sustaining repeated high load cycles without failure.

Generally Resistant to:
Oil and grease, petroleum based products, weather.

Disadvantages:
Water absorption, loss of strength, and softening occurs at higher temperatures. Urethane is a higher priced elastomer.

Temperature Range F	-30F to 175F
Temperature Range C	-34C to 79C
Durometer Range (Shore A)	35-100
Tensile Strength (PSI)	500-6000
Maximum Elongation (%)	750
Economical Price	○
Tear Resistance	●
Metal Adhesion	○
Compression Set	○
Rebound	○
Abrasion Resistance	●
Solvent Resistance	●
Oil/Grease Resistance	◒
Weather/Sunlight Resistance	●
Ozone Resistance	●
Electrical Resistance	○
Permeability to Gases	○
Water Resistance	○
Heat Resistance	○
Flame Resistance	◒
Low Temperature Resistance	◒

"Urethane can be used to make long lasting seals for hydraulic systems!"

About Allstates Rubber & Tool Corp.

Allstates Rubber & Tool Corp. has been providing custom rubber molding services to the automotive, aerospace, transportation, agricultural, medical, and food industries for over 46 years. We can provide lead times as short as 2 weeks for some products. All standard grommets, bumpers, bushings, and O-rings can be modified to meet your application needs. While this guide provides an overview of common rubber molding materials used by our wide range of customers, it is by no means exhaustive. Many of these polymers can be batched for non-conductiveness, or to meet food grade applications. Please contact us directly to discuss your specific project and rubber molding needs.