Terms and Definitions

Abrasion (Tabor Abrasion)
Defined as the level of abrasive resistance, by how well the surface of a mat will hold up to heavy use. The less weight the sample loses, the more durable the product proves to be. touches a Conductive or Static Dissipative

Coefficient of Friction (COF)
Defined as the measure of traction provided by the surface of the mat. It is a measurement of force that must be exerted before an object slips. The higher the number, the better the traction. Recommend a COF of 0.50 in Dry areas and 0.25 in Wet areas.

Compression Deflection (CD)
Defined as a method of measuring the softness or comfort level of a sponge mat. The CD measures how much a person's foot sinks into the mat, and the higher the reading, the softer the mat. The results are affected by the thickness of the sponge backing and the flexibility of the surface material. Consider 0.20 to 0.50 as the ideal range.

Customisation
Defined as specific customer mat specifications and/or configurations, incl width, length, etc PVC entrance matting can be customised to conform to any shape, size and inlay design.

Density
Defined as the measure of a substances weight per unit volume in g/cm3, stiffness, impact strength, and other related properties.

Durometer
Defined as the measure of softness/hardness of moulded rubber and moulded PVC mats. The general rule is, the lower the durometer, the softer the mat. Our mats range between 45 to 70 Durometer, and considered the ideal range for moulded rubber mats.

Elongation at Break %
Defined as the measure of "ultimate elongation" or percentage increase in original length of a specimen when it breaks.

Electro Static Discharge (ESD)
Defined as when static builds up on a determined person's body and they touch another object, that charge is passed onto the object. This discharge can harm sensitive equipment and is drained off when the person steps on or mat.

Hardness (Shore A)
Defined as the rubber durometer hardness as measured on a Shore (TM, Wilson-Shore Instruments) "A" guage. Also refer IRHD. Higher numbers indicate harder materials, lower numbers indicate softer materials.

Life Expectancy
Defined as the term of use a mat will last. Life expectancy of a mat can vary greatly depending upon a diverse range of factors Including compound used, location, mat selection, foot traffic, exposure to grease, oils or chemicals, cleaning frequency and/or importantly their maintenance schedule.

Tear Strength
Defined as the force required to rupture a sample of stated geometry. Tear resistance is the resistance to growth of a cut or nick when Tension is applied to a specimen. PsiT.

Tensile Strength
Defined as the force in pounds per square inch (Psi) required to cause the rupture of rubber. The higher the Psi the stronger the mat.

Working Temperature
Defined as the maximum and minimum Temperature limits within which a mat can function in a given application. Lowering temperature results in loss of resilience, increased hardness, & brittleness.

OHM
Defined as a measure of resistance. The higher an ohm reading on a conductive mat, the more difficult it is for the static electric charge to go through the mat and out the ground. Therefore, the lower the ohm reading, the more conductive the material.
Range: Conductive = 1 x 10/3 to 1 x 10/6 ohms
Range: Dissipative = > 1x10/6 to 1x10/10 ohms

Contact us for specific technical data on any product shown:
Technical: 1800 001 118 **p:** (03) 9357 9811 **f:** (03) 9357 9460 **e:** safetygear@safetygear.com.au

PROPERTIES OF VARIOUS RUBBERS

ELASTOMER RUBBER COMPOUNDS TYPES AND REFERENCES					
General Description	**Chemical Description**	**Abbreviation (ASTM 1418)**	**ISO/DIN 1629**	**Other Trade names & Abbreviations**	**ASTM D2000 Designations**
Nitrile	Acrylonitrile-butadiene rubber	NBR	NBR	Buna-N	BF, BG, BK, CH
Hydrogenated Nitrile	Hydrogenated Acrylonitrile-butadiene rubber	HNBR	(HNBR)	HNBR	DH
Ethylene-Propylene	Ethylene propylene diene rubber	EPDM	EPDM	EP, EPT, EPR	BA, CA, DA
Fluorocarbon	Fluorocarbon Rubber	FKM	FPM	Viton ®, Fluorel ®	HK
Chloroprene	Chloroprene rubber	CR	CR	Neoprene	BC, BE
Silicone	Silicone rubber	VMQ	VMQ	PVMQ	FC, FE, GE
Fluorosilicone	Fluorosilicone rubber	FVMQ	FVMQ	FVMQ	FK
Polyacrylate	Polyacrylate rubber	ACM	ACM	ACM	EH
Ethylene Acrylic	Ethylene Acrylic rubber	AEM	AEM	Vamac ®	EE, EF, EG, EA
Styrene-butadiene	Styrene-butadiene rubber	SBR	SBR	SBR	AA, BA
Polyurethane	Polyester urethane / Polyether urethane	AU / EU	AU / EU	AU / EU	BG
Natural rubber	Natural rubber	NR	NR	NR	AA

General Properties of Elastomer Classes & Rubber Compounds:

Very Good = 1	Good = 2	Average = 3	Poor = 4	Temperature in °F

Basic Property	NBR	HNBR	EPDM	FKM	CR	ACM	AEM	SBR	AU/EU	VMQ	FVMQ	NR
Economy of Material	1	4	2	3	2	3	4	1	3	3	4	1
Compression Set Resistance	1	1	1	1	2	4	2	2	3	2	2	1
Resilience (Rebound)	2	2	2	2	2	3	2	2	2	2	2	1
Tear Strength	2	1	2	2	2	3	2	3	2	4	3	1
Heat Aging Resistance	3	2	2	1	3	1	1	3	1	1	1	3
Ozone Resistance	4	2	2	1	2	2	1	4	1	1	1	4
Resistance to Oil & Grease	2	2	4	1	2	1	3	4	2	3	1	4
Fuel Resistance	4	3	4	2	4	1	4	4	3	4	2	4
Water Swell Resistance	2	2	1	2	3	4	2	1	4	1	1	1
Gas Impermeability	2	2	3	2	2	3	2	3	2	4	4	3
Dynamic Service / Abrasion Res.	2	2	2	3	2	2	2	1	1	4	4	1
High Temperature - Standard	212	300	300	390	250	300	300	212	175	450	400	220
High Temperature - Special	250	-	-	-	-	-	-	-	-	480	-	-
Low Temperature - Standard	-22	- 22	-60	5	-40	-60	-40	-50	-60	-75	-75	-60
Low Temperature - Special	-60	-40	-	-30	-	-	-	-	-	-	-	-

Due to the number of interacting forces, it is STRONGLY RECOMMENDED THAT YOUR ELASTOMER SELECTION BE RIGOROUSLY TESTED IN THE ACTUAL APPLICATION, performance assumptions must be checked so that you are certain that all variables have been carefully considered.

<table>
<tr><th colspan="3">NATURAL RUBBER (NR)</th></tr>
<tr><td rowspan="5">Natural rubber is a product coagulated from the latex of the rubber tree, hevea brasiliensis. Natural rubber features low compression set, high tensile strength, resilience, abrasion and tear resistance, good friction characteristics, excellent bonding capabilities to metal substrate, and good vibration dampening characteristics.</td><td colspan="2">Temperature Range (dry heat)</td></tr>
<tr><td>low</td><td>high</td></tr>
<tr><td>- 60 °F
-51 °C</td><td>220 °F
104 °C</td></tr>
<tr><td colspan="2">Application Advantages</td></tr>
<tr><td colspan="2">» excellence compression set
» good resilience and abrasion
» good surface friction properties</td></tr>
<tr><td>Primary Uses</td><td colspan="2">Application Disadvantages</td></tr>
<tr><td>O-rings, rubber seals and custom molded rubber components for:
» rubber to metal bonded vibration isolators and mounts
» automotive diaphragms
» FDA applications for food and beverage seals</td><td colspan="2">» poor resistance to attack by petroleum oils
» poor ozone, UV resistance</td></tr>
</table>

<table>
<tr><th colspan="3">FLUOROSILICONE (FVMQ)</th></tr>
<tr><td rowspan="5">Fluorosilicones combine most of the attributes of silicone with resistance to petroleum oils and hydrocarbon fuels. Low physical strength and abrasion resistance combined with high friction limit fluorosilicone to static seals. Fluorosilicones are used primarily in aircraft fuel systems.</td><td colspan="2">Temperature Range (dry heat)</td></tr>
<tr><td>low</td><td>high</td></tr>
<tr><td>-75 °F
-59 °C</td><td>450 °F
232 °C</td></tr>
<tr><td colspan="2">Application Advantages</td></tr>
<tr><td colspan="2">» excellent extreme temperature properties
» excellent compression set resistance
» very clean, low odor and taste</td></tr>
<tr><td>Primary Uses</td><td colspan="2">Application Disadvantages</td></tr>
<tr><td>O-rings, rubber seals and custom molded rubber components for:
» seals (static) for extreme temperature applications
» food applications
» medical devices
» FDA applications</td><td colspan="2">» typically not good for dynamic seals due to friction properties and poor abrasion resistance</td></tr>
</table>

SILICONE (VMQ)

<table>
<tr><td rowspan="5">Silicone is a semi-organic elastomer with outstanding resistance to extremes of temperature with corresponding resistance to compression set and retention of flexibility.
Silicone elastomers provide excellent resistance to ozone, oxygen, and moisture.
Low physical strength and abrasion resistance combined with high friction properties limit silicone to static seal applications.
Silicone utilizes a flexible siloxane backbone rather than a carbon backbone like many other elastomers and has very low glass transition temperatures.</td><td colspan="2">Temperature Range (dry heat)</td></tr>
<tr><td>low</td><td>high</td></tr>
<tr><td>-75 °F
-59 °C</td><td>450 °F
232 °C</td></tr>
<tr><td colspan="2">Application Advantages</td></tr>
<tr><td colspan="2">» excellent extreme temperature properties
» excellent compression set resistance
» very clean, low odor and taste</td></tr>
<tr><td>Primary Uses</td><td colspan="2">Application Disadvantages</td></tr>
<tr><td>O-rings, rubber seals and custom molded rubber components for:
» seals (static) for extreme temperature applications
» food applications
» medical devices
» FDA applications</td><td colspan="2">» typically not good for dynamic seals due to friction properties and poor abrasion resistance</td></tr>
</table>

POLYURETHANE (AU) (EU)

<table>
<tr><td rowspan="5">Millable polyurethane exhibits excellent abrasion resistance and tensile strength as compared to other elastomers providing superior performance in hydraulic applications with high pressures, abrasive contamination and shock loads. Fluid compatibility is similar to that of nitrile at temperatures up to approximately 175 °F. At higher temperatures, polyurethane has a tendency to soften and lose both strength and fluid resistance advantages over other elastomers.</td><td colspan="2">Temperature Range (dry heat)</td></tr>
<tr><td>low</td><td>high</td></tr>
<tr><td>- 60 °F
- 51 °C</td><td>175 °F
79 °C</td></tr>
<tr><td colspan="2">Application Advantages</td></tr>
<tr><td colspan="2">» excellent strength and abrasion resistance
» good resistance to petroleum oils
» good weather resistance</td></tr>
<tr><td>Primary Uses</td><td colspan="2">Application Disadvantages</td></tr>
<tr><td>O-rings, rubber seals and custom molded rubber components for:
» seals for high hydraulic pressure
» highly stressed parts subject to wear</td><td colspan="2">» poor resistance to water
» poor high temperature capabilities</td></tr>
</table>

STYRENE BUTADIENE (SBR)

<table>
<tr><td rowspan="5">Styrene-Butadiene (SBR) is a copolymer of styrene and butadiene.
SBR compounds have properties similar to those of natural rubber. SBRs primary custom molded application is the use in hydraulic brakes system seals and diaphragms, with the major of the industry usage coming from the Tire Industry.
SBR features excellent resistance to brake fluids, and good water resistance.</td><td colspan="2">Temperature Range (dry heat)</td></tr>
<tr><td>low</td><td>high</td></tr>
<tr><td>- 50 °F
-46 °C</td><td>212 °F
100 °C</td></tr>
<tr><td colspan="2">Application Advantages</td></tr>
<tr><td colspan="2">» good resistance to brake fluids
» good resistance to water</td></tr>
<tr><td>Primary Uses</td><td colspan="2">Application Disadvantages</td></tr>
<tr><td>O-rings, rubber seals and custom molded rubber components for:
» hydraulic brake systems seals and diaphragms
» plumbing applications</td><td colspan="2">» poor weather resistance
» poor petroleum oil and solvent resistance</td></tr>
</table>

ETHYLENE ACRYLIC (AEM)

<table>
<tr><td rowspan="5">Ethylene-acrylic (Vamac ®) is a terpolymer of ethylene, methyl acrylate, and an acid-containing monomer as a cure site. It exhibits properties similar to those of Polyacrylate, but with extended low temperature range and with enhanced mechanical properties.
Ethylene-acrylic offers a high degree of oil, ozone, UV and weather resistance.</td><td colspan="2">Temperature Range (dry heat)</td></tr>
<tr><td>low</td><td>high</td></tr>
<tr><td>- 40 °F
- 40 °C</td><td>300 °F
149 °C</td></tr>
<tr><td colspan="2">Application Advantages</td></tr>
<tr><td colspan="2">» excellent vibration dampening
» excellent heat aging characteristics
» good dynamic property retention over a wide temperature range
» resistance to transmission fluids, water, glycol mixtures, and alkalies</td></tr>
<tr><td>Primary Uses</td><td colspan="2">Application Disadvantages</td></tr>
<tr><td>O-rings, rubber seals and custom molded rubber components for:
» Automotive sealing applications.
» Automotive transmissions
» Power steering seals</td><td colspan="2">» not recommended for exposure to fuel, brake fluid, aromatic hydrocarbons or phosphate esters.</td></tr>
</table>

POLYACRYLATE (ACM)

<table>
<tr><td rowspan="6">Polyacrylates are copolymers of ethyl and acrylates which exhibit excellent resistance to petroleum fuels and oils and can retain their properties when sealing petroleum oils at continuous high temperatures up to 300 °F. These properties make polyacrylates suitable for use in automotive automatic transmissions, steering systems, and other applications where petroleum and high temperature resistance are required.
Polyacrylates also exhibit resistance to cracking when exposed to ozone and sunlight.
Polyacrylates are not recommended for applications where the elastomer will be exposed to brake fluids, chlorinated hydrocarbons, alcohol, or glycols.</td><td colspan="2">Temperature Range (dry heat)</td></tr>
<tr><td>low</td><td>high</td></tr>
<tr><td>-60 °F
-51 °C</td><td>300 °F
149 °C</td></tr>
<tr><td colspan="2">Application Advantages</td></tr>
<tr><td colspan="2">» petroleum fuel and oil resistance
» resists flex cracking
» good ozone resistance
» good heat resistance</td></tr>
<tr></tr>
<tr><td>Primary Uses</td><td colspan="2">Application Disadvantages</td></tr>
<tr><td>O-rings, rubber seals and custom molded rubber components for:
» Automotive transmissions.
» Automotive steering systems</td><td colspan="2">» poor compression set performance relative to NBR
» lesser water resistance and low temperature performance than some other elastomers</td></tr>
</table>

NEOPRENE / CHLOROPRENE (CR)

<table>
<tr><td rowspan="5">Neoprene homopolymer of chlorobutadiene and is unusual in that it is moderately resistant to both petroleum oils and weather (ozone, UV, oxygen). This qualifies neoprene uniquely for certain sealing applications where many other materials would not be satisfactory. Neoprene is classified as a general purpose elastomer which has relatively low compression set, good resilience and abrasion, and is flex cracking resistant.
Neoprene has excellent adhesion qualities to metals for rubber to metal bonding applications.
It is used extensively for sealing refrigeration fluids due to its excellence resistance to Freon® and ammonia.</td><td colspan="2">Temperature Range (dry heat)</td></tr>
<tr><td>low</td><td>high</td></tr>
<tr><td>- 40 °F
- 40°C</td><td>250 °F
121°C</td></tr>
<tr><td colspan="2">Application Advantages</td></tr>
<tr><td colspan="2">» moderate resistance to petroleum oils
» good resistance to ozone, UV, oxygen
» excellence resistance to Freon® and ammonia</td></tr>
<tr><td>Primary Uses</td><td colspan="2">Application Disadvantages</td></tr>
<tr><td>O-rings, rubber seals and custom molded rubber components for:
» refrigeration industry applications
» general purpose seals, hose and wire</td><td colspan="2">» moderate water resistance
» not effective in solvents environments</td></tr>
</table>

FLUOROCARBON (FKM)

<table>
<tr><td rowspan="8">Fluorocarbon exhibits resistance to a broader range of chemicals combined with very good high temperature properties more so than any of the other elastomers. It is the closest available approach to a universal elastomer for sealing in the use of o-rings and other custom seals over other types of elastomers.
Fluorocarbons are highly resistant to swelling when exposed to gasoline as well as resistant to degradation due to expose to UV light and ozone.
When exposed to low temperatures, fluorocarbon elastomers can become quite hard (-4 °F) but can be serviceable at low temperatures, although FKM compounds are not recommended for applications requiring good low temperature flexibility.
In addition to standard FKM materials, a number of special materials are available with differing monomer compositions and fluorine content (65% to 71%) for improved low temperature, high temperature, or chemical resistance performance.
Fluorocarbons exhibit low gas permeability making them well suited for hard vacuum service and many formulations are self-extinguishing. FKM materials are not generally recommended for exposure to hot water, steam, polar solvents, low molecular weight esters and ethers, glycol based brake fluids, or hot hydrofluoric or chlorosulfonic acids.</td><td colspan="2">Temperature Range (dry heat)</td></tr>
<tr><td>low</td><td>high</td></tr>
<tr><td>5 °F
- 15 °C</td><td>390 °F
199 °C</td></tr>
<tr><td colspan="2">Application Advantages</td></tr>
<tr><td colspan="2">» excellent chemical resistance
» excellent heat resistance
» good mechanical properties
» good compression set resistance</td></tr>
<tr><td colspan="2">Application Disadvantages</td></tr>
<tr><td colspan="2">» poor low temperature flexibility
» poor resistance to hot water and steam</td></tr>
<tr><td colspan="2">Modifications

» differing monomer compositions and fluorine content (65% to 71%) for improved low temperature, high temperature, or chemical resistance performance</td></tr>
<tr><td>Primary Uses</td><td colspan="2">Specialized Applications</td></tr>
<tr><td>O-rings, rubber seals and custom molded rubber components for
» Automotive fuel handling
» Aircraft engine seals
» High temperature applications requiring good compression set
» General industrial seals and gaskets</td><td colspan="2">» degree of fluorination (A, B, F, GB, GF, GFLT, GBLT, GLT, ETP)
» copolymer or terpolymer of fluorinated hydrocarbon monomers</td></tr>
</table>

<table>
<tr><th colspan="3">ETHYLENE-PROPYLENE (EPDM)</th></tr>
<tr><td rowspan="9">Ethylene-propylene compounds are prepared from ethylene and propylene (EPM) and usually a third monomer (EPDM). These compounds are used frequently to seal in brake systems, and for sealing hot water and steam. Ethylene propylene compounds have good resistance to mild acids, detergents, alkalis, silicone oils and greases, ketones, and alcohols. They are not recommended for applications with petroleum oils, mineral oil, di-ester lubricants, or fuel exposure.

Ethylene Propylene has gained wide seal industry acceptance for its excellent ozone and chemical resistance properties and is compatible with many polar fluids that adversely affect other elastomers.

EPDM compounds are typically developed with a sulfur or peroxide cure system. Peroxide-cured compounds are suitable for higher temperature exposure and typically have improved compression set performance.</td><td colspan="2">Temperature Range (dry heat)</td></tr>
<tr><td>low</td><td>high</td></tr>
<tr><td>-60 °F
-51 °C</td><td>300 °F
149 °C</td></tr>
<tr><td colspan="2">Application Advantages</td></tr>
<tr><td colspan="2">» excellent weather resistance
» good low temperature flexibility
» excellent chemical resistance
» good heat resistance</td></tr>
<tr><td colspan="2">Application Disadvantages</td></tr>
<tr><td colspan="2">» poor petroleum oil and solvent resistance</td></tr>
<tr><td colspan="2">Modifications</td></tr>
<tr><td colspan="2">» sulfur-cured and peroxide-cured compounds
» third comonomer EPDM, copolymer ethylene and propylene EPM</td></tr>
<tr><td>Primary Uses</td><td colspan="2">Specialized Applications</td></tr>
<tr><td>O-rings, rubber seals and custom molded rubber components for:
» Water system seals, faucets, etc.
» Brake systems
» Ozone exposure applications
» Automotive cooling systems
» General Industrial Use</td><td colspan="2">» glycol-based brake system seals
» FDA approved applications
» NBR NSF standard 61 for potable water applications
» NBR WRc, KTW water applications</td></tr>
</table>

<table>
<tr><th colspan="3">HYDROGENATED NITRILE (HNBR)</th></tr>
<tr><td rowspan="8">HNBR is created by partially or fully hydrogenating NBR. The hydrogenating process saturates the polymeric chain with accompanying improvements to the ozone, heat and aging resistance of the elastomer and improves overall mechanical properties.
HNBR, like Nitrile, increasing the acrylonitrile content increase resistance to heat and petroleum based oils and fuels, but decreases the low temperature performance.</td><td colspan="2">Temperature Range (dry heat)</td></tr>
<tr><td>low</td><td>high</td></tr>
<tr><td>-22 °F
-30 °C</td><td>300 °F
149 °C</td></tr>
<tr><td colspan="2">Application Advantages</td></tr>
<tr><td colspan="2">» excellent heat and oil resistance
» improved fuel and ozone resistance (approximately 5X) over Nitrile
» abrasion resistance</td></tr>
<tr><td colspan="2">Application Disadvantages</td></tr>
<tr><td colspan="2">» increased cold flow with hydrogenation
» decreased elasticity at low temperatures with hydrogenation over standard nitrile</td></tr>
<tr></tr>
<tr><td>Primary Uses</td><td colspan="2">Modifications</td></tr>
<tr><td>O-rings, rubber seals and custom molded rubber components for:
» Oil resistant applications
» Oil well applications
» Fuel systems, automotive, marine, and aircraft
» General Industrial Use</td><td colspan="2">» acrylonitrile content (ACN) from 18% to 50%
» peroxide vs. sulfur donor cure system</td></tr>
</table>

<table>
<tr><th colspan="3">NITRILE (NBR)</th></tr>
<tr><td rowspan="10">Nitrile is the most widely used elastomer in the seal industry. The popularity of nitrile is due to its excellent resistance to petroleum products and its ability to be compounded for service over a temperature range of -22°F to 212°F.
Nitrile is a copolymer of butadiene and acrylonitrile. Variation in proportions of these polymers is possible to accommodate specific requirements. An increase in acrylonitrile content increases resistance to heat plus petroleum base oils and fuels but decreases low temperature flexibility. Military AN and MS O ring specifications require nitrile compounds with low acrylonitrile content to insure low temperature performance.
Nitrile provides excellent compression set, tear, and abrasion resistance. The major limiting properties of nitrile are its poor ozone and weather resistance and moderate heat resistance, but in many application these are not limiting factors.</td><td colspan="2">Temperature Range (dry heat)</td></tr>
<tr><td>low</td><td>high</td></tr>
<tr><td>-22 °F
-30 °C</td><td>212 °F
100 °C</td></tr>
<tr><td colspan="2">Application Advantages</td></tr>
<tr><td colspan="2">» excellent compression set,
» superior tear resistance
» abrasion resistance</td></tr>
<tr><td colspan="2">Application Disadvantages</td></tr>
<tr><td colspan="2">» poor weather resistance
» moderate heat resistance</td></tr>
<tr><td colspan="2">Modifications</td></tr>
<tr><td colspan="2">» acrylonitrile content (ACN) from 18% to 50%
» peroxide vs. sulfur donor cure system
» XNBR improved wear resistance formulation</td></tr>
<tr></tr>
<tr><td>Primary Uses</td><td colspan="2">Specialized Applications</td></tr>
<tr><td>O-rings, rubber seals and custom molded rubber components for:
» Oil resistant applications
» Low temperature applications
» Fuel systems, automotive, marine, and aircraft
» General Industrial Use</td><td colspan="2">» NBR NSF standard 61 for potable water applications
» NBR WRc, KTW water applications
» NBR FDA white list compounds</td></tr>
</table>

Elastomer Classes & Rubber Compounds Class and Type Details:Due to the number of interacting forces, it is STRONGLY RECOMMENDED THAT YOUR ELASTOMER SELECTION BE RIGOROUSLY TESTED IN THE ACTUAL APPLICATION, performance assumptions must be checked so that you are certain that all variables have been carefully considered. Specific properties of the compound will vary with the formulation or ingredient used to make the compound in addition to the base polymer.