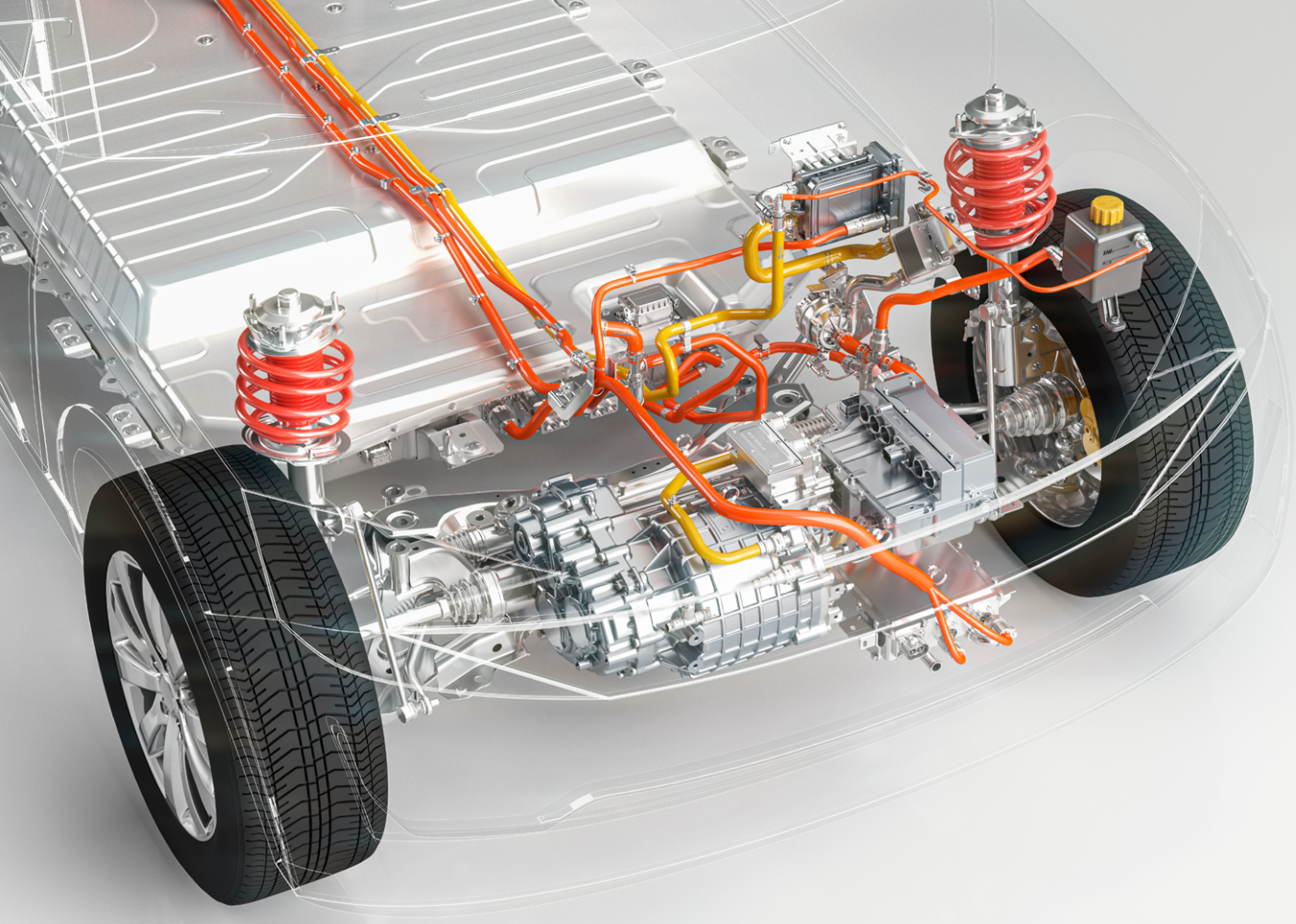
MOMENTIVE®
inventing possibilities

ENERGIZING AND ENABLING E-MOBILITY



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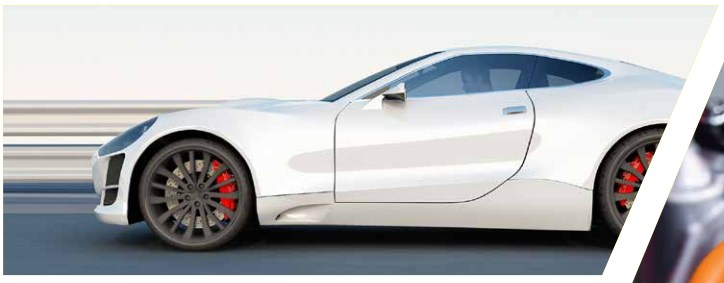
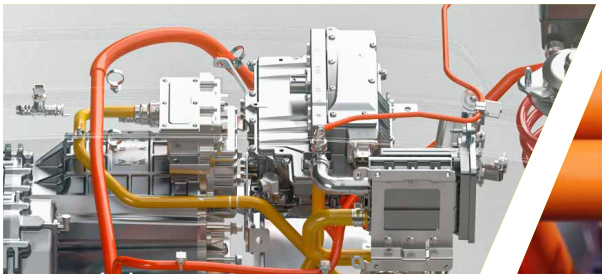
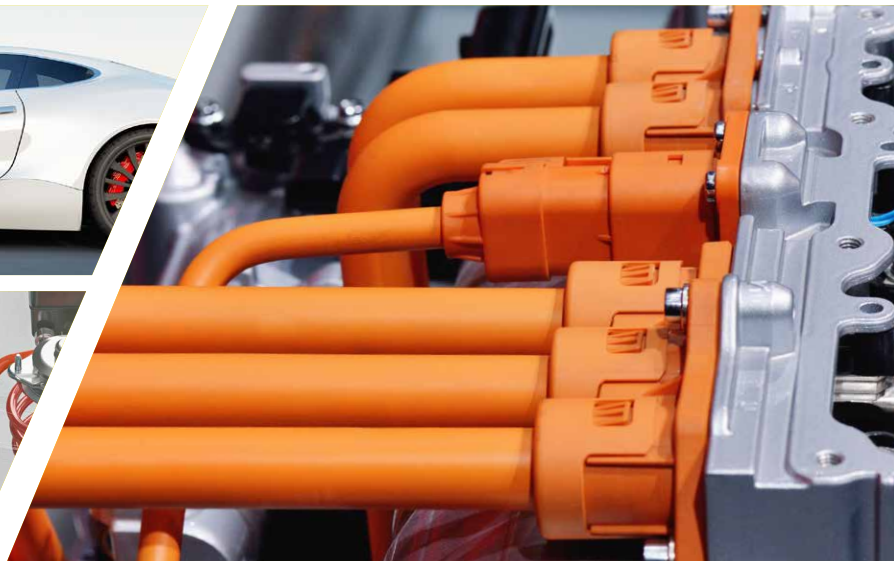






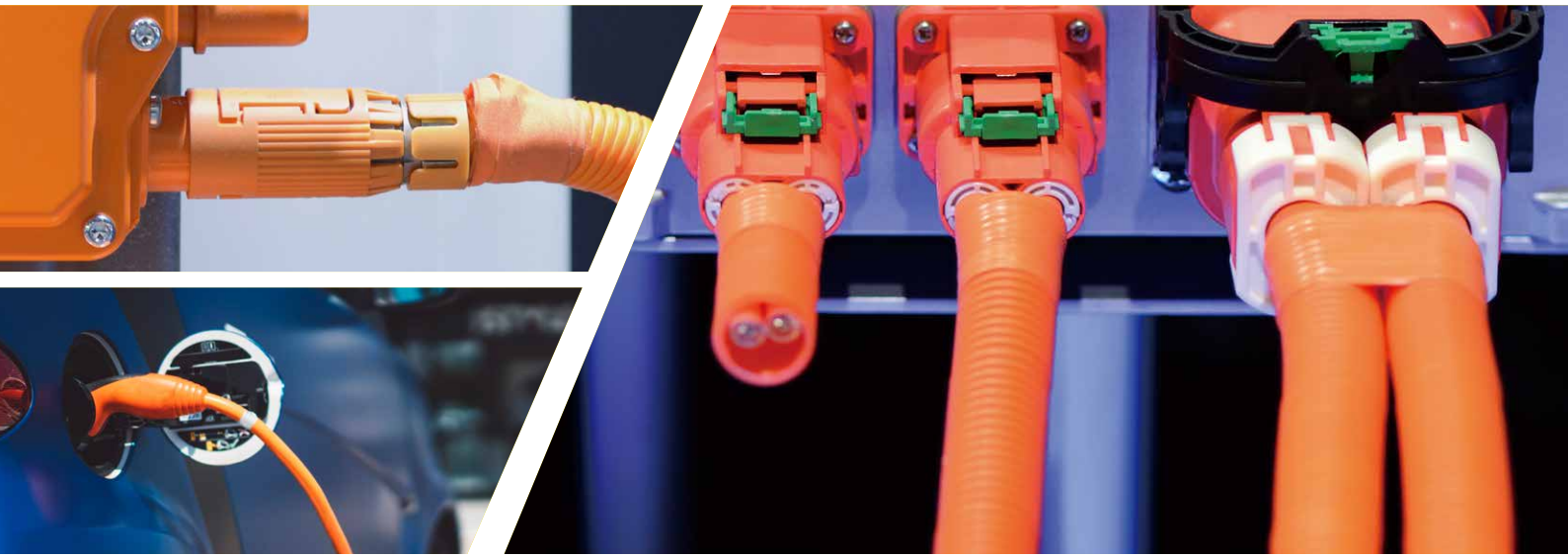
MOMENTIVE ELASTOMERS E-MOBILITY

The future of mobility is being redefined with the paradigm shift from traditional internal combustion technology to steadily growing and continually evolving electric vehicle technology.

As advancements in e-mobility are made, the intrinsic need for advanced materials is ever present and growing. Safety, reliability and performance continue to remain driving forces in the specification of polymers in e-mobility applications.

Silicone's unique properties enable Momentive's materials, such as its LSR and HCR based material technologies, to meet and exceed demanding performance requirements of electric vehicles in a wide breadth of e-mobility applications. Our breadth of experience ensures that wherever there is a need, Momentive will have the industry and technical knowledge and expertise to help our customers and industry partners succeed. Some of the material characteristics that are key to addressing and solving such complex challenges include:

- High Thermal Stability
- Low compression set without post-cure
- Self-lubricating properties
- Low viscosity
- Fast cure
- Low modulus
- Increased crack resistance
- Outstanding resistance to aging
- Easy to color
- Self-bonding
- Thermal conductivity
- Excellent electrically insulating properties
- Dielectric strength



MOMENTIVE SILOPREN LSR

E-Mobility Applications

Self-Lubricating LSR Technologies for Seals & Connectors

Momentive Silopren LSR 3000 Series of self-lubricating LSRs have a long track record of success with all major tiers and OEMs in single-wire seals, radial seals, and matseal systems or family-seals used in electrical connector applications. Grades are now available with low molecular weight content of cyclic siloxanes, compression seat and/or long term heat stability.

Silopren 3x85/xx Series:
Standard Self-Lubricating

Silopren 3x86/xx Series:
Low Compression Set

Silopren 3x96/xx Series:
Ultra Low Compression Set

Silopren 3x76/xx Series:
Low Compression Set / Low Cyclics

Silopren 3x66/xx Series:
Low, Long Term Compression Set / High Heat Stability

Product Name	UL Listing	Appearance	Density [g/cm³]	Durometer [Shore A]	Tensile Strength [MPa]	Elongation [%]	Tear Strength Die B [N/mm]	Compression Set (after 22h@ 175 °C, 25%)
Self-lubrication Standard								
Silopren LSR 3785/30	-	Whitish	1.11	30	9	730	26	25[1]
Silopren LSR 3485/35	UL94HB	Whitish	1.11	33	10	730	26	25[1]
Silopren LSR 3285/50	-	Translucent	1.13	53	10.9	530	40	25[1]
Silopren LSR 3485/50	-	Whitish	1.13	53	10.2	500	38	25[1]
Low Compression Set								
Silopren LSR 3486/20	-	Whitish	1.1	20	6.8	760	12	18
Silopren LSR 3786/20	-	Whitish	1.11	19	6.5	740	14	30
Silopren LSR 3386/30	UL94HB	Whitish	1.12	32	9.2	720	18	25
Silopren LSR 3286/40	-	Translucent	1.12	41	8	620	41	25
Silopren LSR 3386/40	-	Whitish	1.12	41	8.8	620	35	20
Silopren LSR 3186/50	-	Translucent	1.12	49	9.7	600	43	25
Silopren LSR 3286/50	UL94HB	Translucent	1.12	50	8.7	560	45	20
Silopren LSR 3486/50	-	Whitish	1.12	51	8.7	540	44	25
Silopren LSR 3286/60	UL94HB	Translucent	1.14	61	9.6	480	52	20
Silopren LSR 3286/70	UL94HB	Translucent	1.14	69	10.5	420	37	20
Ultra Low Compression Set								
Silopren LSR 3696/25	-	Whitish	1.08	24	6.5	710	12	19
Silopren LSR 3596/30	-	Whitish	1.1	30	8	700	26	15
Silopren LSR 3596/35	-	Whitish	1.11	34	8.5	700	31	15
Low Compression Set / Low Cyclics								
Silopren LSR 3376/50	-	Whitish	1.13	50	9.5	600	43	16
Low Long-term Compression Set / High Heat Stability								
Silopren LSR 3366/50	-	Whitish	1.13	52	8.6	450	40	11
Self-lubricating/Self-bonding								
Silopren LSR 2725/40	-	Whitish	1.1	40	8	600	35	20[2]

Typical properties are average data and are not to be used as or to develop specifications.

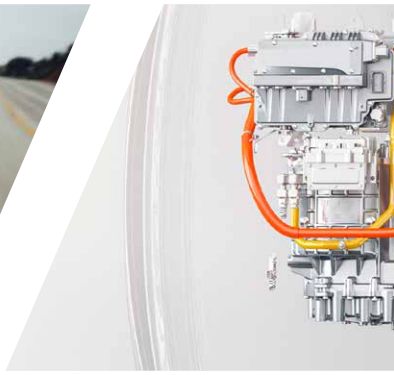
[1] Post-cured | [2] CS after 22h@150 °C

Momentive's Silopren LSR 3000 Series is the material of choice to help meet demanding e-mobility electrical connector applications.

Momentive's Silopren LSR 3000 Series is key in enabling demanding e-mobility electrical connector applications. With ever increasing expectations to vehicle reliability and service-life a more stringent focus is applied to long-term sealing force and temperature stability. Electrical connectors must submit more and more signal cables at the same time while the overall space remains constant. Therefore, single wire seals are often replaced through family- or mat seals.

These parts typically require low modulus HCR compounds to pass the demands of the contact assembly. Silopren LSR 3696/25 for example is a key performance and productivity enabler. Silopren LSR 3696/25 fulfills the typical industry specifications for these applications but is a liquid silicone rubber by nature, allowing for the advantages of the LSR injection molding process to be realized. Because of the outstanding properties, Silopren LSR 3696/25 liquid silicone rubber is excellent for use in wire harness applications for the following elastomeric articles:

- Cable seals
- Mat seals
- Grommets
- Gaskets
- Plug seals



Thermally Conductive Liquid Silicone Rubber

Momentive has developed a line of thermally conductive two-component liquid silicone rubbers for injection molding processes.

These products have been conveniently formulated for a 1:1 mixing ratio, and exhibit high thermal conductivity.

Key Features:

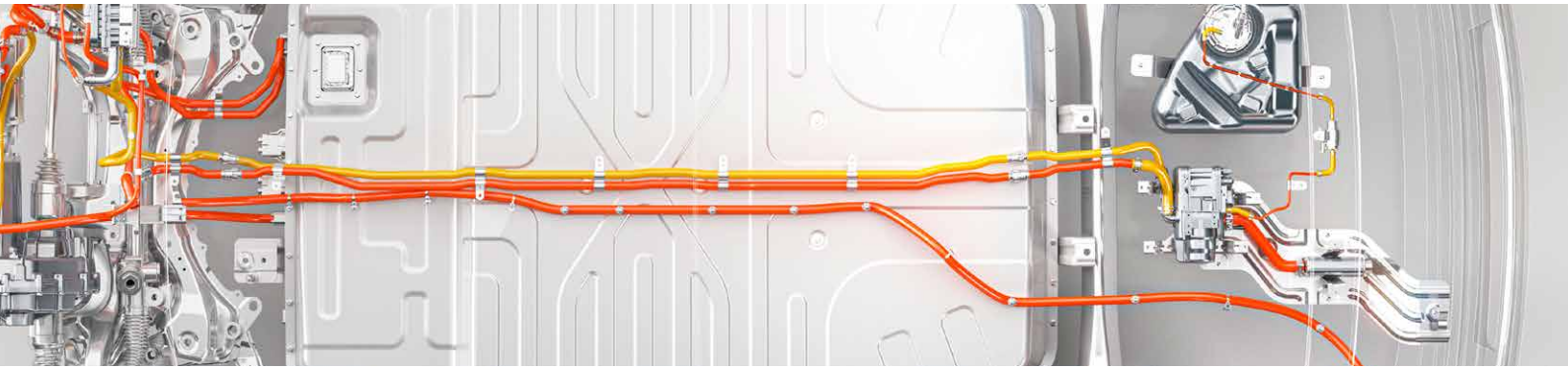
- Excellent thermal conductivity
- Good processability
- High reactivity
- High stability and flexibility at low temperatures
- Low compression set

Typical Applications:

- Heat transfer pads and gaskets
- Under hood cooling parts

Product Name	Appearance	Thermal Conductivity [W/m.k]	Density [g/cm³]	Durometer [Shore A]	Tensile Strength [MPa]	Elongation [%]	Tear Strength [N/mm]	Compression Set (after 22h@ 175 °C, 25%)
Thermally Conductive Injection Moldable LSR								
NL9330	White	1.5	2.3	33	1.6	170	4.5	10
NL9360	White	1.65	2.24	60	3	87	8	9
NL9371	White	2.6	2.85	78	1.8	20	7	-

Typical properties are average data and are not to be used as or to develop specifications.



LSR For Fuel Cell Sealing Applications

Momentive has developed a specialized LSR technology that offers particular benefits for fuel cell bipolar plate sealing applications.

This LSR technology possesses low viscosity to allow decreased injection pressure and, therefore, protection of the bipolar plate substrates during manufacturing/ molding. This material offers good bonding characteristics to both stainless steel and graphite when combined with Momentive's XP81-A6361 primer technology. The NL6140DFC technology has shown to have a significant advantage over RTV products that have been utilized in similar applications, due in large part to its cure speed, injection moldability, and greatly enhanced compression set characteristics.

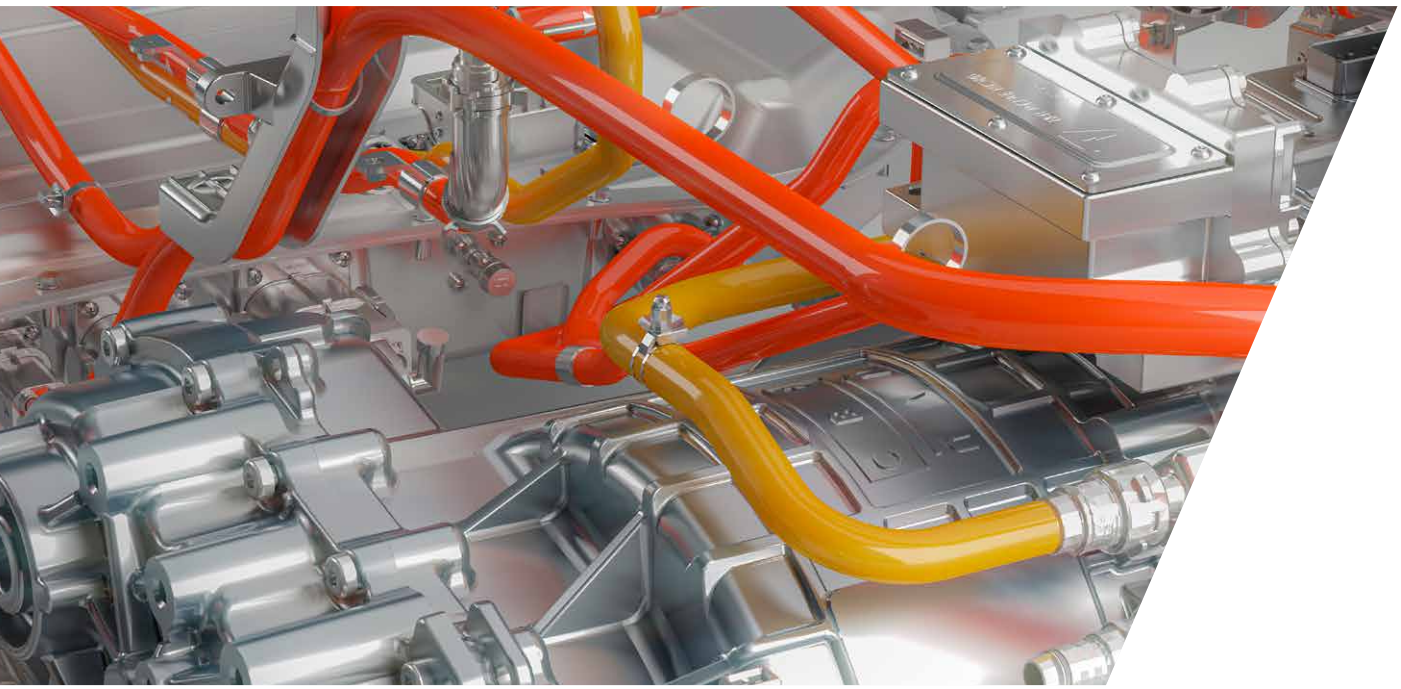
Key Features:

- Non post-cure
- Low Viscosity
- High reactivity
- Low compression set
- Long pot life at ambient temperature

Product Name	Appearance	Density [g/cm³]	Durometer [Shore A]	Tensile Strength [MPa]	Elongation [%]	Tear Strength [N/mm]	Compression Set (after 22h@ 120 °C, 25%)
General Purpose - Sealing & Gasketing							
NL6140DFC	Translucent	1.08	40	5.5	350	24	6.5

Viscosity in Pa.s gamma = $10s^{-1}$ @ 20°C DIN 53018	A- Component	B- Component
	60	70

Typical properties are average data and are not to be used as or to develop specifications.



Self-bonding technologies for E-Mobility

As applications evolve, E-Mobility design engineers now have the ability to leverage two-component hard-soft design systems, and allow the sealing features to be integrated into the engineering thermoplastic part design. This further allows for ease of assemble, and helps ensure critical seal placement and performance.

Momentive's self-bonding technologies easily accommodate two-component hard-soft design and component system integration.

Over-molding plastic and metal substrates with self-bonding Silopren LSR materials offers many benefits to critical e-mobility applications. Momentive's broad portfolio of self-bonding LSR solutions work with a variety of technical thermoplastics, including PBTs, various Polyamides, metallic substrates and many more. Additionally, adhesion to glass has been done successfully. Momentive has experts ready and eager to assist you with determining the best material combinations for your specific design challenges.

Product Name	UL Listing	Appearance	Density [g/cm³]	Durometer [Shore A]	Tensile Strength [MPa]	Elongation [%]	Tear Strength Die B [N/mm]	Compression Set (after 22h@ 150 °C, 25%)
Self-lubrication / Self-bonding								
Silopren LSR 2725/40	-	Whitish	1.11	40	8	600	35	20
Self-bonding 2 Component Sealing & Gasketing								
Silopren LSR 2730	-	Translucent	1.1	30	8	750	15	-
Silopren LSR 2740	-	Translucent	1.11	38	9.3	700	20	25
Silopren LSR 2750	-	Translucent	1.12	50	10	650	30	-

Typical properties are average data and are not to be used as or to develop specifications.

Momentive General Purpose & Low Viscosity LSR Technologies for E-Mobility

Momentive offers a wide variety of LSR technologies to cover a broad base of application needs across the e-mobility market.

The Silopren LSR 2600 Series provides a lower viscosity than the Silopren LSR 2000 Series, improved tear resistance and higher reactivity. Therefore, it provides the ability to reduce the vulcanization temperature while maintaining a equivalent crosslinking and no impact on the physical properties of the vulcanizate. Silopren LSR 2500 series provides the lowest viscosity while maintaining a long service life at dynamic stresses and outstanding resistance to aging.

Key Features and Typical Benefits of Silopren LSR 2000 & 2600 Series include:

- High thermal stability
- Excellent stability and flexibility at low temperatures
- Long service at dynamic stress
- High stability under ozone and ultraviolet light exposure
- Outstanding resistance to aging
- Excellent dielectric behavior over a wide range of temperatures
- Low combustibility; does not melt or drip
- Ease of pigmentation

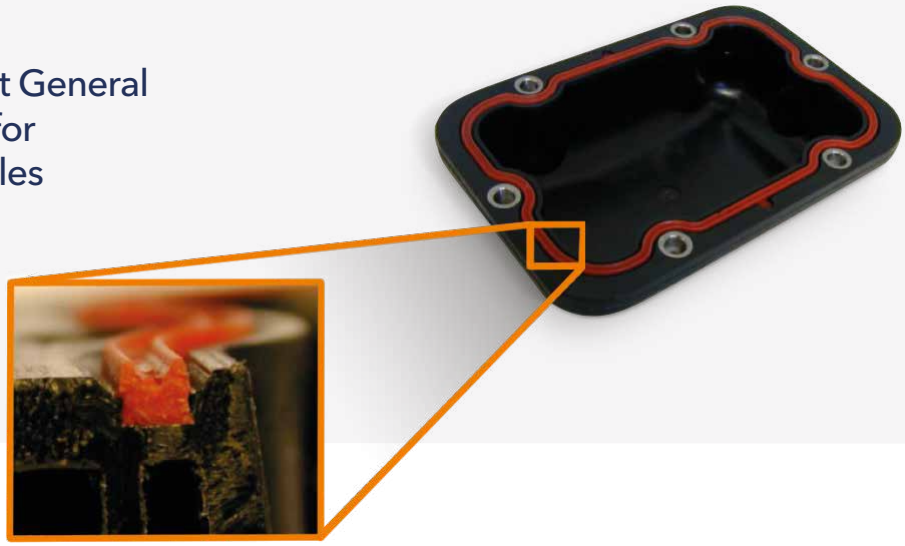
Product Name	UL Listing	Appearance	Density [g/cm³]	Durometer [Shore A]	Tensile Strength [MPa]	Elongation [%]	Tear Strength Die B [N/mm]	Compression Set (after 22h@ 175 °C, 25%)
General Purpose - Sealing & Gasketing								
Silopren LSR 2030	UL94HB	Translucent	1.11	31	8	800	18	15[1]
Silopren LSR 2040	UL94HB	Translucent	1.12	40	9	750	25	25[1]
Silopren LSR 2050	UL94HB	Translucent	1.12	51	10	600	35	25[1]
High Productivity LSRs								
Silopren LSR 2620	-	Translucent	1.08	24	5	600	20	20
Silopren LSR 2630	UL94HB	Translucent	1.10	32	8	700	35	15
Silopren LSR 2640	UL94HB	Translucent	1.12	42	8	600	40	25
Silopren LSR 2650	UL94HB	Translucent	1.12	52	10	550	50	25
Silopren LSR 2660	UL94HB	Translucent	1.13	62	9	400	45	20
Low Viscocity - Sealing & Gasketing								
Silopren LSR 2530	UL94HB	Translucent	1.05	30	4	500	10	-
Silopren LSR 2540	UL94HB	Translucent	1.08	40	7	500	25	20[1]
Silopren LSR 2560	-	Translucent	1.08	60	7	300	7	-

Typical properties are average data and are not to be used as or to develop specifications.

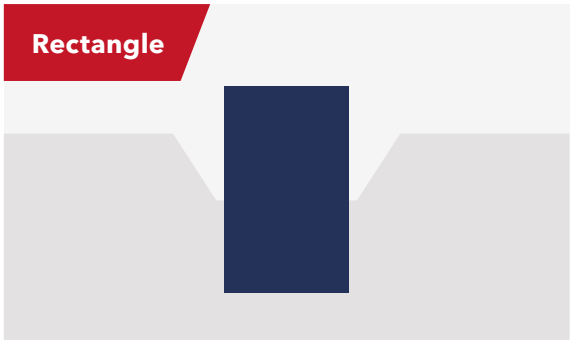
[1] Post-cured

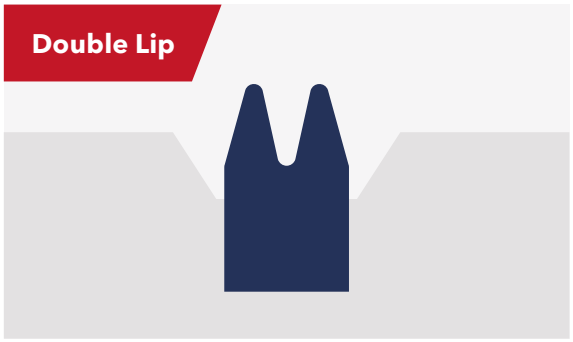
Product Name	Dielectric Strength [kV/mm]	Volume Resistivity [Ω cm]	Loss Factor tan δ	Permittivity ε	Tracking Index CTI [volts]
Silopren LSR 2030	28	10 15	$3*10^{-4}$	2,8	≥ 600
Silopren LSR 2650	28	10 15	$3*10^{-4}$	2,9	≥ 600
Silopren LSR 2540	28	10 15	$3*10^{-4}$	2,8	≥ 600

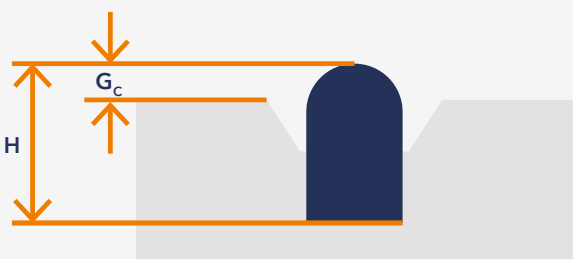
Silopren LSR Gasket General Design Guidelines for 2-Component Articles



Various Gasket Designs:







Gasket Dimensions:

Gap Cover G_C: 0,2 - 2 mm

Compression Ratio: 10 - 20, max 30%

Compression Ratio = G_C/H x 100%

Basic Principle of Gasket Design:

Expansion of LSR:
LSR has a higher thermal expansion than Engineering Plastics or Metals.

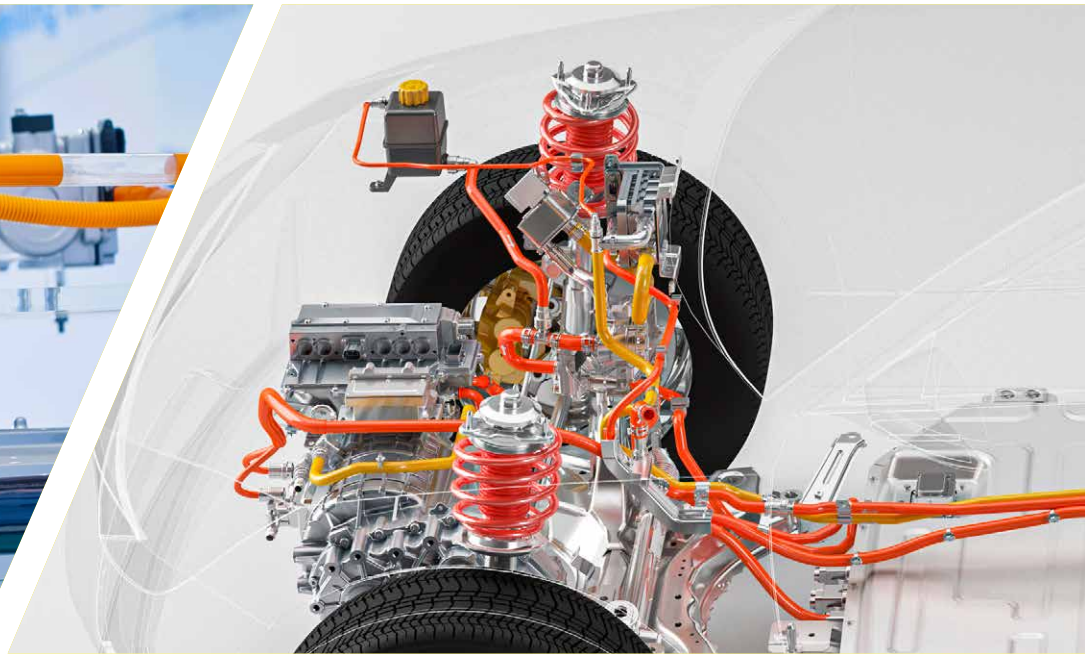
Expansion Ratio:
$a_{LSR} = 2 - 4 \times 10^{-4} K^{-1}$

Contact with some fluids can swell the LSR gasket. To accomodate this, it is recommended that the silicone gasket be allowed to expand in the grove.

Expansion volume for gasket:
~ 10 -30%
$A_b = A_a \times 1.1$ to 1.3

Example of 2-Component Gasket Design:

Critical to Quality (CTQ) Parameters
Expansion volume for deformed gasket 15-20%
Design optimized of Injection molding process.



MOMENTIVE HCR TECHNOLOGIES

E-Mobility Applications

Silplus Heat-Cured Rubber (HCR)

The Silplus family of heat-cured rubbers can be extruded using conventional rubber processing equipment, creating the potential to assist our customers in effectively meeting a range of cost, durability and mechanical performance standards as it relates to the e-mobility segment. Our Silplus portfolio for e-mobility applications includes three different families of products with a broad-range of characteristics: Silplus CW products for cable and wire applications, Silplus MP products for multiple purpose applications, and Silplus HS products for high-performance applications requiring even greater tear strength and enhanced mechanical properties.

Addisil Heat-Cured Rubber (HCR)

Addisil technology is utilized to meet stringent mechanical, electrical and thermal requirements for e-mobility wire and cable applications.

This series is based on an addition cure platinum system that is a particularly attractive solution for high value extrusion applications where compliance, mechanical performance and/or productivity are of critical importance. The Addisil Series offers a full range of extrusion products consisting of one-component or two-component systems, with hardness ranges from 40-80 Shore A - to cover the demanding needs of various e-mobility wire and cable system applications.

High voltage cable (48-1000V) as it relates to e-mobility is a particularly demanding application; silicone, which inherently possesses a high dielectric strength, excellent mechanical and insulative properties, while maintaining flexibility across a broad range of in application temperature has demonstrated a particularly high level of efficiency in these applications.

Our Addisil series offers OEMs, Tier 1's, fabricators and processors a competitive advantage based on increased performance and productivity. Addition curable HCRs generally offer increased mechanical performance when compared to peroxide curable grades and has no organic by-products. The Addisil series technology has been optimized to provide even higher tear strength and resilience for ever increasing e-mobility application demands.

In addition, Momentive's team of experts are here to help you meet your specific application requirements, and to attain maximum productivity through optimized formulations that provide the critical properties needed in order to work synergistically with your processing equipment. Momentive's custom compounding team will assist in selecting the right catalyst system technology, as well as propose custom formulations to meet the demanding needs of e-mobility applications, delivering maximum results.

Product Name	Catalyst	Appearance	Density [g/cm³]	Durometer [Shore A]	Tensile Strength [MPa]	Elongation [%]	Tear Strength Die B [N/mm]
Cable Extrusion HCR - Platinum Cured							
Addisil 2060	Platinum	Transparent	1.15	60	11	600	37
Addisil 2070	Platinum	Transparent	1.17	72	11	450	35
Cable Extrusion HCR - Peroxide Cured - Multi-Purpose							
Silplus 60 MP	Peroxide	Transparent	1.16	60	11	500	28
Silplus 70 MP	Peroxide	Transparent	1.2	70	11	420	30
Cable Extrusion HCR - Peroxide Cured - High Strength							
Silplus 60 HS	Peroxide	Transparent	1.15	60	12.5	700	40
Silplus 70 HS	Peroxide	Transparent	1.18	70	11.5	600	45
Cable Extrusion HCR - Peroxide Cured - Cale & Wire							
Silplus 60 CW	Peroxide	Transparent	1.2	63	11	500	24
Silplus 70 CW	Peroxide	Transparent	1.2	72	11	380	24

Typical properties are average data and are not to be used as or to develop specifications.

Specialty Bonding Agents

Momentive offers a variety of primer/speciality bonding agent technologies which enable striong adhesion to many metallic and plastic substrates such as steel, aluminum, glass fiber/ expoy resin and polyamides.

Product Name	Appearance	Viscosity, 10^{-1} @ 20 °C [mPa*s]	Density [g/cm³]
General Purpose - Sealing & Gasketing			
Bonding Agent 1-0	Translucent/yellowish	500	0.88
Bonding Agent 1-1	Translucent/yellowish	1.19	0.0867
XP81-A6361	Translucent/yellowish	250	2.85

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NAICS Codes: 325199, 332812
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† Momentive demonstrates its global commitment to quality and environmental, health and safety performance through multiple third party certification programs. Certifications may vary by product, country and region. For more information visit: https://www.momentive.com/operational-excellence/accreditations