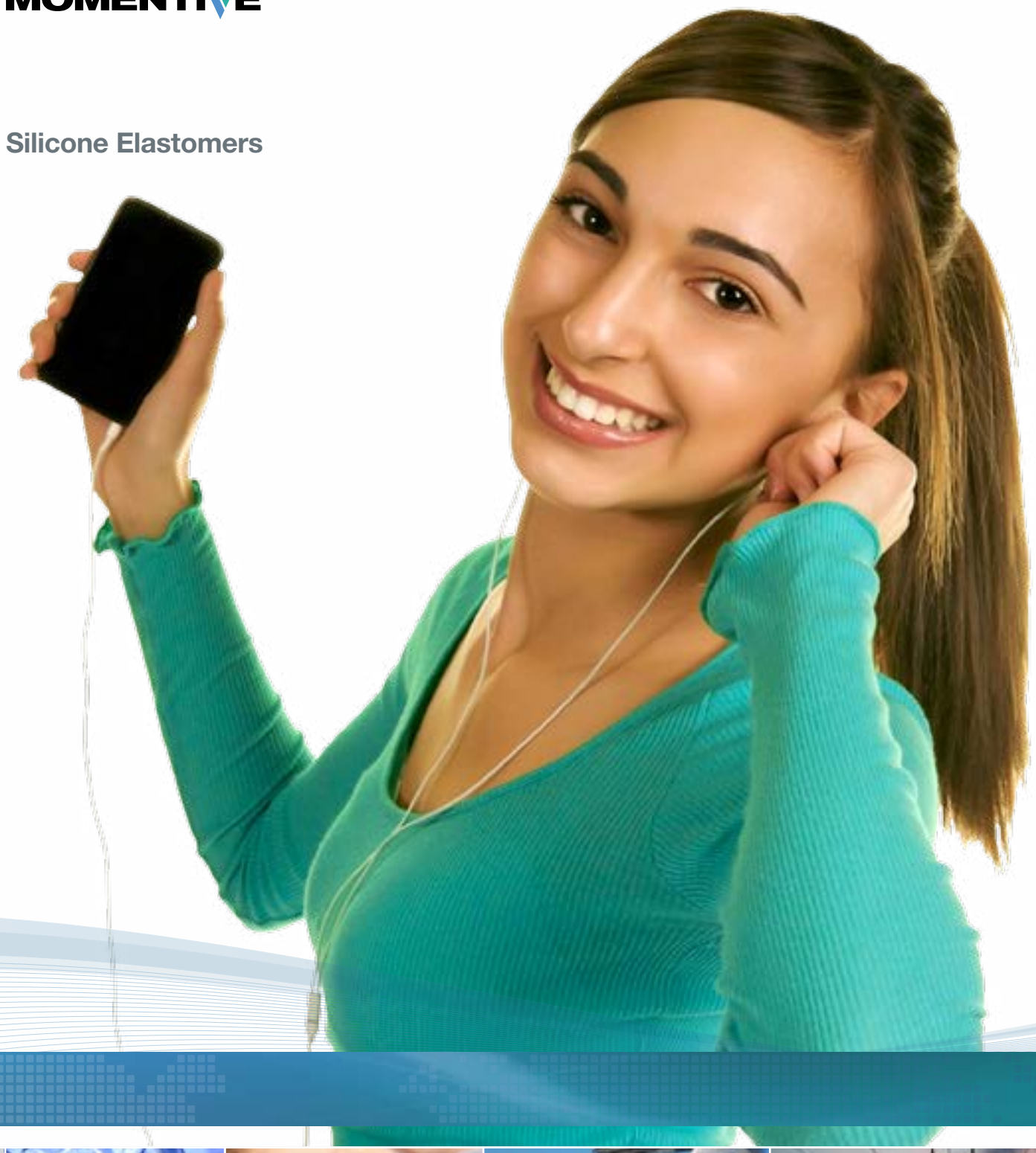
MOMENTIVE™

Silicone Elastomers



A Leader in Silicones

Momentive Performance Materials is a global leader in silicones and advanced materials, delivering the science behind the solutions across a wide range of specialty performance applications.

Our rich, blended 70-year heritage of innovation and market firsts provides product portfolios and technical competencies that link custom technology platforms to opportunities for our customers.

Momentive's silicone elastomers have been shown to provide outstanding properties to rubber products globally. Excellent heat resistance and lower impact on the environment are offered for applications in the healthcare, consumer goods, electronics and automotive industries. Electrical properties of our products have earned widespread use of silicone rubber in the energy sector. Low viscosity allows liquid silicone rubber to be pumped and used efficiently in the injection molding process.

Momentive has pioneered many of these applications and processes, and we continue to serve our customers with leading innovations and creative ideas.

We offer a portfolio of liquid silicone rubber (LSR) and high consistency rubber (HCR) products. We can also deliver ready-to-use, custom elastomers based on individual customer needs or specifications.

You're Global, We're Global

Our Silplus* HCR product line is standardized to the same high-quality properties and specifications around the world, including products for extrusion, calendering, multipurpose molding and high-strength applications. The global portfolio includes our Addisil* products and fluorosilicones.

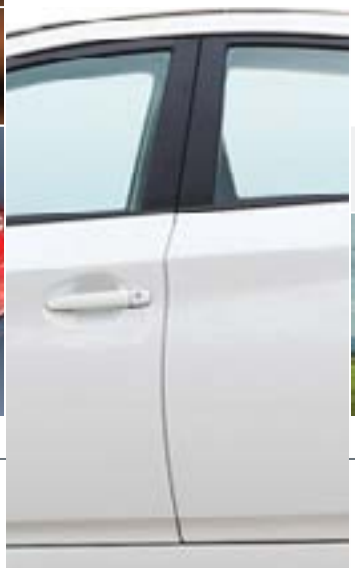
You're Local, We're Local

Momentive Custom Elastomers has facilities in North America, Latin America, Europe and Asia Pacific and local personnel to support your local needs. Give us a call about custom formulated elastomers. Our Application Development Centers are staffed to help customers develop LSR products for their application requirements.

Demand for distinctive products is growing, and our materials are at the frontline of innovation. We offer a variety of silicone rubber products and extensive technical expertise to support your needs.

*Silplus and Addisil are trademarks of Momentive Performance Materials Inc.

Industries & Applications



Automotive

Our products are used in a wide variety of automotive applications. Momentive's silicone products are easy to process and generally maintain their elastomeric properties in extreme hot and cold environments, offer excellent dielectric properties, resist weathering and offer low compression set. Momentive's silicone elastomers are excellent candidates to consider for a variety of sealing, bonding and insulating applications. Momentive also offers specialty products that can provide excellent resistance to many types of automotive fluids.

Typical applications include, but are not limited to:

- Gaskets
- O-rings
- Hoses
- Spark plug boots
- Diaphragms
- Connector seals
- Ignition cables
- Air-management system gaskets
- Exhaust hangers
- Fuel system valves
- Powertrain applications
- Oil-system seals

Aviation and Aerospace

Our products are used in a wide variety of aerospace and aviation applications. Momentive's silicone products are excellent choices to consider for a variety of sealing, bonding and insulating applications. Momentive offers specialty products that can withstand stress and temperature extremes.

Typical applications include, but are not limited to:

- Profiles
- Gasketing
- Door seals
- Masks

Consumer Goods

Our portfolio of products is used in a wide variety of consumer goods and home appliances. Momentive's silicone products can provide heat resistance, flame retardancy and moisture/ dirt protection, making them excellent choices to consider for a variety of sealing, bonding and insulating applications.

Typical applications include, but are not limited to:

- Shoe inserts
- Infant care products
- Bakeware
- Kitchen utensils
- Gasketing
- Advanced aesthetics
- Seals
- Tubes
- Emblems
- Irrigation

Materials for Consumer E/E markets

The electronics industry encompasses a broad range of devices and components that present a wide spectrum of material performance requirements. Momentive Performance Materials' expansive portfolio of silicones offers an array of potential solutions for a variety of applications, including:

- LED
- Mobile phones
- Portable electronic devices
- Home networking and entertainment equipment
- Document handling systems
- Computers, laptops and peripherals
- Displays and projectors
- Keypads
- Lighting

As the design trend of such equipment undergoes miniaturization, the ultra clear or the high thermal conductivity properties and low hardness that our elastomer can offer become increasingly crucial to the success of equipment reliability and performance.

If the right material doesn't exist already, we may be able to custom compound a solution to meet your application's precise demands.

Keypads

Silicone mobile phone keypads offer excellent feel in a wide range of hardness, superb durability and long life even in the most harsh environment.

Selfbonding (primerless) and low-temp cure elastomers offer great process flexibility for the fabrication of keypads co-molded with PC film.

Gaskets

Apart from coating application, silicone seals, o-rings and gaskets provide excellent resistance to temperature extremes and compression set while maintaining a high degree of flexibility and cohesion required in many outdoor portable electronics.

Rollers

Low-compression set, high-temperature resistance silicone elastomers offer superb material selection options for a range of document handling rollers such as Charge, Electro Conductive, Electro Static, Pressure and Feed Rollers.

Healthcare

Our broad portfolio of silicone elastomers for applications in the healthcare industry has been tested against USP Class VI and/or ISO10993 biocompatibility standards. The distinctive properties of silicone elastomers – purity, clarity, strength – coupled with ease of processability, have resulted in their use in a broad range of medical device applications. Our silicone materials exhibit exceptional stability over a wide range of temperatures, lending themselves to use in applications requiring repeated sterilization performance.

Typical applications include, but are not limited to:

- Dental / surgical devices
- Diagnostics / imaging
- Fluid and drug delivery devices
- Orthopedics / prosthetics
- Scar management
- Septa / stoppers / laboratory accessories
- Medical tubing
- Wound drains and bulbs
- Sterilization mats
- Pharmaceutical closures
- Instrument grips
- Dialysis o-rings
- Positioning devices
- Catheters
- Seals / o-rings / valves
- Respiratory / anesthesia
- Medical equipment keypads

Energy

Our broad portfolio of silicone products offers innovative solutions as possible replacements for ceramic materials, such as porcelain and glass, in the field of medium and high voltage technology. Our silicone solutions generally are lighter, require less maintenance, offer improved hydrophobicity, excellent tracking and erosion resistance, ease of processing and outstanding service life.

Typical applications include, but are not limited to:

- High voltage insulators
- Cable accessories Terminations/cable joints
- Breakers / disconnect switches
- Surge arrestors
- Wire and cable

Liquid Silicone Rubber (LSR)

Our family of LSR is a versatile class of liquid silicone rubbers. LSR is a two-component, platinum (addition/heat) curable and pumpable silicone elastomer that can be molded and cured with very fast cycle times at elevated temperatures. The molding process allows complex part geometry and exact dimensions. LSR can enable short cycle time injection and fully automatic flash-less and trim-free manufacturing.
This family of products may offer:

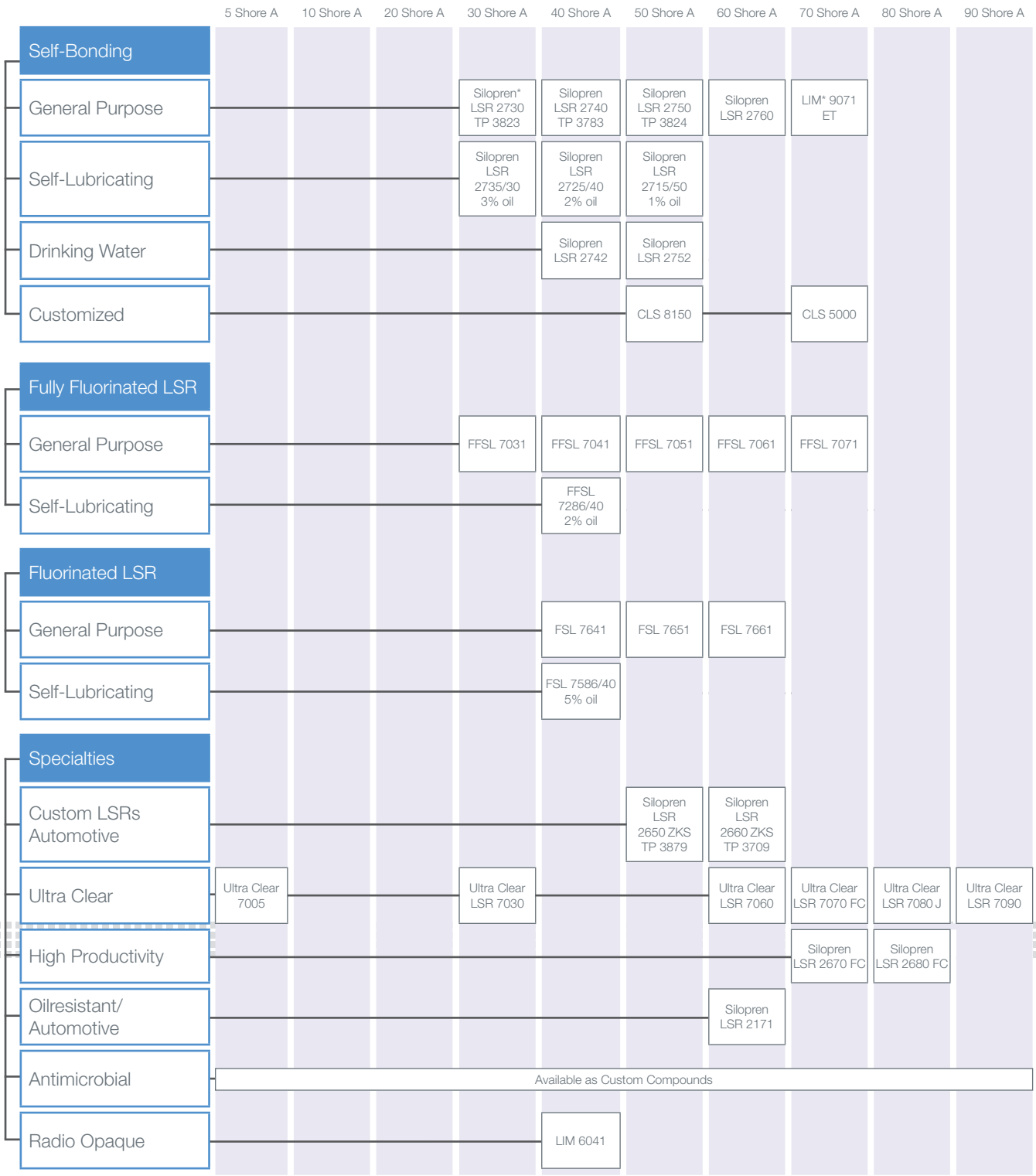
- Regulatory compliance
- Fast cycle times
- High clarity
- High tear strength
- Self-bonding options
- Broad range of durometers (3 to 80 shore A)
- Self-lubricating
- Fully fluorinated
- Electrically conductive

Liquid Silicone Rubber Grades

	5 Shore A	10 Shore A	20 Shore A	30 Shore A	40 Shore A	50 Shore A	60 Shore A	70 Shore A	80 Shore A
Standard									
General Purpose	Silopren* LSR 2000	Silopren LSR 2010 TP 3470	Silopren LSR 2020 TP 3364	Silopren LSR 2030	Silopren LSR 2040	Silopren LSR 2050	Silopren LSR 2060	Silopren LSR 2070	Silopren LSR 2080 TP 3652
Fast Cure High Tear		Silopren LSR 2610	Silopren LSR 2620	Silopren LSR 2630	Silopren LSR 2640	Silopren LSR 2650	Silopren LSR 2660	Silopren LSR 2670	
Low Volatile High Tear					Silopren LSR 2640 LV				
Non Post-cure Low Compression Set				Silopren LSR 2631 TP 3729	Silopren LSR 2641 TP 3730	Silopren LSR 2651 TP 3731	Silopren LSR 2661 TP 3732	Silopren LSR 2671 TP 3733	
Textile Coating				Silopren LSR 2530	Silopren LSR 2540		Silopren LSR 2560		
Good Flex Life					Silopren LSR 2841				
High Tear - Baby Care						Silopren LSR 2645			
Healthcare									
General Purpose			Silopren LSR 4020 TP 3364	Silopren LSR 4030	Silopren LSR 4040	Silopren LSR 4050	Silopren LSR 4060	Silopren LSR 4070	Silopren LSR 4080
		LIM* 6010		LIM 6030	LIM 6040	LIM 6050			
Fast Cure/High Tear					Silopren LSR 4640		Silopren LSR 4660	Silopren LSR 4670	
Self-Lubricating									
Standard						Silopren LSR 3285/50 2% oil			
				Silopren LSR 3785/30 7% oil		Silopren LSR 3485/50 4% oil			
				Silopren LSR 3485/35 4% oi					
Low Compression Set						Silopren LSR 3186/50 TP 3651 1% oil			
					Silopren LSR 3286/40 TP 3649 2% oil	Silopren LSR 3286/50 TP 4224 2% oil	Silopren LSR 3286/60 TP 0125 2% oil	Silopren LSR 3286/70 TP 3650 2% oil	
			Silopren LSR 3486/20 TP 3648 4% oil	Silopren LSR 3386/30 TP 3616 3% oil	Silopren LSR 3386/40 3% oil	Silopren LSR 3486/50 TP 4268 4% oil			
Ultra Low Compression Set				Silopren LSR 3696/25 6% oil	Silopren LSR 3596/35 5% oil				
				Silopren LSR 3596/30 5% oil					

*LIM is a trademark of Momentive Performance Materials Inc.
*Silopren is a trademark of Bayer AG, used under license

Liquid Silicone Rubber Grades



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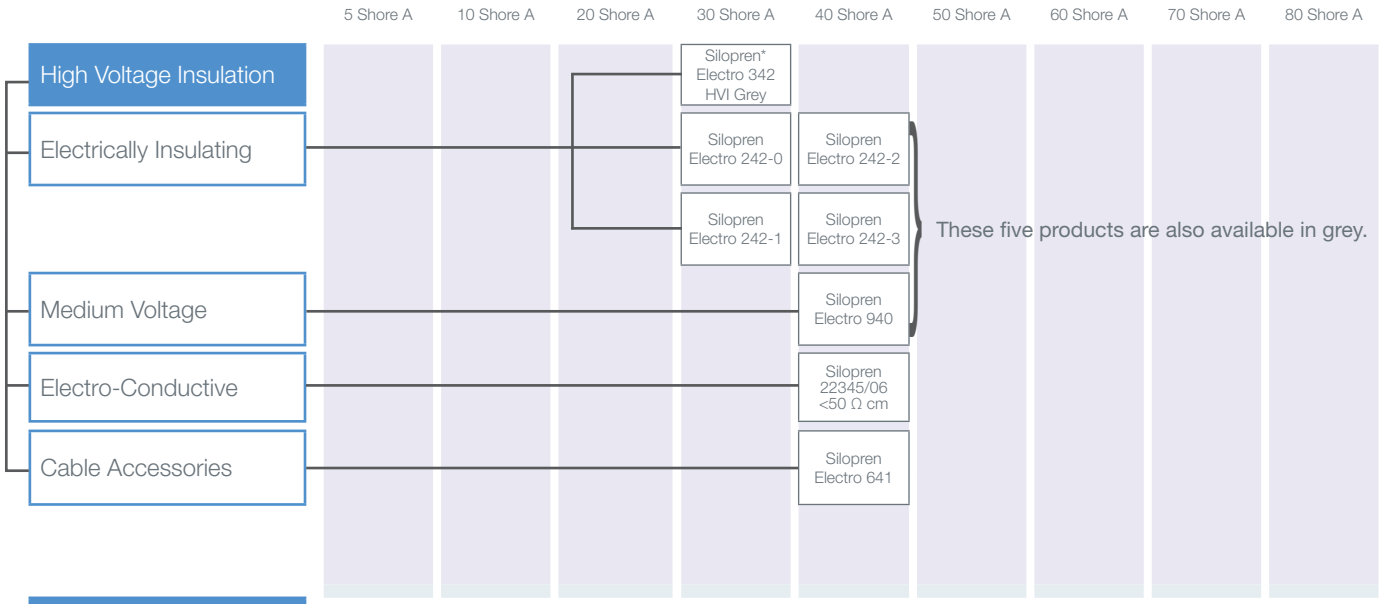
Liquid Silicone Rubber Grades



Coatings

Electro-Seal 1959	High Voltage Anti-Pollution Coating
Silopren LSR 2345/07	Conductive Coating
LSR Topcoat HE	Low Surface Friction Coating
LSR Topcoat TP 3719	Low Surface Friction Coating / USP Class VI Compliancy

Additives / Primers

General Additives	Color Paste Additive U	
	Hardness Additive	TP 3547
	Bonding Additive	TP 3662
	Reactive Additive	TP 3581
	Modulus Additive	TP 3813
	Heat Stab. Additive	TP 3605
	Inhibitor Additive	TP 3660
	Oil-Resistance Additive	LIM BG1
Primers	Bonding Agent 1-0	
	Bonding Agent 1-1	
	Bonding Agent BA 2	
	XP81 A6361	

LSR Color Pastes

Yellow RAL 1016 Pantone 604 C	Maize Yellow RAL 1007 Pantone 130 C	Orange New RAL 2004 Pantone 021 C	Vermilion RAL 2002 Pantone 179 C
Wine Red New RAL 3027 Pantone 200 C	Blue RAL 5005 Pantone 2945 C	Ultramarine Blue RAL 5002 Pantone 2738 C	Black RAL 9005 Pantone 4 C 2X
Green RAL 6010 Pantone 364 C	Light Green RAL 6032 Pantone 356 C	Reddish Brown RAL 3011 Pantone 484 C	Brown RAL 8011 Pantone 469 C
Red RAL 3020 Pantone 285 C 2X	Light Grey RAL 7040	Grey RAL 7000	White RAL 9010

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Silopren* LSR

General Purpose

Product Name	USP Class VI [a]	ISO10993 [b]	BfR [c]	FDA Indirect Food Contact [d]	European Pharmacopia [e]	UL Listing	Potable Water Standards [f]	Appearance	Density g/cm³	Hardness/Durometer Shore A	Tensile Strength MPa	Elongation %	Tear Strength, Die B N/mm	Compression Set % (post-cured)
General Purpose														
LSR 2003[6]	•	•	+	O	-	-	-	Transparent	1.05	50[6]	3	500	4	20
LSR 2010	•	•	+	•	-	-	-	Transparent	1.07	8	3	970	6	15
LSR 2020	•	•	+	•	-	-	-	Transparent	1.08	22	6	1000	15	20
LSR 2030	•	•	+	•	•	UL94HB	•	Transparent	1.10	31	8	800	18	15
LSR 2040	•	•	+	•	•	UL94HB	•	Transparent	1.12	40	9	750	25	25
LSR 2050	•	•	+	•	•	UL94HB	•	Transparent	1.12	51	10	600	35	25
LSR 2060	•	•	+	•	•	UL94HB	•	Transparent	1.13	60	10	450	30	25
LSR 2070	•	•	+	•	•	UL94HB	•	Transparent	1.14	70	9	400	20	25
LSR 2080	•	•	+	•	•	-	•	Transparent	1.13	79	7	150	5	25
Fast Cure / High Tear														
LSR 2610	-	-	+	+	-	-	-	Transparent	1.04	16	3	560	9	12
LSR 2620	-	-	+	+	-	-	-	Transparent	1.08	24	5	600	20	20
LSR 2630	•	•	+	•	-	UL94HB	•	Transparent	1.10	32	8	700	35	15
LSR 2640	•	•	+	•	-	UL94HB	•	Transparent	1.12	42	8	600	40	25
LSR 2650	•	•	+	•	-	UL94HB	•	Transparent	1.12	52	10	550	50	25
LSR 2660	•	•	+	•	-	UL94HB	•	Transparent	1.13	62	9	400	45	20
LSR 2670	•	•	+	•	-	UL94HB	•	Transparent	1.13	69	9	350	30	20
LIM* 6010	•	•	+	+	-	UL94HB	-	Transparent	1.05	15	3	440	10	-
LIM 6030	•	•	+	•	-	UL94HB	-	Transparent	1.12	35	9	675	31	-
LIM 6040	•	•	+	•	-	UL94HB	-	Transparent	1.12	42	9	600	39	-
LIM 6045	•	•	+	•	-	-	-	Transparent	1.12	44	9	650	39	-
LIM 6050	•	•	+	•	-	UL94HB	-	Transparent	1.12	53	9	530	43	-
LIM 6061	•	-	+	•	-	UL94HB	-	Transparent	1.12	60	9	400	36	-
LIM 6071	•	-	+	•	-	UL94HB	-	Transparent	1.12	70	7	330	36	-

Typical data are average data and actual values may vary.
Typical data shall not be used as product specifications.

All LSR grades are platinum cured materials which are mixed in a 1:1 ratio by weight

[a] Based upon USP Class VI testing, on a representative sample of the product, for intramuscular implantation, intracutaneous injection and systemic injection. For some products, additional testing has been conducted. Please contact the Product Regulatory Group for details.

[b] Based upon ISO 10993 part 6, 10, and 11 testing, conducted on a representative sample of the product. For some products, additional testing has been conducted. Please contact the Product Regulatory Group for details.

[c] Based on listing of ingredients in the BfR recommendation XV "Silicones".

[c1] Producer of the final article needs to test and confirm that the final product meets the extraction limits of BfR XV or corresponding EU legislation.

[d] Based on compositional compliance with the requirements of 21 CFR 177.2600 – Rubber articles intended for repeated use and have been found, through extractive testing of a representative sample, to meet the extractives limitations in 21 CFR 177.2600(e) and/or (f).

[d1] It is the responsibility of the user to determine that the final product complies with the extractive limitations and other requirements of 21 CFR 177.2600 under their specific manufacturing procedures.

[e] Based on testing conducted on a representative sample of a single lot of the product as per the test requirements of EP. 3.1.9.

[f] Based on testing conducted on a representative sample of the product, as per the requirements of KTW, WRAS and W270. Please contact the Product Regulatory Group for details.

[6] Tested using Shore 00 scale.

• = Meets the requirements for passing the test standard, - = Not tested, + = product is compositionally compliant, o = Does not meet the requirements of Rubber Articles Intended for Repeated Use, 21 CFR 177.2600.

Note: All of the aforementioned test results, are based on single lots of material. Although lot-to-lot variance would not be expected to show different test results, these data should not be construed as a warranty of fitness for use. Prior to use for any application, the user has sole responsibility for determination of the suitability and safety of any Momentive material in its end use application.

Additional information may be contained on the technical datasheet.
For custom opportunities, please contact your local Momentive sales representative.

*Silopren is a trademark of Bayer AG, used under license

Silopren* LSR

Specialties

Product Name	USP Class VI [a]	ISO10993 [b]	BfR [c]	FDA Indirect Food Contact [d]	European Pharmacopia [e]	UL Listing	Potable Water Standards	Appearance	Density g/cm³	Hardness/Durometer Shore A	Tensile Strength MPa	Elongation %	Tear Strength, Die B N/mm	Compression Set % (post-cured)
Low Volatile / High Tear														
LSR 2640 LV	-	-	+	+	-	-	-	Transparent	1.11	37	8	660	33	-
High Tear Baby Care														
LSR 2645	•	•	+	•	-	-	-	Transparent	1.14	47	11	700	42	25
Non Post Cure / Low Compression Set														
LSR 2631	-	-	-	-	-	-	-	Translucent	1.10	29	8	850	30	25[6]
LSR 2641	-	-	-	-	-	-	-	Translucent	1.11	40	9	700	35	25[6]
LSR 2651	-	-	-	-	-	-	-	Translucent	1.12	50	10	650	45	25[6]
LSR 2661	-	-	-	-	-	-	-	Translucent	1.13	60	9	500	50	25[6]
LSR 2671	-	-	-	-	-	-	-	Translucent	1.13	69	9	450	30	25[6]
High Productivity LSRs														
LSR 2670 FC†	-	-	-	-	-	UL94HB	•	Transparent	1.15	67	9	450	44	-
LSR 2680 FC	-	-	-	•	-	UL94HB	-	Transparent	1.15	76	7	200	10	-
Textile Coating														
LSR 2530	-	-	+	-	-	UL94HB	-	Translucent	1.05	30	4	500	10	-
LSR 2540	-	-	+	•	-	UL94HB	-	Translucent	1.08	40	7	500	25	20
LSR 2560	-	-	+	•	-	-	-	Translucent	1.08	60	7	300	7	-
Good Flex Life														
LSR 2841	•	-	+	•	-	UL94HB	-	Transparent	1.07	40	6	550	21	-
Spark Plug Boots Automotive														
LSR 2650 ZKS	-	-	-	-	-	-	-	Black	1.12	50	10	590	38	17
LSR 2660 ZKS	-	-	-	-	-	-	-	Black	1.13	59	8	500	35	18
Ultra Clear LSRs														
LSR 7005	-	-	-	-	-	-	-	Optically Clear	0.98	5	0.3	210	-	-
LSR 7030	-	-	-	-	-	-	-	Optically Clear	1.10	30	3.5	250	3	-
LSR 7060	-	-	-	-	-	UL94HB	-	Optically Clear	1.03	60	6.5	340	11	-
LSR 7070 FC	-	-	-	-	-	-	-	Optically Clear	1.05	70	8.5	145	7	-
LSR 7080 J	-	-	-	-	-	-	-	Optically Clear	1.06	80	10	90	7	-
LSR 7090	-	-	-	-	-	-	-	Optically Clear	1.08	90	8	50	8	-
Oil Resistant														
LSR 2171	-	-	-	-	-	-	-	Off white	1.35	68	7.4	350	25	15
Specialty Coatings														
LSR TOPCOAT HE[7]	-	-	+	+	-	-	-	Matte	Physical properties subject to the substrate used					
LSR TOPCOAT 3719[8]	•	-	+	•	-	-	-	Matte	Physical properties subject to the substrate used					

Typical data are average data and actual values may vary.
Typical data shall not be used as product specifications.

All LSR grades are platinum cured materials which are mixed in a 1:1 ratio by weight.

[a] Based upon USP Class VI testing, on a representative sample of the product, for intramuscular implantation, intracutaneous injection and systemic injection. For some products, additional testing has been conducted. Please contact the Product Regulatory Group for details.

[b] Based upon ISO 10993 part 6, 10, and 11 testing conducted on a representative sample of the product. For some products additional testing has been conducted. Please contact the Product Regulatory Group for details.

[c] Based on listing of ingredients in the BfR recommendation XV "Silicones".

[c1] Producer of the final article needs to test and confirm that the final product meets the extraction limits of BfR XV or corresponding EU legislation.

[d] Based on compositional compliance with the requirements of 21 CFR 177.2600 – Rubber articles intended for repeated use and have been found, through extractive testing of a representative sample, to meet the extractives limitations in 21 CFR 177.2600(e) and/or (f).

[d1] It is the responsibility of the user to determine that the final product complies with the extractive limitations and other requirements of 21 CFR 177.2600 under their specific manufacturing procedures.

[e] Based on testing conducted on a representative sample of a single lot of the product as per the test requirements of EP. 3.1.9

[6] Non post-cured

[7] LSR Top coat as applied to LSR 2645. Other compositionally compliant products have not been tested but are not anticipated to vary the LSR Top coat test results.

[8] LSR Top coat as applied to LIM 6040. Other compositionally compliant products have not been tested but are not anticipated to vary the LSR Top coat test results.

† = Based on testing conducted on a representative sample of an analogous product, as per the requirements of KTW, WRAS and W270. Differing results would not be expected for this product.

• = Meets the requirements for passing the test standard, - = Not tested, + = product is compositionally compliant.

Note: All of the aforementioned test results, are based on single lots of material. Although lot-to-lot variance would not be expected to show different test results, these data should not be construed as a warranty of fitness for use. Prior to use for any application, the user has sole responsibility for determination of the suitability and safety of any Momentive material in its end use application.

Additional information may be contained on the technical datasheet.

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Silopren* LSR

Healthcare

Product Name	USP Class VI [a]	ISO10993 [b]	BfR [c]	FDA Indirect Food Contact [d]	European Pharmacopia [e]	Appearance	Density g/cm³	Hardness/Durometer Shore A	Tensile Strength MPa	Elongation %	Tear Strength, Die B N/mm	Compression Set % (post-cured)
Healthcare												
LSR 4020	•	•	+	•	-	Transparent	1.08	22	7	1000	15	20
LSR 4030	•	•	+	•	•	Transparent	1.10	31	8	800	18	15
LSR 4040	•	•	+	•	•	Transparent	1.12	40	9	750	25	25
LSR 4050	•	•	+	•	•	Transparent	1.12	51	10	600	35	25
LSR 4060	•	•	+	•	•	Transparent	1.13	60	10	450	30	25
LSR 4070	•	•	+	•	•	Transparent	1.14	70	9	400	20	25
LSR 4080	•	•	+	•	•	Transparent	1.13	79	7	150	5	25
LSR 4640	•	•	+	•	-	Transparent	1.12	42	8	600	45	25
LSR 4660	•	•	+	•	-	Transparent	1.13	62	9	400	45	20
LSR 4670	•	•	+	•	-	Transparent	1.13	69	10	350	30	20
LSR 4630 FC	•	•	+	•	-	Transparent	1.10	31	9	730	20	-
LSR 4640 FC	•	•	+	•	-	Transparent	1.10	36	8	700	30	-
Self-Bonding												
LIM* 8040	•	-	-	-	-	Translucent	1.08	43	5	390	37	>50
CLS 5000	•	•	-	-	-	Translucent	1.12	67	11	460	44	-
LSR 2740	•	•	-	•	-	Translucent	1.12	40	10	700	15	25[6]
CLS 8150	•	-	-	-	-	Translucent	1.10	52	8	515	34	-
Healthcare - Radio Opaque (X-Ray Detectability)												
LIM 6041	•	-	•	•	-	White	1.19	45	7	700	32	-

Typical data are average data and actual values may vary.
Typical data shall not be used as product specifications.

All LSR grades are platinum cured materials which are mixed in a 1:1 ratio by weight

[a] Based upon USP Class VI testing, on a representative sample of the product, for intramuscular implantation, intracutaneous injection and systemic injection. For some products, additional testing has been conducted. Please contact the Product Regulatory Group for details.

[b] Based upon ISO 10993 part 6, 10, and 11 testing conducted on a representative sample of the product. For some products additional testing has been conducted. Please contact the Product Regulatory Group for details.

[c] Based on listing of ingredients in the BfR recommendation XV "Silicones".

[c1] Producer of the final article needs to test and confirm that the final product meets the extraction limits of BfR XV or corresponding EU legislation.

[d] Based on compositional compliance with the requirements of 21 CFR 177.2600 – Rubber articles intended for repeated use and have been found, through extractive testing of a representative sample, to meet the extractives limitations in 21 CFR 177.2600(e) and/or (f).

[d1] It is the responsibility of the user to determine that the final product complies with the extractive limitations and other requirements of 21 CFR 177.2600 under their specific manufacturing procedures.

[e] Based on testing conducted on a representative sample of a single lot of the product as per the test requirements of EP. 3.1.9.

[6] Post-cured at 120 °C.

• = Meets the requirements for passing the test standard, - = Not tested, + = product is compositionally compliant.

Note: All of the aforementioned test results, are based on single lots of material. Although lot-to-lot variance would not be expected to show different test results, these data should not be construed as a warranty of fitness for use. Prior to use for any application, the user has sole responsibility for determination of the suitability and safety of any Momentive material in its end use application.

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Silopren* LSR

Self-Lubricating

Product Name	UL Listing	Appearance	Density g/cm³	Hardness/Durometer Shore A	Tensile Strength MPa	Elongation %	Tear Strength, Die B N/mm	Compression Set % (non-post-cured)
Self-Lubricating / Standard								
LSR 3785/30	-	Translucent	1.11	30	8	800	35	20[6]
LSR 3485/35	UL94HB	Translucent	1.11	31	9	700	25	25[6]
LSR 3285/50	-	Translucent	1.12	52	9	500	40	25[6]
LSR 3485/50	-	Translucent	1.12	52	9	500	30	25[6]
Self-Lubricating / Low Compression Set								
LSR 3486/20	-	Translucent	1.09	22	8	1000	10	25
LSR 3786/20	-	Translucent	1.11	20	7	700	14	30
LSR 3386/30	UL94HB	Translucent	1.11	29	6	750	40	25
LSR 3486/35	-	Translucent	1.12	36	9	680	18	20
LSR 3286/40	-	Translucent	1.11	40	8	700	38	25
LSR 3386/40	-	Translucent	1.12	40	8	600	30	25
LSR 3186/50	-	Translucent	1.12	51	9	600	35	25
LSR 3286/50	UL94HB	Translucent	1.12	50	6	400	40	25
LSR 3486/50	-	Translucent	1.12	50	8	550	40	20
LSR 3286/60	UL94HB	Translucent	1.13	60	9	400	45	25
LSR 3286/70	-	Translucent	1.14	70	9	300	18	25
Self-Lubricating / Ultra Low Compression Set								
LSR 3696/25	-	Translucent	1.08	25	6.5	750	12	18
LSR 3596/30	-	Translucent	1.11	30	8	700	24	15
LSR 3596/35	-	Translucent	1.11	36	9.1	710	20	19

Typical data are average data and actual values may vary.
Typical data shall not be used as product specifications.

[6] post-cured

Note: All of the aforementioned test results, are based on single lots of material. Although lot-to-lot variance would not be expected to show different test results, these data should not be construed as a warranty of fitness for use. Prior to use for any application, the user has sole responsibility for determination of the suitability and safety of any Momentive material in its end use application.

Additional information may be contained on the technical datasheet.
For custom opportunities, please contact your local Momentive sales representative.

Silopren* LSR

Self-Bonding

Product Name	USP Class VI [a]	ISO10993 [b]	BfR [c]	FDA Indirect Food Contact [d]	European Pharmacopia [e]	UL Listing	Potable Water Standards [f]	Appearance	Density g/cm³	Hardness/Durometer Shore A	Tensile Strength MPa	Elongation %	Tear Strength, Die B N/mm	Compression Set % (post-cured)
Self-Bonding														
LSR 2730	-	-	-	-	-	-	-	Translucent	1.10	30	8	750	15	-
LSR 2740	•	•	-	•	-	-	-	Translucent	1.12	40	10	700	15	25[6]
LSR 2750	-	-	-	-	-	-	-	Translucent	1.12	50	10	650	30	-
LSR 2760	-	-	-	-	-	-	-	Translucent	1.13	60	8	400	35	-
LSR 2742	•	•	-	-	-	-	•	Translucent	1.12	40	8	550	35	-
LSR 2752	-	-	-	-	-	-	-	Translucent	1.12	52	9	450	38	-
LIM* 8040	•	-	-	-	-	-	-	Translucent	1.08	43	5	390	37	>50
LIM 9071 ET	-	-	-	-	-	-	-	Translucent	1.11	70	6	250	17	30
Self-Bonding / Self-Lubricating														
LSR 2735/30	-	-	-	-	-	-	-	Translucent	1.10	25	9	750	15	-
LSR 2725/40	-	-	-	-	-	-	-	Translucent	1.11	42	7	530	34	-
LSR 2715/50	-	-	-	-	-	-	-	Translucent	1.12	45	10	650	35	-
Self-Bonding / Customized														
CLS 5000	•	•	-	-	-	-	-	Translucent	1.12	67	11	460	44	-
CLS 8150	•	-	-	-	-	-	-	Translucent	1.10	52	8	515	34	-

Typical data are average data and actual values may vary.
Typical data shall not be used as product specifications.

All LSR grades are platinum cured materials which are mixed in a 1:1 ratio by weight

[a] Based upon USP Class VI testing, on a representative sample of the product, for intramuscular implantation, intracutaneous injection and systemic injection. For some products, additional testing has been conducted. Please contact the Product Regulatory Group for details.

[b] Based upon ISO 10993 part 6, 10, and 11 testing conducted on a representative sample of the product. For some products additional testing has been conducted. Please contact the Product Regulatory Group for details.

[c] Based on listing of ingredients in the BfR recommendation XV "Silicones".

[c1] Producer of the final article needs to test and confirm that the final product meets the extraction limits of BfR XV or corresponding EU legislation.

[d] Based on compositional compliance with the requirements of 21 CFR 177.2600 – Rubber articles intended for repeated use and have been found, through extractive testing of a representative sample, to meet the extractives limitations in 21 CFR 177.2600(e) and/or (f).

[d1] It is the responsibility of the user to determine that the final product complies with the extractive limitations and other requirements of 21 CFR 177.2600 under their specific manufacturing procedures.

[e] Based on testing conducted on a representative sample of a single lot of the product as per the test requirements of EP. 3.1.9.

[f] Based on testing conducted on a representative sample of the product, as per the requirements of KTW and W270. Please contact the Product Regulatory Group for details.

[6] Measured at 125 °C.

• = Meets the requirements for passing the test standard, - = Not tested, + = product is compositionally compliant.

Note: All of the aforementioned test results, are based on single lots of material. Although lot-to-lot variance would not be expected to show different test results, these data should not be construed as a warranty of fitness for use. Prior to use for any application, the user has sole responsibility for determination of the suitability and safety of any Momentive material in its end use application.

Additional information may be contained on the technical datasheet.
For custom opportunities, please contact your local Momentive sales representative.

*Silopren is a trademark of Bayer AG, used under license

Silopren* LSR

Fluorosilicones

Product Name	USP Class VI [a]	ISO10993 [b]	BfR [c]	FDA Indirect Food Contact [d]	European Pharmacopia [e]	Appearance	Density g/cm³	Hardness/Durometer Shore A	Tensile Strength MPa	Elongation %	Tear Strength, Die B N/mm	Compression Set % (post-cured)
Fully Fluorinated LSR												
FFSL 7031	-	-	-	-	-	Off White	1.43	32	10	410	14	19
FFSL 7041	-	-	-	-	-	Off White	1.42	42	9	260	31	22
FFSL 7051	-	-	-	-	-	Off White	1.44	52	8	230	23	17
FFSL 7061	-	-	-	-	-	Off White	1.44	58	7	180	19	19
FFSL 7071	-	-	-	-	-	Off White	1.42	67	7	210	19	18
FFSL 7286/40	-	-	-	-	-	Off White	1.43	42	8	300	20	31
Fluorinated LSR												
FSL 7641	-	-	-	-	-	Translucent	1.23	40	6	500	20	17
FSL 7651	-	-	-	-	-	Translucent	1.23	50	6	400	20	15
FSL 7661	-	-	-	-	-	Translucent	1.26	60	7	300	32	23
FSL 7586/40	-	-	-	-	-	Translucent	1.23	40	6	380	20	17

Typical data are average data and actual values may vary.
Typical data shall not be used as product specifications.

All LSR grades are platinum cured materials which are mixed in a 1:1 ratio by weight

[a] Based upon USP Class VI testing, on a representative sample of the product, for intramuscular implantation, intracutaneous injection and systemic injection. For some products, additional testing has been conducted. Please contact the Product Regulatory Group for details.

[b] Based upon ISO 10993 part 6, 10, and 11 testing conducted on a representative sample of the product. For some products additional testing has been conducted. Please contact the Product Regulatory Group for details.

[c] Based on listing of ingredients in the BfR recommendation XV "Silicones".

[c1] Producer of the final article needs to test and confirm that the final product meets the extraction limits of BfR XV or corresponding EU legislation.

[d] Based on compositional compliance with the requirements of 21 CFR 177.2600 – Rubber articles intended for repeated use and have been found, through extractive testing of a representative sample, to meet the extractives limitations in 21 CFR 177.2600(e) and/or (f).

[d1] It is the responsibility of the user to determine that the final product complies with the extractive limitations and other requirements of 21 CFR 177.2600 under their specific manufacturing procedures.

[e] Based on testing conducted on a representative sample of a single lot of the product as per the test requirements of EP. 3.1.9.

• = Meets the requirements for passing the test standard, - = Not tested, + = product is compositionally compliant.

Note: All of the aforementioned test results, are based on single lots of material. Although lot-to-lot variance would not be expected to show different test results, these data should not be construed as a warranty of fitness for use. Prior to use for any application, the user has sole responsibility for determination of the suitability and safety of any Momentive material in its end use application.

For custom opportunities, please contact your local Momentive sales representative.

Silopren* LSR

High Voltage Industry

Product Name	Platinum	Tracking Resistance kV	Mix ratio by weight	Appearance	Density g/cm³	Hardness/Durometer Shore A	Tensile Strength MPa	Elongation %	Tear Strength, Die B N/mm	Compression Set % (post-cured)	Volume Resistivity Ωcm	Surface Resistivity Ω (0,15mm)
Electrically Insulating												
Electro 242-0	✓	4.5	1 : 1	Translucent	1.07	30	4	300	20			
Electro 242-1	✓	4.5	1 : 1	Grey + Translucent	1.06	32	6	620	16			
Electro 242-2	✓	4.5	1 : 1	Grey + Translucent	1.08	36	8	720	27			
Electro 242-3	✓	4.5	1 : 1	Translucent	1.11	40	9	770	40			
Electro 342 Grey	✓	4.5	1 : 1	Grey	1.08	37	7	530	24			
Electro 641	✓	4.5	1 : 1	Translucent	1.12	43	10	720	35			
Cable Accessories Cold Shrink												
Electrically-Conductive												
LSR 2345/06	✓	-	1 : 1	Black	1.08	40	7	650	40		45	
Medium Voltage												
Electro 940	✓	3.5	1 : 1	Translucent	1.10	43	6	340	12			
Specialty Coatings												
LSR 2345/07	✓	-	1 : 1	Black	Physical properties subject to the substrate used							230
EL 1959		-	1 Comp	Customized	Physical properties subject to the substrate used							

Typical data are average data and actual values may vary.
Typical data shall not be used as product specifications.

All LSR grades are platinum cured materials which are mixed in a 1:1 ratio by weight
• = Meets the requirements for passing the test standard, - = Not tested, + = product is compositionally compliant
✓ Denotes catalyst system

Note: All of the aforementioned test results, are based on single lots of material. Although lot-to-lot variance would not be expected to show different test results, these data should not be construed as a warranty of fitness for use. Prior to use for any application, the user has sole responsibility for determination of the suitability and safety of any Momentive material in its end use application.

Additional information may be contained on the technical datasheet.
For custom opportunities, please contact your local Momentive sales representative.

*Silopren is a trademark of Bayer AG, used under license

Color Pastes

Color pastes are available to pigment addition cure products such as LSRs. The recommended quantity of color to add is 0.5% to 2%, depending on the desired depth of color. The use of Momentive's color additives should not affect the performance properties of our products. Additional information may be found on the color paste technical datasheet.

Momentive's portfolio contains:

LSR Color Pastes

maize yellow RAL approx. 1007 approx. 1.00 g/cm³ BfR IX	yellow RAL approx. 1016 approx. 1.15 g/cm³ BfR IX	vermilion RAL approx. 2002 approx. 1.02 g/cm³ BfR IX
orange new RAL approx. 2004 approx. 1.03 g/cm³ BfR IX	reddish brown RAL approx. 3011 approx. 1.14 g/cm³ BfR IX	red RAL approx. 3020 approx. 1.02 g/cm³ BfR IX
wine red RAL approx. 3027 approx. 1.05 g/cm³ BfR IX	ultramarine blue RAL approx. 5002 approx. 1.18 g/cm³ BfR IX	blue RAL approx. 5005 approx. 1.12 g/cm³ BfR IX
green RAL approx. 6010 approx. 1.16 g/cm³ BfR IX	light green RAL approx. 6032 approx. 1.12 g/cm³ BfR IX	grey RAL approx. 7000 approx. 1.11 g/cm³ BfR IX
light grey RAL approx. 7040 approx. 1.14 g/cm³ BfR IX	brown PAL approx. 8011 approx. 1.10 g/cm³ BfR IX	white RAL approx. 9010 approx. 1.18 g/cm³ BfR IX
black RAL approx. 9005 approx. 0.98 g/cm³ BfR IX		

LSR: General Overview

LSR and LIM* liquid silicone rubbers are two-component liquid silicone compounds used to produce elastic parts by chemical reaction during injection molding. Ready-for-use mixtures (components A and B) are fed directly to an injection-molding machine by means of multi-component meter-mix units.

While grade dependant, the addition cure, cross-linking silicone rubber typically vulcanizes within seconds at mold temperatures ranging from 140-230 °C. Short vulcanization times and ease of de-molding can enable automated production of a large number of articles per unit time. LSR and LIM liquid silicone rubber materials are distinguished by the following properties:

- Fast cure cycles can offer excellent productivity
- Deep and thin-section cure capability
- Low to no flash produced

Processing

LSR and LIM liquid silicone rubbers are supplied in the form of ready-to-use components (part A and part B). Equal amounts of the two components are transferred by a multi-component metering machine from the original containers to a static mixer.

Color paste can be fed into the system as an additional component. From the static mixer, the mixture passes into the injection-molding machine and is then injected into the heated mold. The mixture vulcanizes to form a cured silicone rubber, typically within a few seconds at temperatures of 140-230 °C, depending on the grade. To prevent premature vulcanization of liquid silicone rubber in the nozzle and cylinder, these are chilled with water to a temperature of about 20 °C.

Dosing

The components are conveyed to the mixing chamber by hydraulic piston pumps. These are sometimes connected by an interlocking system that ensures a 1:1 feed ratio. The proper mix ratio can be maintained even if the components differ greatly in viscosity.

Regulators that measure the pressure and volume flow of the components control the flow of the material between the metering device and mixing chamber. Vertically adjustable end switches on the cylinders of the drum press switch off the machine when drums are empty, preventing the sucking of air into the piston pumps.

Injection pressure

An injection pressure of 50 to 150 bars (specific) is normally sufficient for liquid silicone rubber. The pressure is dependent on the cross-section of the feed channel.

Injection into the mold

The un-vulcanized material is subjected to differing shear forces during processing. The shear forces are:

- Small at the pumping stage
- Moderate in the static mixer and screw
- High at the injection stage

Holding pressure

As the injected material is heated to a high temperature, it tries to swell and force its way back through the injection nozzle. To prevent this, the nozzle is held in the forward position under a holding pressure of about 50 bars until the material in the region of the gate has started to cure.

Shrinkage

In dimensioning molds, the linear shrinkage must be taken into account. The following shrinkage values were determined for 2 mm thick LSR 2050 test specimens vulcanized for 10 seconds at 200 °C.

- Without post-cure: approximately 2.7% shrinkage.
- Post-cured: approximately 3.5% shrinkage

Typically, thinner specimens shrink more than thicker specimens. The shrinkage will be highly dependent on the temperature of the mold.

Post-cure

Post-cure of the material may provide an improvement in the mechanical properties of the finished part (such as compression set). The content of volatile components may also be reduced. During post-curing, it is primarily siloxane-cycles that evaporates, leading to a slight loss of weight. It is recommended to maintain a supply of fresh air into the post-curing oven to prevent the formation of flammable air/siloxane mixtures (100-130 liters of fresh air per minute per kg silicone rubber).

Appropriate post-curing of the rubber article may vary depending upon the product and application. Unless otherwise indicated, test results noted in this brochure are generally for appropriately post-cured samples. For information on recommended processing, including post-curing, please contact your local Momentive sales representative.

*LIM is a trademark of Momentive Performance Materials Inc.

Troubleshooting for
LSR and LIM* Liquid Silicone Rubber Products

Typically, issues with LSR and LIM liquid silicone rubber injection molding can be resolved by troubleshooting three principles of molding. Time related factors are cure time, rate of injection, mold open time, residence time in the barrel, and duration of holding pressure. Temperature related factors are mold temperature; frictional heat from the screw, gate, and runners; sprue diameters; backpressure; and frictional heating during injection. Pressure related factors are high injection and/or injection hold pressure, clamp pressure, back pressure, vents, pressure drops up to the gate, and cavity pressure.

Problem	Probable Cause	Recommended Action
Blisters Air inclusion in molding (sometimes with white edges)	Incomplete curing	Extend curing time and increase temperature.
	Insufficient molding pressure	Increase pressure.
	Injection time too long	Complete air vent of pail; adjust injection velocity.
	Injection speed is too high	Reduce injection speed.
	Uneven heating	Adjust heating unit.
Voids	Incomplete curing	Extend curing time.
	Insufficient air vent	Complete air vent of pail.
Rough surface	Air bubbles	Prevent air entrapment in injection.
Uneven color	Too high temperature of metal mold	Decrease temperature of metal mold; control temperature distribution of metal mold.
	Uneven mixing	Adjust injection velocity; check mixer.
Weld marks	Fluctuation in mixing ratio and incomplete mixing	Adjust volume mixer and injection velocity.
	Improper molding pressure	Increase pressure.
	Injection time too long	Decrease injection time.
	Poor de-aeration at fused part	Provide an air vent.
	Defective gate port	Balance the gate.
Poor luster	Incomplete curing	Extend curing time; increase temperature of metal mold.
	Rough surface of metal mold	Use polished metal mold with hard chromium plating; apply adequate mold-releasing agent.
Material is sticking to the cavity	Improper curing conditions	Extend curing time; increase temperature of metal mold.
	Defective surface condition of metal mold	Clean and/or repair metal mold.
	Uneven distribution of surface temperature	Make a thermal check of the mold; check the heating controls.
	Air is present in the piston pump	Vent the pump.
	Pressure exerted by the hydraulic pressure metering unit is too low	Equalize the pressure.
	Materials are not mixed properly (the static mixer and/or the screw are partially blocked by cured material)	Clean, or possibly replace, the mixer and/or screw.
Leak from injection nozzle	Wear and incision on injection nozzle	Check injection nozzle.
Incomplete cure	Cure inhibition	Eliminate inhibitive material.
	Improper mixing ratio	Check mixing system.
Flash formation	Cavity pressure is too high	(a) Reduce injection speed and/or injection or holding pressure; or (b) Optimize the changeover from injection pressure to holding pressure.
	Locking pressure is too low	Ensure proper closing of the cavities; use a larger machine.
	Mold design is imprecise	Redesign the mold more precisely.
	Mold tolerance is too high	Modify the mold.

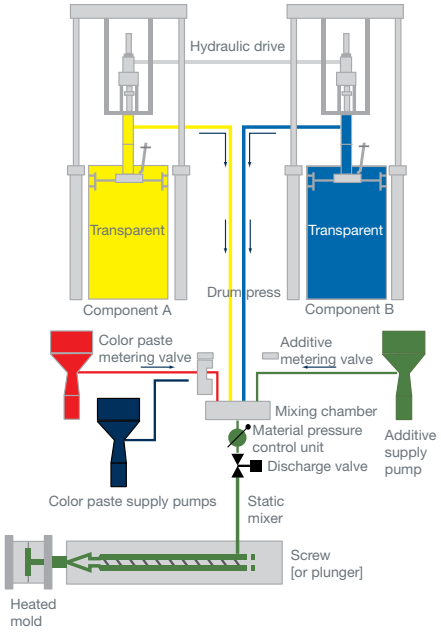
*LIM is a trademark of Momentive Performance Materials Inc.

Performance Data for LSR and LIM* Materials

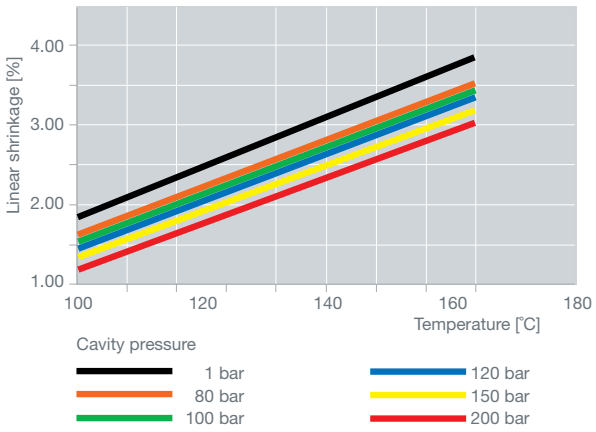
Two-shot molding:
The plastic part and silicone section are molded in the same injection-molding machine with two injection units. This method can be used when:

- Higher production lots (production should be high enough to utilize the equipment) are run
- LSR (liquid silicone rubber) injection and thermoplastic injection can be done in the same cycle
- Lower probability of rejects is needed

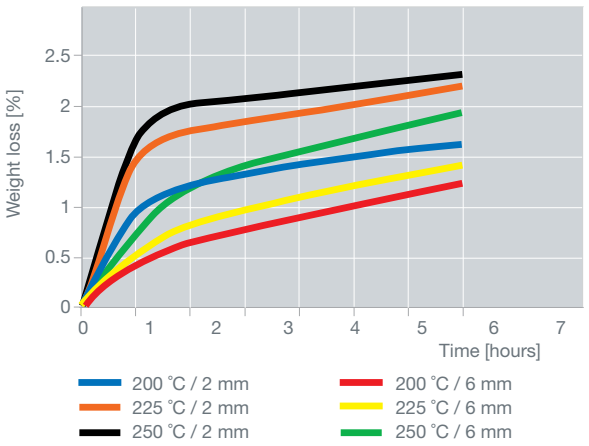
Mixing/metering devices
and injection molding machine



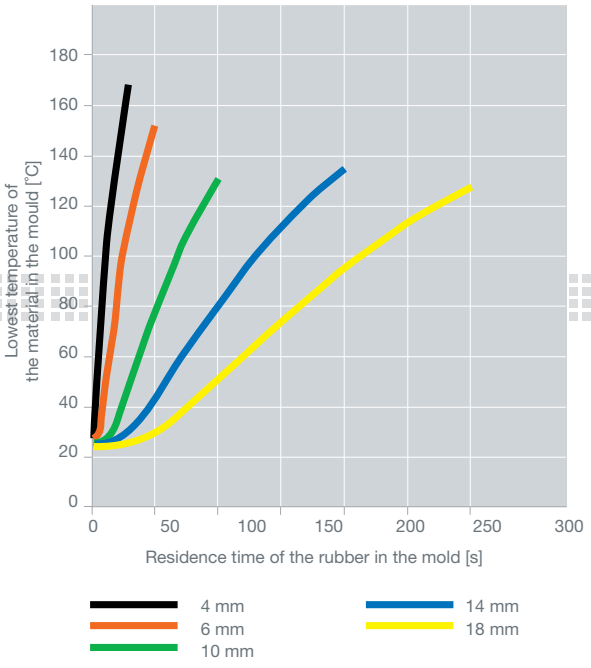
Linear Shrinkage of Silopren* LSR



Weight loss under varying post-cure conditions



Effect of the thickness of the part of residence time using Silopren LSR 2040 as an example; mold temperature 200 °C, injection temperature of the compound 25 °C



Note: Test data. Actual results may vary.

*LIM is a trademark of Momentive Performance Materials Inc.
*Silopren is a trademark of Bayer AG, used under license

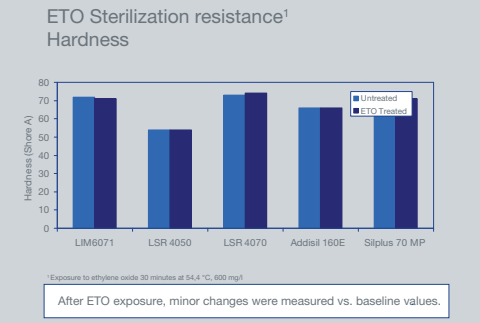
Sterilization Performance

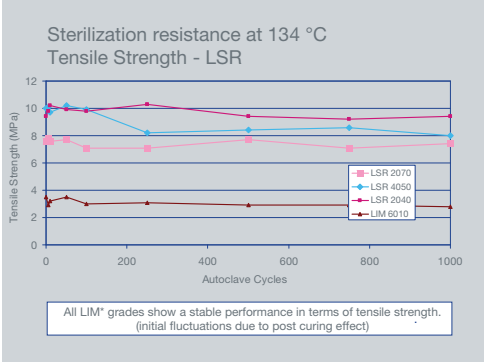
The strength of the silicone-oxygen backbone leads to high thermal stability of silicone elastomers. Due to this property, silicone elastomers are excellent candidates for products and applications requiring sterilization, whether by steam autoclave, ETO, or gamma radiation. These charts depict the performance of a sampling of our products after exposure to sterilization.

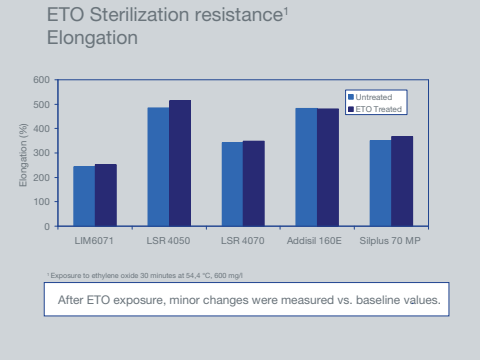
Conditions

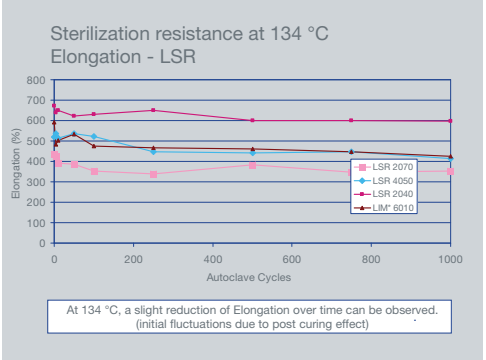
ETO concentration	600 mg/L
ETO pressure	26.6 psia
Pre-humidification time at 60% RH	30 min
Pre-vacuum	1.5 psia
Chamber Temperature	54.4 °C
Exposure Time	2h
Post vacuum	1.45 psia
Air washes	3

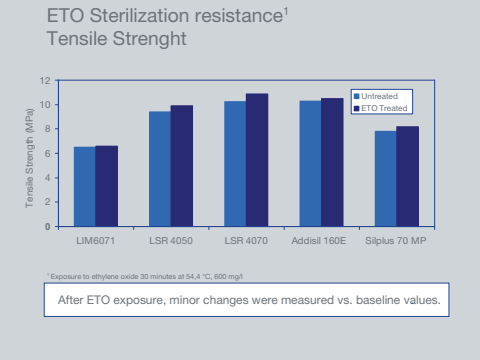
Effects of ETO Sterilization

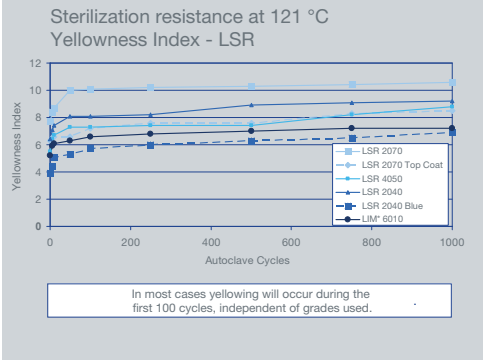


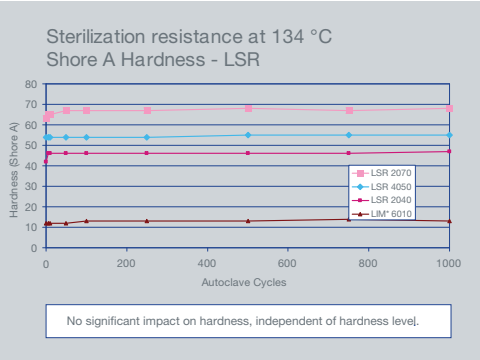


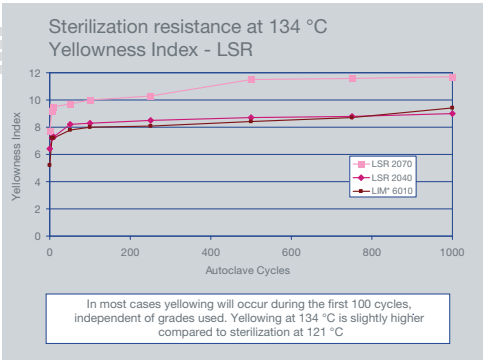




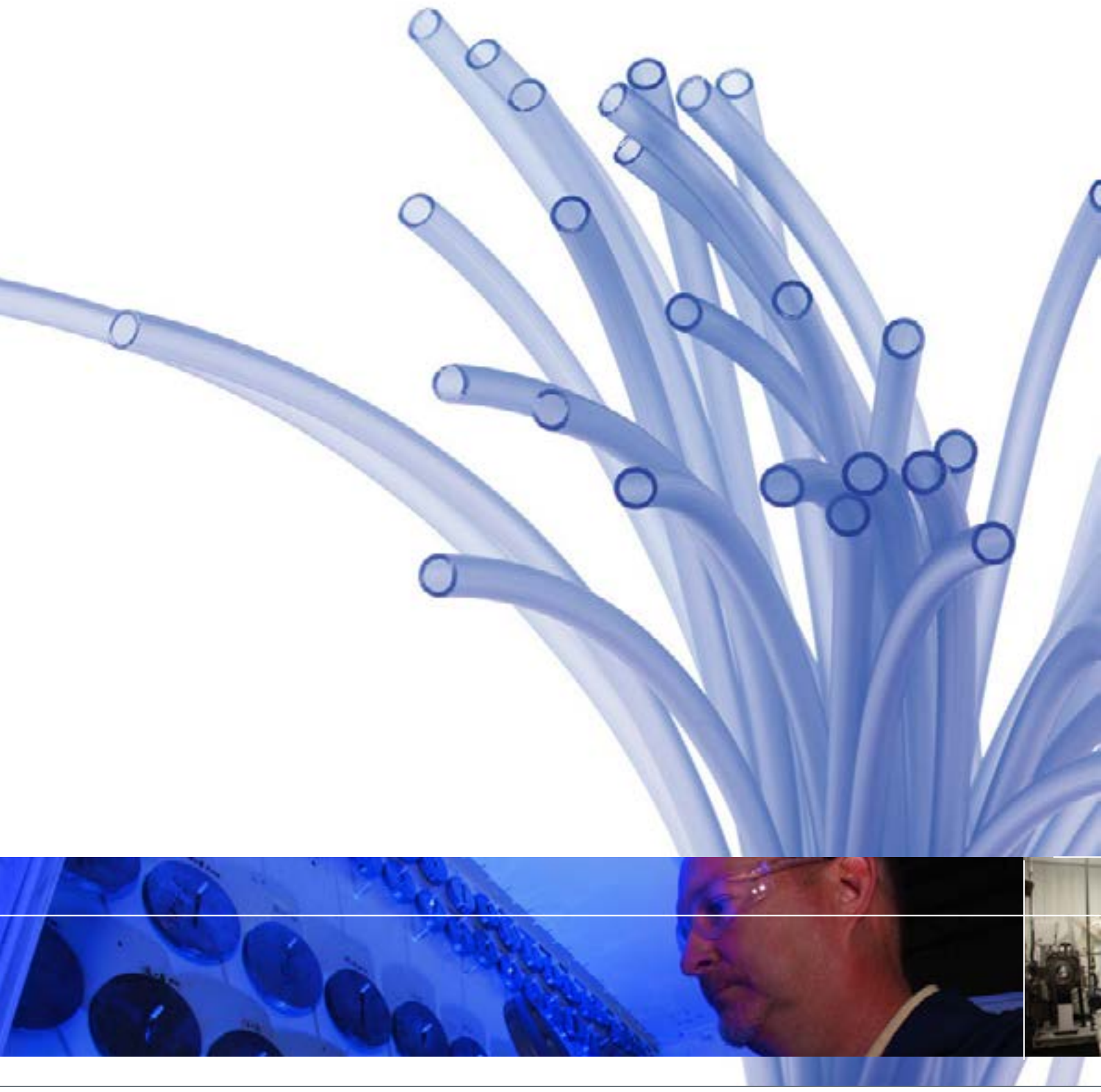




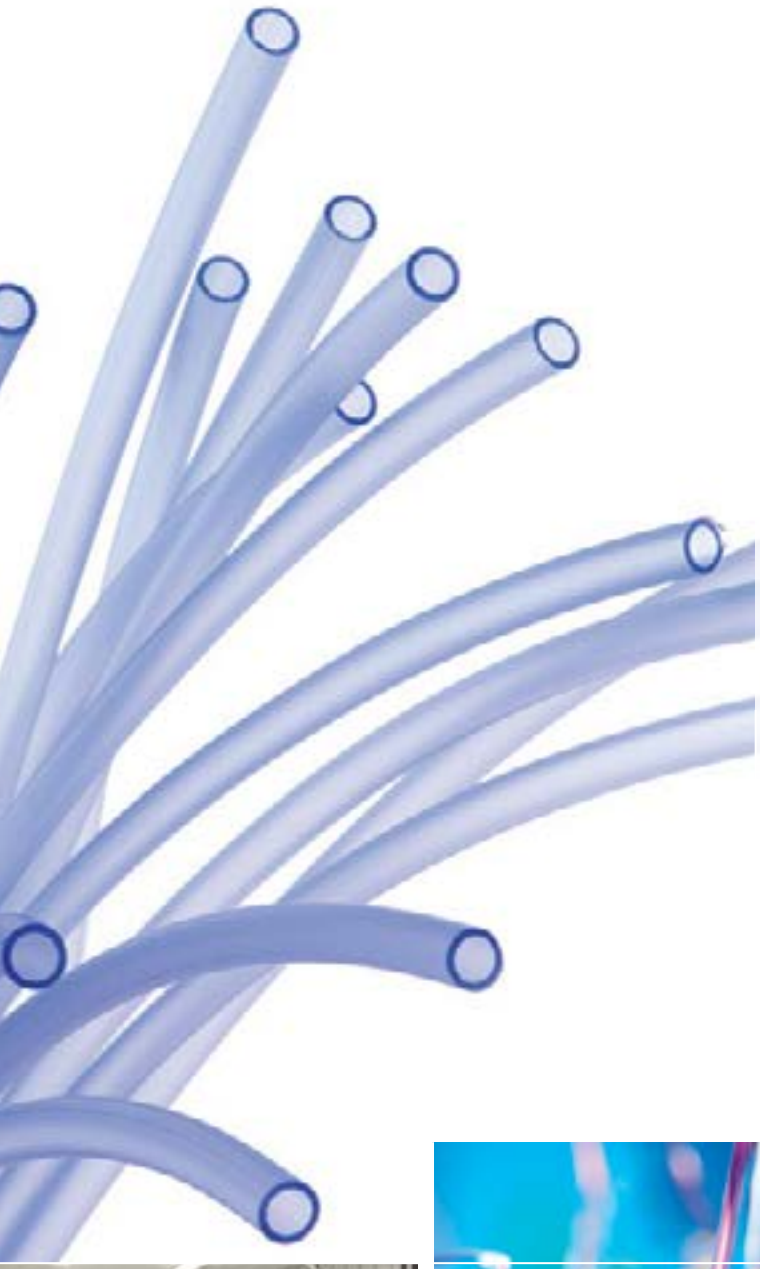




Note: Test data. Actual results may vary.



Heat Cured Rubber (HCR)



Our HCR portfolio includes both peroxide and platinum (addition/heat) curable silicone elastomers. Typical processes include extrusion, calendering and molding (injection, compression, transfer). Momentive provides base materials and ready-to-use compounds. This family of products may offer:

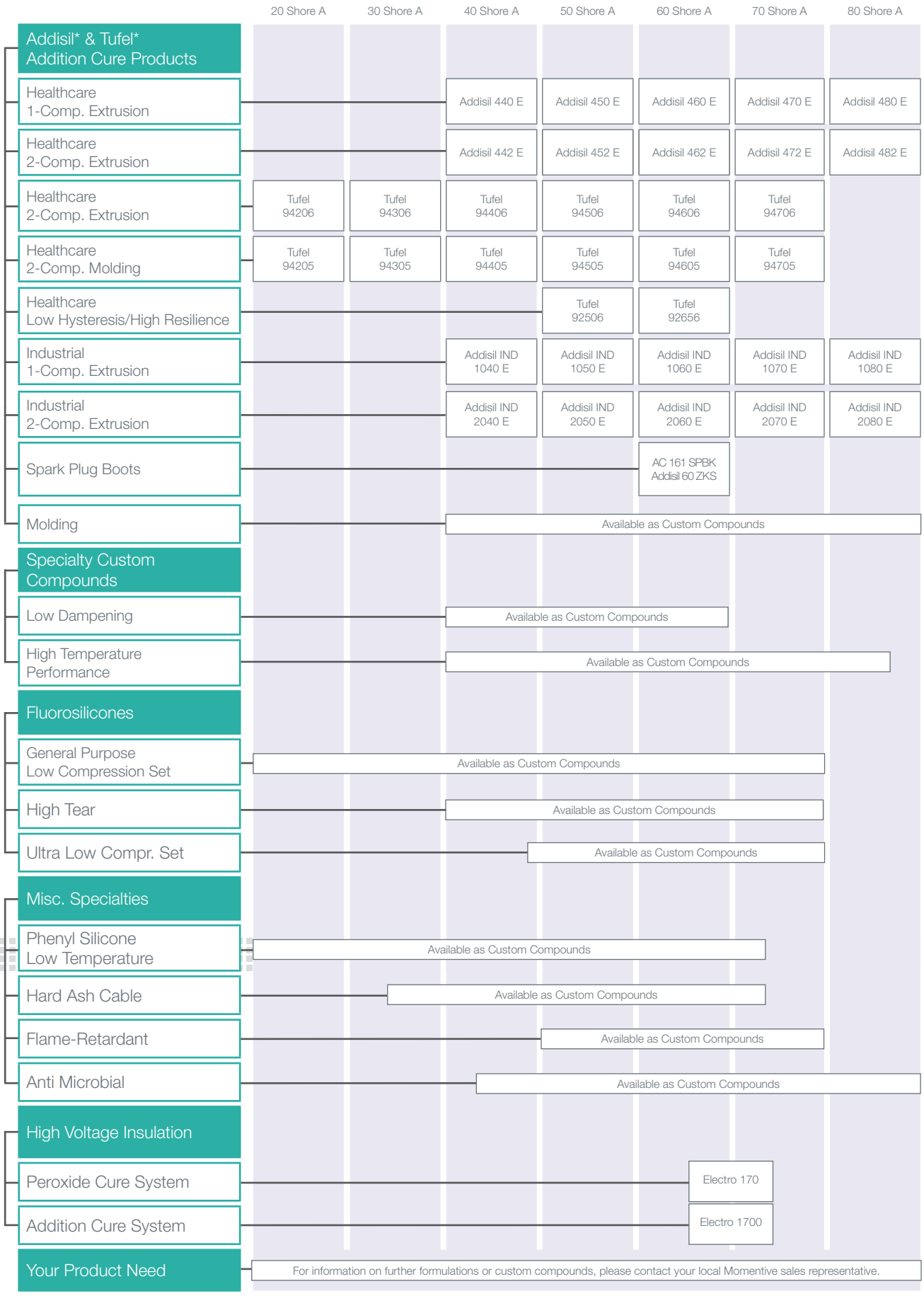
- Regulatory compliance
- Enhanced mechanical performance
- High clarity
- Low hysteresis and high resilience coupled with low compression set for highly mechanical operations
- One component, ready-to-use options
- Broad range of durometers

Customized Silicones

The material you choose should fit the application. Momentive's elastomer formulation services can help you identify a material engineered to the performance, processing, and production demands unique to your requirements. Drawing from an extensive product portfolio and technical expertise, Momentive can create specialized products in a fast and flexible manner. Examples of these services may include:

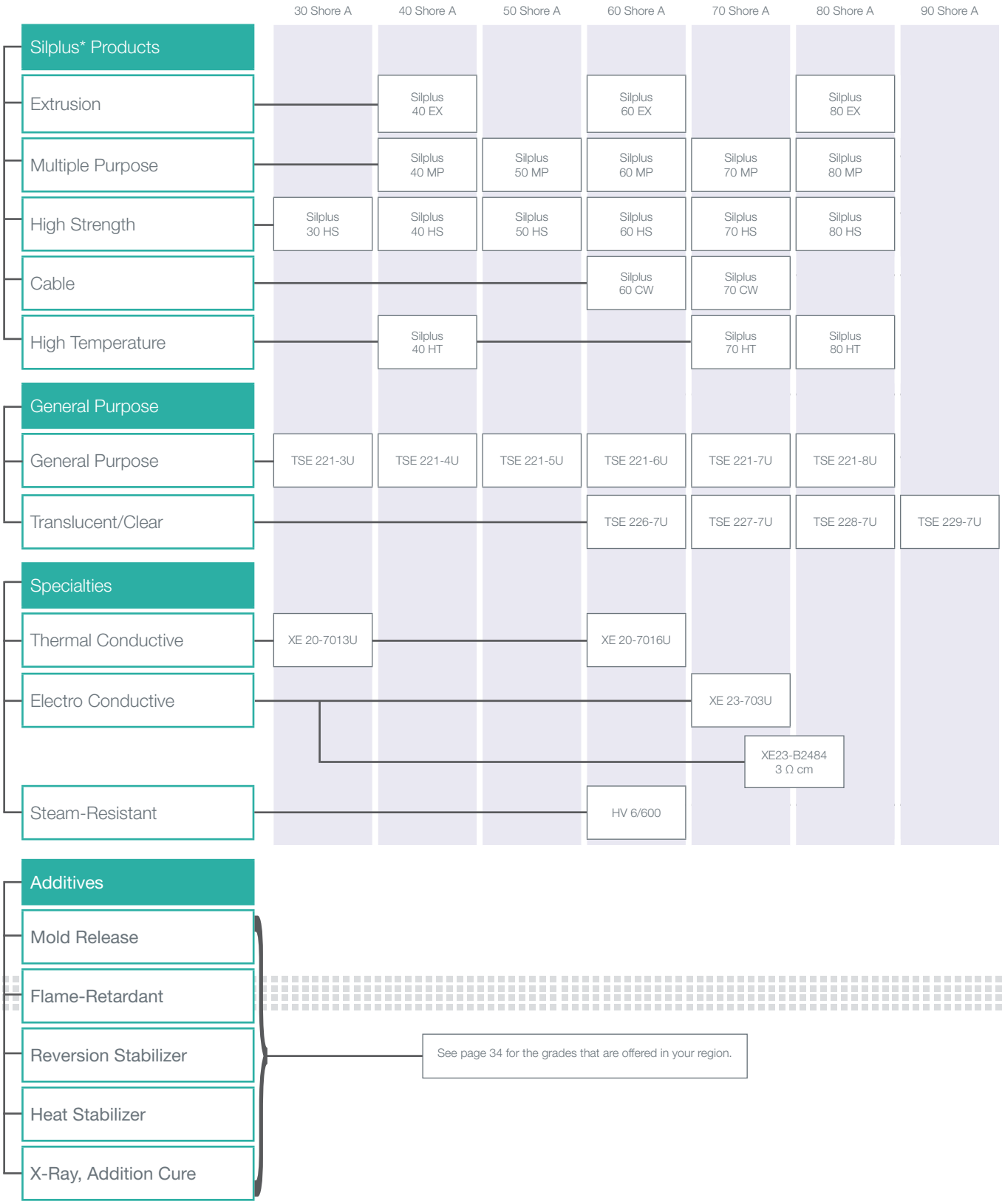
- Improved heat age performance
- V-0 and V-1 flame retardancy
- Customized cure/ rheological profiles
- Incorporation of specialty additives such as barium sulfate for radio-opacity
- Color matching
- Tailored performance attributes
- Electrically conductive or semi-conductive formulations

Heat Cured Rubber Grades



*Addisil and Tufel are trademarks of Momentive Performance Materials Inc.

Heat Cured Rubber Grades



See page 34 for the grades that are offered in your region.

*Silplus is a trademark of Momentive Performance Materials Inc.

HCR

Addition Curing Portfolio

HealthCare

Product Name	Platinum	USP Class VI [a]	ISO10993 [b]	BfR [c]	FDA Indirect Food Contact [d]	European Pharmacopeia [e]	Appearance	Density g/cm³	Hardness/Durometer Shore A	Tensile Strength Mpa	Elongation %	Tear Strength, Die B N/mm
Addisil* Healthcare Extrusion												
440 E[5]/442† E[6]	✓	-	•	+	•	-	Transparent	1.13	40	11.5	800	35
450 E[5]/452† E[6]	✓	-	•	+	•	-	Transparent	1.14	50	11.5	800	43
460 E[5]/462† E[6]	✓	-	•	+	•	•	Transparent	1.14	60	11.0	600	37
470 E[5]/472† E[6]	✓	-	•	+	•	-	Transparent	1.17	72	10.5	500	41
480 E[5]/482† E[6]	✓	-	•	+	•	-	Transparent	1.19	81	9.0	400	30
TUFEL* II Low Volatile Extrusion												
9420X [7#]	✓	•	-	+	•	-	Translucent	1.07	22	8.2	1000	22
9430X [7#]	✓	•	-	+	-	-	Translucent	1.10	28	9.3	1050	30
9440X [7#]	✓	•	-	+	-	-	Translucent	1.11	43	9.6	780	40
9450X [7#]	✓	•	-	+	-	-	Translucent	1.15	52	9.7	880	47
9460X [7#]	✓	•	-	+	-	-	Translucent	1.19	62	8.6	690	46
9470X[7#]	✓	•	-	+	-	-	Translucent	1.22	74	9.2	580	57
TUFEL III Biocompatible Extrusion – Low Hysteresis / High Resilience												
92506#	✓	•	•	-	+	-	Translucent	1.12	50	7.6	500	18
92656#	✓	•	•	-	•	-	Translucent	1.14	65	8.9	350	21

Typical data are average data and actual values may vary.
Typical data shall not be used as product specifications.

[a] Based upon USP Class VI testing, on a representative sample of the product, for intramuscular implantation, intracutaneous injection and systemic injection. For some products, additional testing has been conducted. Please contact the Product Regulatory Group for details.
[b] Based upon ISO 10993 part 6, 10, and 11 testing conducted on a representative sample of the product. For some products additional testing has been conducted. Please contact the Product Regulatory Group for details.
[c] Based on listing of ingredients in the BfR recommendation XV "Silicones".
[c1] Producer of the final article needs to test and confirm that the final product meets the extraction limits of BfR XV or corresponding EU legislation.
[d] Based on compositional compliance with the requirements of 21 CFR 177.2600 – Rubber articles intended for repeated use and have been found, through extractive testing of a representative sample, to meet the extractives limitations in 21 CFR 177.2600(e) and/or (f).
[d1] It is the responsibility of the user to determine that the final product complies with the extractive limitations and other requirements of 21 CFR 177.2600 under their specific manufacturing procedures.
[e] Based on testing conducted on a representative sample of a single lot of the product as per the test requirements of EP. 3.1.9.
[5] One part ready-to-use compound
[6] Two part ADDISIL, Mixing ratio of A:B 1:1
[7] "X" equals "5" for products optimized for molding processes; "X" equals "6" for products optimized for extrusion and calendering processes
[#] Available in the United States
[†] Based on biocompatibility testing conducted on a representative sample of an analogous product; differing results would not be expected for this product. No FDA extraction testing is available. Please contact the Product Regulatory Group for details
• = Meets the requirements for passing the test standard, - = Not tested, + = product is compositionally compliant.
✓ Denotes catalyst system.

Note: All of the aforementioned test results, are based on single lots of material. Although lot-to-lot variance would not be expected to show different test results, these data should not be construed as a warranty of fitness for use. Prior to use for any application, the user has sole responsibility for determination of the suitability and safety of any Momentive material in its end use application.

Additional information may be contained on the technical datasheet.
For custom opportunities, please contact your local Momentive sales representative.

*Addisil and Tufel are trademarks of Momentive Performance Materials Inc.

HCR

Addition Curing Portfolio

Addisil* Industrial

Product Name	Platinum	BfR [c]	FDA Indirect Food Contact [d]	KTW [e]	WRAS [f]	W270 [g]	Appearance	Density g/cm³	Hardness/Durometer Shore A	Tensile Strength MPa	Elongation %	Tear Strength, Die B N/mm
Addisil Industrial Extrusion												
1040 E[5]/2040 E[6]	✓	+	+	-	•	-	Transparent	1.13	40	11	800	35
1050 E[5]/2050 E[6]	✓	+	+	-	•	-	Transparent	1.14	50	11.5	800	43
1060 E[5]/2060 E[6]	✓	+	+	•	•	•	Transparent	1.15	60	11	600	37
1070 E[5]/2070 E[6]	✓	+	+	•	•	•	Transparent	1.17	72	10.5	500	41
1080 E[5]/2080 E[6]	✓	+	+	•	•	•	Transparent	1.19	80	8	350	30
Addisil Industrial Molding												
1140 M[7]	✓	+	•	-	-	-	Translucent	1.13	42	12	940	43
1150 M[7]	✓	+	+	-	-	-	Translucent	1.13	50	10	640	30
1160 M[7]	✓	+	+	-	-	-	Translucent	1.14	58	10.5	670	40
1170 M[7]	✓	+	+	-	-	-	Translucent	1.18	70	10.5	620	45
1180 M[7]	✓	+	•	-	-	-	Translucent	1.22	74	9.2	580	57

Typical data are average data and actual values may vary.
Typical data shall not be used as product specifications.

[c] Based on listing of ingredients in the BfR recommendation XV "Silicones".
[c1] Producer of the final article needs to test and confirm that the final product meets the extraction limits of BfR XV or corresponding EU legislation.
[d] Based on compositional compliance with the requirements of 21 CFR 177.2600 – Rubber articles intended for repeated use and have been found, through extractive testing of a representative sample, to meet the extractives limitations in 21 CFR 177.2600(e) and/or (f).
[d1] It is the responsibility of the user to determine that the final product complies with the extractive limitations and other requirements of 21 CFR 177.2600 under their specific manufacturing procedures.
[e] Based on testing conducted on a representative sample of the product for tubes, fittings, seals and storage systems (cold and warm water), as per the requirements of KTW, German Water regulation.
[f] Based on testing conducted on a representative sample of the product as per the requirements of BS 6920 (cold and hot water).
[g] Based on testing conducted on a representative sample of the product as per the requirements of the W270, Microbiological growth test.
[5] One part ready-to-use compound.
[6] Two part ADDISIL, Mixing ratio of A:B 1:1.
[7] One part ready-to use compound, all Addisil Industrial Molding grades can be offered as 2 part system.
• = Meets the requirements for passing the test standard, - = Not tested, + = product is compositionally compliant.
✓ Denotes catalyst system

Note: All of the aforementioned test results, are based on single lots of material. Although lot-to-lot variance would not be expected to show different test results, these data should not be construed as a warranty of fitness for use. Prior to use for any application, the user has sole responsibility for determination of the suitability and safety of any Momentive material in its end use application.

Additional information may be contained on the technical datasheet.
For custom opportunities, please contact your local Momentive sales representative.

HCR

General Purpose

Product Name	Peroxide	UL 94HB	Appearance	Density g/cm³	Hardness/Durometer Shore A	Tensile Strength MPa	Elongation %	Tear Strength, Die B N/mm
General Purpose								
TSE 221-3U	✓	•	Translucent	1.08	30	4.9	450	15
TSE 221-4U	✓	•	Translucent	1.13	40	8.6	520	22
TSE 221-5U	✓	•	Translucent	1.16	50	9.1	350	23
TSE 221-6U	✓	•	Light Grey	1.25	60	7.3	280	18
TSE 221-7U	✓	•	Light Grey	1.32	70	6.5	230	17
TSE 221-8U	✓	•	Light Grey	1.42	80	6.1	170	16
High Duro Translucent								
TSE 226-7U	✓	-	Translucent	1.21	60	10.3	400	29
TSE 227-7U	✓	•	Translucent	1.22	70	9.8	360	28
TSE 228-7U	✓	-	Translucent	1.24	80	7.6	190	24
TSE 229-7U	✓	-	Translucent	1.28	90	7.1	300	25

Typical data are average data and actual values may vary.
Typical data shall not be used as product specifications.

• = Meets the requirements for passing the test standard, - = Not tested,
✓ Denotes catalyst system

Note: All of the aforementioned test results, are based on single lots of material. Although lot-to-lot variance would not be expected to show different test results, these data should not be construed as a warranty of fitness for use. Prior to use for any application, the user has sole responsibility for determination of the suitability and safety of any Momentive material in its end use application.

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For custom opportunities, please contact your local Momentive sales representative

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Specialties

Product Name	Platinum	Peroxide	Appearance	Density g/cm^3	Hardness/Durometer Shore A	Tensile Strength MPa	Elongation %	Tear Strength, Die B N/mm	Tear Strength, angle N/mm	Key Features
Electro Conductive										
XE23-703U	-	✓	Black	1.20	70	6	240	-	16	Vol. Res. 3 Ohm*cm^{-1}
XE23-B2484	-	✓	Black	1.21	75	7.2	180	-	20	Vol. Res. 2 Ohm*cm^{-1}
Thermal Conductive										
XE20-A7013U	-	✓	Dark Grey	1.63	30	3	480	-	10	Thermal Conduc. 0.44 W/(m*K)
XE20-A7016U	-	✓	Dark Grey	2.15	60	4	280	-	11	Thermal Conduc. 1,01 W/ (m*K), UL 94V0
High Voltage Insulating										
Electro 170	-	✓	Grey	1.57	70	5.5	250	16	-	Excellent tracking and erosion resistance (1A 4.5KV); improved hydrophobicity
Electro 1700	✓	-	Grey	1.58	70	5.2	270	20	-	
STEAM Resistant										
HV 6/600	-	✓	Translucent	1.11	62	8	230	13	-	Increased steam resistance

Typical data are average data and actual values may vary.
Typical data shall not be used as product specifications.

✓ Denotes catalyst system

Additional information may be contained on the technical datasheet.
For custom opportunities, please contact your local Momentive sales representative.

HCR

Fluorosilicones

Fluorosilicones may be considered for applications in presence of fuel, oils, blow by gas and various solvents.

Product Name	Peroxide	Appearance	Density g/cm³	Hardness/Durometer Shore A	Tensile Strength MPa	Elongation %	Tear Strength, Die B N/mm	Compression set % (post-cured)
General Purpose								
FSE7520	✓	White	1.36	26	7.7	550	16	15
FSE7540	✓	White	1.39	44	8.3	380	13	8
FSE7560	✓	White	1.42	62	9.2	290	18	10
FSE7570-D1	✓	White	1.41	79	9.3	290	33	20
High Tear Resistance								
FSE7340	✓	Pale Yellow	1.44	43	11.2	500	42	8
FSE7360	✓	Pale Yellow	1.47	62	10.5	400	38	12
Low Compression Set								
FQE205U	✓	Pale Yellow	1.42	52	9.2	290	17	4
FQE206U	✓	Light Yellow	1.45	61	11.2	280	22	5
FQE207U	✓	Light Yellow	1.53	71	8.5	190	17	3
Low Compression Set - High Strength								
FQE307U	✓	Light Yellow	1.45	70	10.5	260	14	4

Typical data are average data and actual values may vary.
Typical data shall not be used as product specifications.

All Fluorosilicones are available as customized ready-to-use compounds.
✓ Denotes catalyst system

Additional information may be contained on the technical datasheet.
For custom opportunities, please contact your local Momentive sales representative.

HCR

Silplus* Products

Product Name	Peroxide	USP Class VI [a]	ISO10993 [b]	BfR [c]	FDA Indirect Food Contact [d]	KTW [e]	WRAS [f]	W270 [g]	Appearance	Density g/cm³	Hardness/Durometer Shore A	Tensile Strength MPa	Elongation %	Tear Strength, Die B N/mm
Silplus Multi Purpose														
40 MP	✓	•	•	+	•	-	-	-	Translucent	1.12	40	9	700	17
50 MP	✓	•	•	+	•	-	-	-	Translucent	1.15	50	11	550	25
60 MP	✓	•	•	+	•	•	•	•	Translucent	1.17	60	11	500	28
70 MP	✓	•	•	+	•	•	•	•	Translucent	1.21	70	11	420	30
80 MP	✓	•	•	+	•	-	-	-	Translucent	1.19	78	10.5	350	22
Silplus Extrusion														
40 EX	✓	•	•	+	•	-	•	-	Translucent	1.14	44	11	600	24
60 EX†	✓	•	•	+	•	•	•	•	Translucent	1.19	62	11	500	25
80 EX	✓	•	•	+	•	-	•	-	Translucent	1.24	80	10	440	28
Silplus Cable & Wire														
60 CW	✓	-	-	-	-	-	-	-	Translucent	1.20	63	11	500	24
70 CW	✓	-	-	-	-	-	-	-	Translucent	1.20	72	11	380	24
Silplus High Strength														
30 HS	✓	•	•	+	•	-	-	-	Translucent	1.10	30	9	1100	30
40 HS	✓	•	•	+	•	-	-	-	Translucent	1.12	40	11	1000	35
50 HS	✓	•	•	+	•	-	-	-	Translucent	1.13	50	12	750	40
60 HS	✓	•	•	+	•	-	-	-	Translucent	1.16	60	12.5	700	40
70 HS	✓	•	•	+	•	-	-	-	Translucent	1.18	70	11.5	600	45
80 HS	✓	•	•	+	•	-	-	-	Translucent	1.20	80	11	450	40
Silplus High Temperature														
40 HT	✓	-	-	-	-	-	-	-	Translucent	1.10	40	6.5	450	10
70 HT	✓	-	-	-	-	-	-	-	Translucent	1.23	70	10.5	400	26.5
80 HT	✓	-	-	-	-	-	-	-	Translucent	1.24	80	8	250	15

Typical data are average data and actual values may vary.
Typical data shall not be used as product specifications.

[a] Based upon USP Class VI testing, on a representative sample of the product, for intramuscular implantation, intracutaneous injection and systemic injection. For some products, additional testing has been conducted. Please contact the Product Regulatory Group for details.
[b] Based upon ISO 10993 part 6, 10, and 11 testing conducted on a representative sample of the product. For some products additional testing has been conducted. Please contact the Product Regulatory Group for details.
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[d1] It is the responsibility of the user to determine that the final product complies with the extractive limitations and other requirements of 21 CFR 177.2600 under their specific manufacturing procedures.
[e] Based on testing conducted on a representative sample of the product for fittings, seals and storage systems (cold and warm water), as per the requirements of KTW, German Water regulation.
[f] Based on testing conducted on a representative sample of the product as per the requirements of BS 6920 (cold and hot water).
[g] Based on testing conducted on a representative sample of the product as per the requirements of the W270, Microbiological growth test.
† Based on biocompatibility testing conducted on a representative sample of an analogous product; differing results would not be expected for this product.
• = Meets the requirements for passing the test standard, - = Not tested, + = product is compositionally compliant
✓ Denotes catalyst system

Note: All of the aforementioned test results, are based on single lots of material. Although lot-to-lot variance would not be expected to show different test results, these data should not be construed as a warranty of fitness for use. Prior to use for any application, the user has sole responsibility for determination of the suitability and safety of any Momentive material in its end use application.

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*Silplus is a trademark of Momentive Performance Materials Inc.

Additives for HCR

Typical Curing Agents for HCR				
Peroxides[1]	Commercial Grades	Form	Typical Molding Temperature	Recommended Use
Bis (2,4-di-chlorobenzoyl) Peroxide DCBP-50	Perkadox™[2] PD-50S-ps-a Luperox®[4] CST	50% active paste	104-132 °C (220-270 °F)	Hot Air Vulcanization
Benzoyl Peroxide BP-50	Perkadox™[2] L-50S-ps	50% active paste	116-138 °C (240-280 °F)	Molding; Steam Curing
DiCumyl Peroxide	Di-Cup®[3] 40C Varox®[5] DCP-40C	40% active powder	154-177 °C (310-360 °F)	Molding Thick Sections; Bonding; Steam Curing
2,5-DiMethyl- 2,5-Di (t-butyl peroxy) Hexane DBPH	Varox®[5] DBPH-50 Luperox®[4] 101 Trigonox®[2] 101	45%-50% active powder 92%-95% active liquid	166-182 °C (330-360 °F)	Molding Thick Sections; Bonding; Steam Curing

[1] Peroxide catalysts are not commercially available through Momentive.
[2] Trigonox is a registered trademark and Perkadox is a trademark of AKZO Nobel Chemical B.V.
[3] Di-Cup is a registered trademark of Geo Specialty Chemicals, Inc.
[4] Luperox is a registered trademark of Arkema, Inc.
[5] Varox is a registered trademark of R.T. Vanderbilt Company, Inc.

Additives for HCR				
	AMR[1]	EMEA[2]	PAC[3]	Key Features
Mold Release	-	VH 9	ME400-MR	Improves mold release
Flame Retardancy	SE6921FR	SE6921EUFR	ME400-FR	Flame retardant additive
Heat Age	SE6916HA	SE6916EUHA	ME400-HA1, ME400-HA3	Heat age stabilizer
Reversion Stabilizer	SE6910MO	RS56, RS75	ME400-HA2	Avoids decomposition of the polymer

[1] Available in the American Market
[2] Available in Europe, Africa, Middle East and India Markets
[3] Available in the Pacific Market

Silicone Rubber for High Voltage Applications (HVI)

For years now, there has been a growing tendency for these innovative materials to replace ceramic materials, such as porcelain and glass, in the field of medium and high voltage technology.

Porcelain and Glass (Ceramics) were the first materials used for high voltage insulators and have over 100 years of application history across the world. Despite this incumbent position of porcelain and glass in the market, organic polymeric materials such as EPDM and epoxy have been positioned as alternative (first in 1959 by GE) insulator materials due to higher product quality, lower maintenance cost, higher performance/properties and lower per part production cost.

As organic polymers evolved and were installed in HVI applications, it became clear that these materials showed some deficiencies in higher voltage classes. One issue in particular is polymer surface hydrophobicity. The hydrophobicity, which provides a barrier to surface electro conductivity, diminishes with time (permanently). This in turn leads to problems with the tracking resistance being limited after an electrical stress event (corona/ flashover). Improving the hydrophobic and electrical properties for non-ceramic HVI materials was a central effort for R&D centers in the late 1960s and early 1970s.

At that time, silicone insulators were first tested and introduced to end users. Continued improvement in the mechanical and electrical properties of silicone materials has led to a wider acceptance and use in the industry, beginning in the early to mid 1980s.

For insulation purposes, Momentive Performance Materials has developed special silicone rubbers that are included in the Silopren* Electro portfolio. In addition to the familiar properties of silicone rubber, these products are typically characterized by the following properties when used in the field of medium or high voltage systems.

- Outstanding hydrophobicity
- High tracking and arc resistance
- Excellent weathering, ozone and UV resistance
- Flexibility from –55 up to 180 °C with no effect on insulating properties
- No melting
- Residue consists of insulating silica
- Rubber-like aspect leaves it virtually unaffected by vandalism
- Low weight for easy transportation and installation
- With surge arrestors: No shattering in case of flashover

Compared to ceramic products, components made of Silopren Electro are lighter and require less maintenance. They do not shatter in the event of vandalism or flashover. This substantially improves safety in the vicinity of the assemblies of this kind.

*Silopren is a trademark of Bayer AG, used under license

HCR: General Overview

Fabricating & Curing: Fabrication Methods and Curing Techniques

Silicone rubber can be fabricated by all standard methods for thermoset elastomers including compression molding, transfer molding, extrusion and calendering. Compared to many organic elastomers, silicone is relatively easy to process and often needs no secondary post cure operations. It is an excellent candidate for detailed molding applications and provides rapid cure times and relatively low odor during fabrication. The following summarizes fabrication and curing techniques.

Fabrication Techniques: Compression Molding

Compression molding is a widely used method for molding silicone rubber parts. The stock is usually preformed to the approximate size and weight of the final part. It is then placed in the heated cavity of the mold, where it is cured under heat and pressure.

The process is labor intensive because it is a manual process and it is necessary to remove flash, but requires the lowest investment in tooling and equipment.

Transfer Molding

Transfer molding is a process through which uncured rubber compound is transferred from a holding vessel (transfer pot) to the mold cavities using a hydraulically operated piston. Transfer molding is especially conducive to multicavity designs and can produce nearly flashless parts.

Older designs, using hot transfer pots, resulted in considerable cured waste. Newer designs, using water-cooled transfer pots, have significantly reduced this problem. For certain applications, transfer molding is now comparably successful to injection molding.

Injection Molding

Silicone rubber's relatively low viscosity and fast cure rate make it an excellent material for injection molding. Although the screw can be directly fed with pre-formed strip, many prefer to use a stuffer box, which insures constant feed and minimizes handling of the uncured compound.

Injection molding cure cycles are typically in the range of 0.5 – 3 minutes, depending on part size, and mold shrinkage tends to be lower than other molding methods due to high injection pressures. Balanced gates and venting are required to avoid air entrapment and insure complete fill in multicavity molds.

Extrusion

Extrusion is the fabricating technique for continuous profile shapes and pre-forms such as tubing and wire and cable insulation. Standard rubber extruders with water-cooling and roller feeds can be used to fabricate silicone rubber. It is suggested that barrel construction be abrasion-resistant, surface-hardened steel, such as nitrided 4140, to minimize wear. Typically, the screw may have a compression ratio in the range of 2:1 to 4:1 and an L/D (length/diameter) ratio of 8:1 to 12:1. Deep flights in the feed section can facilitate feeding of the compound. Stainless steel screens of 40 to 150 mesh may help remove contamination, increase backpressure, reduce porosity, and provide better dimensional control. Also see Curing Methods for Extrusion below.

Calendering

Calendering is for producing long runs of uniformly thick sheets of silicone rubber, either unsupported or on a support backing. A standard 3 or 4-roll calender with linear speed range of 0.5 to 3 m/minute is typical for silicone rubber. Firm compound with good green strength and resistance to over-milling may work best for calendering. It is suggested that soft stocks be aged a minimum of 24 hours after milling to help build up structure prior to calendering. Unsupported sheet may be partially cured by passing over a heated drum or through a hot air vulcanization unit, and then may be post-cured in an air-circulating oven. Both supported and unsupported sheet may be cured on a roll in a steam autoclave.

Cure Techniques: Curing Methods For Extrusion

The extruded profile may be cured by hot air vulcanization (HAV), steam vulcanization (CV) or liquid-medium cure. HAV uses a heated tunnel, through which the profile is fed continuously on a moving conveyor. Air temperature reaches 315 °C [600 °F] to 648 °C [1200 °F], and cure times are usually short, on the order of 3 to 12 seconds. The recommended curing agents are DCBP-50 or addition cure, both of which can provide rapid cure with no porosity.

Steam cure commonly refers to systems (used by the wire and cable industry) that consist of chambers 100 to 150 mm in diameter and 30 to 50 meters in length. Steam pressure varies from 3,5 to 15 bar, depending on wall thickness of the insulation and line speed. A typical cure with benzoyl peroxide is 13 seconds or 400 feet/minute at 125 psig.

For liquid-medium cure, continuous lengths of extruded profile are fed into a bath of molten material (salt or lead), which cures the extrudate. This technique requires DCBP-50 to prevent porosity.

Oven Curing

Oven curing or post-baking is the process of heating cured silicone rubber parts in an oven to remove volatiles and peroxide decomposition by-products. This process improves dimensional stability and high temperature performance. Oven curing is recommended for parts cured with either 2,4-dichlorobenzoyl peroxide or benzoyl peroxide, as these curing agents can release an acidic by product. The byproduct should be removed by post-baking the material prior to exposure to high temperatures in the end use application.

Electric and indirectly fired gas air circulating ovens have been used successfully for post-baking silicone rubber parts. It is suggested that fresh airflow be maintained at a minimum of 100 liters per minute per kg of silicone rubber. Consider supporting parts on open trays to maximize exposure. Generally, it is suggested that post-bake temperature be a minimum of 10 °C [50 °F] higher than the service temperature of the part. Sections thicker than 2mm may require a stepped post-bake (gradually increasing temperatures) to avoid sponging of the part.

Troubleshooting for HCR

Molding

Problem	Probable Cause	Recommended Action
Back Rind	Flash-type molds resulting from a combination of high shrinkage, high thermal expansion and compressibility of silicone	Lower mold temperature.
		Bump press as charge heats.
		Use accurately weighed preform.
		Reduce mold pressure.
		Cool mold before opening.
Brown Spots	Entrapped air	Add masking color.
		Make sure stock is freshened properly for reasonable flow.
		Use weighed pre-form, shaped and loaded to most effectively sweep out air.
		Close mold completely, and then bump several times.
		Avoid excess release agent.
		Use an even mold temperature.
		Lower temperature if charge is heavy.
		Raise mold temperature if charge is light.
		Venting of mold may be necessary.
Gassing and Decomposition	Contamination	Check for contamination. See Brown Spots above.
Flow Marks	Some hindrance to plastic flow. This is more likely to appear on light-gauge, deep draw or highly complicated moldings.	Stock should be well freshened.
		Fast loading and closing of the mold is essential to prevent premature curing.
		Reduce the molding temperature.
		Conditions may be such that elimination of flow lines may not be possible unless process or stock is modified.
Shrinkage Variation	Variations of more than +1% can result from improper molding procedures	Check plasticity of stock.
		Check mold temperature.
		Check preform weight.
		Check molding time.
		Increase shelf age.
		Use low shrink gum base.
White Spots		Raise mold temperature.
		Increase oven temperature, time and air circulation.
		Raise mold temperature.
		Shorten storage time.
“Windows” (clear spots in a pigmented stock)		Make sure freshening is not started on tight mill rolls.
		Make sure crumbs from the mill pan are not added after the stock has been broken down.

Troubleshooting for HCR

Milling and Freshening

Problem	Probable Cause	Recommended Action
Lumps	Improper freshening technique	Gradually reduce mill nip during freshening.
		Lengthen milling time at original wide nip setting.
		Avoid addition of un-freshened crumbs to freshened stock.
Stickiness	Over-freshening	Shorten milling time after stock has knit on mill.
Porosity	Entrapped air due to over-freshening	Shorten milling time after stock has knit on mill.
		Pass stock through wide nip to gently squeeze out entrapped air.
Brown Spots	Entrapped air	Shorten milling time after stock has knit on mill.
		Pass stock through wide nip to gently squeeze out entrapped air.
Flow Lines	Under-freshening	Extend milling of stock after mill.
Specks in Compound	Contamination from handling and/or milling	Keep compound in closed container when in storage, both before and after freshening.
		Clean all traces of organic rubber fillers, etc., from mill pan, roll guides, etc.

Troubleshooting for HCR

Extrusion for Wire and Cable

Problem	Probable Cause	Recommended Action
Rough Surface	Structured compound	Freshen compound.
	Scorched compound	Check cooling water screw speed, catalyst type, etc.
	Die land too long	Maintain 1:1 land to orifice ratio.
	Surface imperfections	Polish die surface.
Wavy insulation Fluctuating Diameter	Die orifice too small or too large	Orifice should approximate desired wire diameter.
	Die land too short	Maintain 1:1 land to orifice ratio.
		Install diameter control device.
Blisters	Moisture on conductor	Preheat conductor (125-150 ºC).
	Oil or other contaminant on conductor	Clean, dry and preheat conductor.
	HAV temperature too high	Reduce HAV temperature or increase extrusion speed.
	Entrapped air	Increase pressure in extruder (screens, die design).
		Apply vacuum to extruder.
	Humid atmosphere	Minimize moisture condensation as much as possible.
Poor Cure	HAV temperature too low	Increase HAV temperature or reduce extrusion speed.
	Catalyst level too low	Run Mooney scorch test. Compare with O.C. limits. Adjust as necessary.
	Contamination on conductor or in compound	Clean, dry and pre-heat conductor.
	Too much air circulation in HAV tunnel	Reduce air circulation.
Porosity	Wrong catalyst	Replace material.
	Entrapped air or moisture	Add more or finer mesh screens.
		Preheat conductor.
Brittle Insulation	HAV temperature too high	Reduce HAV temperature.
	Excessive dwell time in HAV	Increase production speeds.
Mis-feeding	Poor design of extruder throat	Redesign throat.
	Poor screw design	Try single-flight screw.
	Wrong preform size	Adjust preform size.
	Soft and sticky compound	Dust lightly with talc.
	Operator carelessness	
Inadequate Delivery	Misfeeding	See above.
	Poor screw design	Increase compression ratio or use deeper flight screw.
	Blocked screen packs; Compound scorching.	Change screen packs.
		Reduce backpressure and frictional heat build-up. Change to high temperature catalyst for CV cures.
	Inadequate gum space	Increase clearance between tip and die.
Adhesion to Conductor	Organic lubricant on strand	Clean conductor prior to use.
	High lead content in lead/tin alloy	Reduce lead content or use separator.
	Too high post cure	Adjust post cure temperature to conform to conductor plating.
		Bare Copper-125 ºC
		Tin Copper-150 ºC
		Silver Plate-200 ºC
		Stainless Steel or Nickel Clad-232 ºC
	Soft insulation buried into strand interstices	Reduce extrusion and curing pressure, or use separator.

Momentive Custom Elastomers:

Custom elastomers for demanding applications.

A leader in custom silicones

Our rich, 70-year heritage of innovation and market firsts provides product portfolios and technical competencies that link custom technology platforms to opportunities for our customers.

Our unique portfolio of high consistency Silopren*, Addisil*, Silplus* and liquid silicone rubbers is the starting point for new and creative ideas across hundreds of commercial and consumer applications such as automotive, healthcare, consumer goods and more. The demand for distinctive products is growing, and our materials and enabling technologies are at the frontline of innovation.

Your application: unique & demanding

Your schedule: short & inflexible

The material you choose should be engineered to fit the application, not the other way around. Our custom silicone formulations can help you design a material that meets the performance, processing and production demands of your product.

Your application determines our approach to suggesting a formulation that can help meet your unique challenges.

Whether your priority is performance, manufacturability, testing, packaging, or shipping; whether your industry is healthcare, automotive, consumer goods, electrical/electronics, or aerospace, Momentive Custom Elastomers can often offer a fast, productive and simple solution.

Application development

Momentive is a leading innovator. We understand application development. Our customers can build upon our world-renowned resources and expertise through the ancillary Momentive Customer Application Development Center, which offers tools such as:

- Injection molding machines for prototyping and short runs
- Tabletop pumping units
- Silplus, Silopren, Addisil elastomers
- LSR molds
- Custom mixers
- Compression/stress relaxation

Your Custom Solution: Within Days

Within 24 hours of your request, you can typically expect a response from a professional Momentive technical staff member.

Momentive Custom Elastomers offers a proprietary portfolio of high-performance materials developed to meet your needs quickly.

Global Custom Facilities:

- Garrett, Ind., U.S.
- Chino, Calif., U.S.
- Itatiba, Brazil
- Lostock, England
- Shanghai, China
- Chennai, India

Testing in well-equipped facilities

After collecting a detailed work order, Momentive's technical staff can quickly help you identify optimal base compounds facilitate formulation of a potential custom solution, conduct trial runs and review whether the material meets critical performance attributes, such as durometer, viscosity, tear strength and density.

Other considerations include biocompatibility, conformance to regulation, electrical properties, heat aging, modulus, tackiness and elongation.

Our manufacturing operations are in compliance with ISO9001. We produce materials that comply with ASTM, AMS, MIL, UL, USP Class VI, ISO10993, Eur. Pharmacopeia 3.1.9, NSF and A-A59588, BS6853, NF F 16-101, BfR, KTW, W270, WRAS BS 6920, DIN 4102 Part 12, NFC 32070, BS 6387 requirements.

Packaging and Shipping

We work with you to deliver a compound that fits your fabrication equipment. To minimize handling at your fabrication operation, Momentive Custom Elastomers can be shaped into dozens of standard dimensions. Options include preformed pellets with tolerances of 0.2 grams, logs with diameters to 8-in, pig, wigwag, coil strip, or sheet.

Our packaging and labeling options are diverse and designed to help minimize handling and waste at your facility. From syringes to special boxes, we are committed to working with you to identify a material solution that helps meet your performance needs and helps satisfy your packaging requirements.

For Custom Coumpounding solutions, please refer to Brochure 153-042-00.

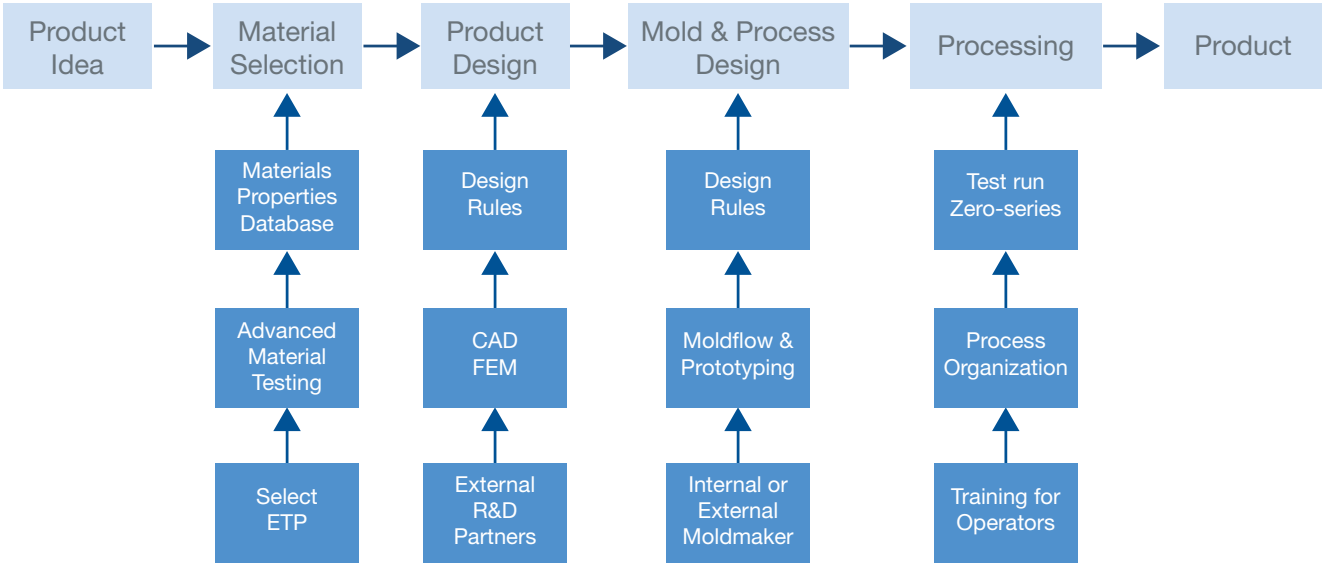
*Addisil and Silpus are trademarks of Momentive Performance Materials Inc.
*Silopren is a trademark of Bayer AG, used under license

Application Development Center (ADC)

Our ADC provides state-of-the-art technical and managerial support. This center works in a worldwide network furnishing Momentive Performance Materials customers with the best equipment, tools and technical advice available in their industries, including process modeling, prototyping, productivity analysis and troubleshooting.

This information will help you understand the newest LSR Technology for supporting ongoing and new projects, especially in the high voltage industries.

Our support already starts at the early beginning of the project: the idea! We can offer at any stage of your ongoing projects the right support from our global experience. After advanced material selections, we like to help fix the product design as well as mold and process setup. We can deliver prototypes as well, and we continue to support when production has started.



Reference Guide

Chemical Resistance of Silicone Rubber

	Valid for VMQ			Valid for FVMQ	
Material	Weight Change %	Volume Change %	Durometer Change Points	Volume Change %	Durometer Change Points
Acids					
Nitric conc.	10	10	-30	5	0
Nitric 7 %	<1	<1	-2	0	0
Sulfuric conc.	Disintegrates	Disintegrates			
Sulfuric 10 %	<1	<1	-2	0	0
Acetic conc.	2	3	-4	20	-
Acetic 5 %	4	4	8	-	-
Hydrochloric conc.	1	1	-6	10	-5
Hydrochloric 10 %	2	4	-4	0	-5
Hydrochloric 3 %	<1	1	-2	-	-
Bases					
Sodium hydroxide 20 %	<1	<1	-2	0	-5
Hydroxide 1 %	<1	<1	-4	0	0
Ammonium hydroxide conc.	2	2	-4	5	-5
Ammonium hydroxide 10 %	3	2	-6	0	0
Salts					
Sodium chloride 10 %	<1	<1	-2	-	-
Sodium carbonate 2 %	<1	<1	0	-	-
Solvents					
Ethyl alcohol	5	6	-10	5	0
Acetone	5	15	-15	180	-20
Toluene	75	120	-30	20	-10
Gasoline, regular	65	130	-25	20	-12
Gasoline, aviation	60	110	-30	10	-5
Mineral spirits	65	110	-30	0	0
Carbon tetrachloride	130	110	-25	20	-5
Hydraulic Fluids					
Hollingshead H-2	4	5	-10	-	-
Hollingshead H-2	9	12	-15	-	-
Skydrol®	4	4	-8	25	-10
Skydrol[a]	7	8	-10	-	-
PRL3161	5	7	-8	-	-
PRL3161[a]	9	9	-15	-	-
Oils					
Castor oil	<1	<1	-4	-	-
Lard oil	<1	<1	-4	-	-
Linseed oil	<1	<1	-2	-	-
Mineral oil	5	6	-6	-	-
ASTM #1 oil[b]	3	5	-6	0	-5
ASTM #3 oil[b]	20	31	-20	5	-5
Silicone oil SF96* (100)[b]	25	35	-25	0	-5
Silicone oil 42,000 cstk.[b]	9	10	-12	0	-5
Other					
Water	<1	<1	<1	0	0
Hydrogen peroxide 3 %	<1	<1	<1	0	0
Pyranol 1476	4	4	-8	-	-

a 70 hr @ 100 °C (212 °F)
b 70 hr @ 149 °C (300 °F)
c 7 days @ 49 °C (128 °F)

VMQ data from Momentive Performance Materials Silicones Technical Data Book S-1E.
Data on FVMQ from Dow Corning Bulletin 17-052.
Courtesy: W. Lynch, Handbook of Silicone Rubber Fabrication; Van Nostrand; Reinhold Company, New York, 1978.
Skydrol is a registered trademark of Solutia, Inc.

Reference Guide

Comparison with Other Elastomeric Materials

Property	Units	Silicone Rubber	Polytetrafluoro-ethylene	SBR Rubber	Butyl Rubber	Oil-Base Rubber	Polyvinyl-chloride	Polyethylene
Temperature Rating	°C [°F]	150-250 [300-480]	250 [480]	75 [170]	90 [190]	75 [170]	60-105 [140-220]	75 [170]
Mechanical Water Absorption	Mg/sq in. [Mg/sq cm]	1.6 [10]	0.8 [0.05]	2.3 [15]	1.2 [8]	3.9 [20-30]	1.4 [8-10]	0.08 [0.05]
Insulation Resistance	Megohm Constant	30,000	50,000	2000	30,000	21,000	2000	50,000
Dielectric Constant	-	3	2.1	5	3.5	5	5 to 8	2.3
Power Factor	%	0.1	0.1	4.5	3	5	5 to 8	0.1
Dielectric Strength	-	Excellent	Excellent	Very Good	Very Good	Excellent	Excellent	Excellent
Tensile Strength	MPa	8.4	14.0	5.6	5.6	8.4	10.5	10.5
Elongation	%	400+	150	350	400	300	200	400
Heat Aging 5 days @ 200 °C	% retention	Tensile 75 Elongation 60	Tensile 85 Elongation 75	Fails	Fails	Fails	Fails	Melts
Cold bend @ -55 °C	-	Passes	Passes	Fails	Passes	Fails	Fails	Passes
Ozone and Corona Resistance	-	Excellent	Good	Fails	Good	Good	Very Good	Good
Radiation Resistance	Ergs/gram (gamma radiation)	108	4 X 105	4 X 108	3 X 108	2 X 109	1010	1010
Flammability	-	Burns to Non-Conducting ash	Self-Extinguishing	Burns	Burns	Burns	Self-Extinguishing	Burns
Chemical Resistance	-	Good	Excellent	Fair	Fair	Poor	Very Good	Good
Processibility		Good	Poor	Good	Good	Good	Very Good	Very Good
Weathering		Excellent	Excellent	Poor	Excellent	Fair	Excellent	Must be Pigmented

Courtesy: W. Lynch, Handbook of Silicone Rubber Fabrication; Van Nostrand; Reinhold Company, New York, 1978.

Frequently Asked Questions

What is the difference between Heat Cured Rubber (HCR) and Liquid Silicone Rubber?

Heat cured rubber is a high consistency product that can be molded, extruded or calendered using conventional rubber processing equipment to meet a wide range of cost, durability and performance standards.

Liquid silicone rubber is a flowable, pumpable material that can be injection molded with minimal manual labor and fast curing times. Liquid silicone rubber technology combines the speed, cost efficiency and versatility of plastic injection molding with the outstanding properties of silicone rubber.

Both HCR and liquid silicone rubber are thermally cured and require heat to crosslink the uncured materials to obtain the final cured rubber part.

What does post-cure mean?

Post-cure of the material brings about an improvement in the mechanical properties (such as compression set) of the finished part. The content of volatile components is reduced. During post-curing, it is mainly volatile siloxane that evaporates, leading to a loss of weight. Since no decomposition products are formed, this weight loss is naturally less than in the case of peroxide-vulcanized silicone rubbers.

What's the recommended post curing method for dimensional stability?

It depends on the molding process used by the individual fabricator. Some may use a lower temperature to fill a complicated mold or a high temperature to increase productivity. Each fabricator should conduct several process parameter variations to determine which is suitable for the end use application, and then test those parts for extractables. Based on the extraction results, they can expose these molded parts to additional post cure conditions at various times and temperatures to achieve lower extractable levels.

What is cure inhibition and how do I prevent it?

Cure inhibition is a phenomenon that may occur with addition cure silicone products, which use a platinum catalyst to drive the curing reaction. The interface between the silicone and the substrate will appear "gummy/sticky," and/or incomplete cure will be attained. The best way to prevent cure inhibition is to avoid contact with inhibiting materials. When that is not possible, inhibition may be prevented by increasing the cure temperature; wiping the insert surface with a solvent such as acetone or isopropyl alcohol (IPA); applying a barrier coat; or replacing the inhibiting material with a suitable alternative.

Typical platinum contaminants include, but are not limited to: sulfur; sulfides (e.g., latex gloves); tin-fatty acids; tin salts; tin soaps; clay (intermittent); natural rubber; neoprene rubber; petroleum jelly; organophosphorus compounds; phosphines; phosphites; nitrogen-amines; amides; nitriles; cyanates; arsenic-arsines; compounds with unsaturated bonds; esters; ethyl acetate; vinyl acetate; alginates; peroxides; copper salts; substrates containing plasticizers; anti-slip additives or stabilizers; substrates with coatings containing polyvinyl acetate, acrylic latex, or natural rubber latex; substrates containing plasticizers, anti-slip additives, or stabilizers.

Is it safe to leave liquid silicone in an injection-molding machine overnight?

Momentive's LSR and LIM* liquid silicone rubbers are specifically formulated to offer extended catalyzed pot-life properties that allow the product to remain in the barrel overnight without purging the machine. When allowing the product to remain, it is recommended that barrel cooling be maintained during non-purge shutdowns. For shutdown periods greater than 24 hours, an "A" component purge of the barrel is strongly recommended.

How do I shut down the machine for the weekend to avoid curing in the manifold?

The following steps should be taken for weekend shutdown.

- Place water jacket around the manifold and run chiller at 15.5 °C [60 °F] or lower.
- Purge with the "A" component and keep away from any heat source.

How do you determine the tonnage required for a particular mold?

The rule of thumb is 0.2 to 1 ton of clamp force per square centimeter of the total projected area of the molded surface.

How do you determine cure time?

Cure time is dependent upon many factors, including mold temperature, cross-sectional thickness of the part, nature of the substrate (if any), and LSR material properties such as rheometry, flow, viscosity, and injection profiles (pressure/speed). Usually, one chooses a relatively long cure time as an initial setting and then reduces cure time until signs of under cure, such as soft spots, porosity, and sticking, are observed in the thickest areas of the part. The cure time should then be increased gradually until the quality of the part is consistently restored.

How much can I vary the mix ratio of the A and B part from the standard 1:1 ratio?

"Mix ratio" is a term used to state the amount of each material to be used in a multi-component material. The mix ratios are provided on the individual product data sheets and are given as a ratio by weight of each material. It is always desirable to stay as close as possible to the 1:1 mix ratio in order to achieve consistent results. However, ratio variability due to meter-mixing equipment tolerances may occur. To limit their impact, be certain to specify equipment that is guaranteed to hold the mix ratio tolerance to within +/- 5% of the prescribed 1:1 mix ratio.

Can I add color to liquid silicone rubber?

A third stream of a color master batch can be added by using a metering pump; the color master batch typically comprises 0.5% to 2% (by weight) of the total formulation. Momentive offers several color master batches. For specific color requirements, Momentive works with several specialty silicones dispersion compounders that can provide customized color matches. It is important to ensure the right color choice, as some colors can inhibit the reactivity of adhesion promoters. Dyes that contain sulfur, phosphorous and nitrogen will inhibit the platinum catalyst and subsequently retard the cure.

*LIM is a trademark of Momentive Performance Materials Inc.

How do you determine clamping force?

Clamping force is the amount of pressure required to close the two halves of the mold. This force has to be higher than the injection pressure and cavity (mold) pressures or else the material may leak in the form of excessive flash. Typically, 0.2 to 1 ton of clamp force per square centimeter per total projected surface area of the mold is recommended.

What factors control/determine mold pressure?

Cavity pressures are generated during the mold filling (which should equal the injection pressure) and material curing process. As material cures, it solidifies and increases in volume due to expansion. This builds cavity/mold pressure. Placing a pressure transducer in the cavity can monitor this.

What's the rule of thumb on gate size? What's the smallest gate size that can be used?

Always start with smaller gates, about 2µm that can be opened at a later stage depending on the material flow. The maximum gate size is about 5µm.

Is there a rule of thumb on holding pressure and holding time?

Holding pressure is another way to maintain and keep material in the cavity. The holding pressure and holding time should be minimized to keep the material in the cavity and to provide additional time for the material to cure inside the cavity.

How do you prevent material from pre-curing in the nozzle?

A water jacket around the nozzle of the molding machine with a circulating water temperature of 15-20 ºC [55ºF] is desirable. Move the nozzle from the hot mold after each injection cycle has been completed. Also, check the severity of the screw, which might be causing pre-curing inside the barrel and allow material to accumulate in the nozzle.The screw and the nozzle should be cleaned frequently.

How do you prevent flashing when using a mechanical ejector?

It's very difficult to prevent flashing when using mechanical ejectors. Mechanical ejectors require smooth movement at 2 to 5µm, and this is where LSR liquid silicone rubbers can leak out and create flashing. As such, mechanical ejectors should be avoided when possible.

Is there a rule of thumb for venting vacuum systems?

It depends on the number of cavities and the complexity of the mold. If it takes a long time to fill the entire mold or the part design consists of thin and thick sections, then it is essential to use a vacuum vent. Also, in situations where it is difficult to eliminate trapped air, vacuum venting will help.

Is humidity a concern with LSR liquid silicone rubber systems? Can air entrapment issues be due to the inhibitor?

Humidity could inhibit cure or, if entrapped, could form air bubbles. Air entrapment can be caused by various factors (e.g., air trapped in the material, air trapped in the cavity that could not be removed during mold filling, or humidity). Certain types of inhibitors, which volatilize off at very low temperatures, may also entrap air.

How does mold texture affect release?

Texturing a mold creates a uniform surface area with peaks and valleys. The valleys hold a fractional amount of air, which acts as a mold release agent during the molding of the LSR rubber part. Thus, the part is released easily during the de-molding process.

What's a typical thickness size for plating?

Plating thickness depends on the type of plating material. Typically the range is from 2 to 5µm. The higher plating thickness will change the critical dimensions of the part. Additional plating thickness should be included in the mold design.

How does the temperature of the mold surface affect de-molding?

Normally, the material will have a higher tendency to stick to the lower temperature side of the mold, while material will release more readily from the higher temperature side of the mold.

How do you know when a finished part is cured?

Check the resiliency or "snap back" on a part that has been cured. If any portion of it shows a gummy surface, this is an indicator of uncured material. You can also measure hardness of the part using a Shore A tester.

What do the following terms refer to?

- Hardness (ASTM D-2240): Resistance to load, indentation, scratching, abrasion, and marring. Most silicone rubbers fall within the range of 10 to 80 on a Shore A durometer scale.
- Tensile Strength, Tear Strength, Elongation, and 100% Modulus (ASTM D-638): These are the mechanical properties of the material in tension. The tensile strength is the force required to pull apart the cured rubber and is measured in force per unit area. Elongation is the total extension of the rubber when it breaks and is measured as a percent of the original length. 100% Modulus is the force needed to stretch the rubber 100% (or twice its original length) and is measured in force per unit area.
- Compression Set: Compression set is a measurement of the degree to which a compressed rubber article fails to bounce back to its original dimension after being released from any constraints. Typically, test parts are compressed at a known compression (e.g., 25%) in a steel jig and placed at a test temperature (e.g., 176 °C [350 °F]) for some period of time (e.g. 22 hrs). At the end of the test period, the part is removed from the jig and allowed to stabilize to room temperature. Compression Set is then the reduction in thickness of the part expressed as a percent of the amount compressed

Does silicone expand as long as it sees heat?

During the curing phase, material goes through cross-link density build, a slight increase in volume and then shrinks as it cools. Higher temperatures can cause silicone volatiles to be released from the silicone polymers contained within the molded part and are, thus susceptible to higher shrinkage.

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Patent Status

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Product Safety, Handling and Storage

Customers should review the latest Material Safety Data Sheet (MSDS) and label for product safety information, safe handling instructions, personal protective equipment if necessary, emergency service contact information, and any special storage conditions required for safety. Momentive Performance Materials (MPM) maintains an around-the-clock emergency service for its products. MSDS are available at www.momentive.com or, upon request, from any MPM representative. For product storage and handling procedures to maintain the product quality within our stated specifications, please review Certificates of Analysis, which are available in the Order Center. Use of other materials in conjunction with MPM products (for example, primers) may require additional precautions. Please review and follow the safety information provided by the manufacturer of such other materials.

Limitations

Customers must evaluate Momentive Performance Materials products and make their own determination as to fitness of use in their particular applications.

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