AUTOMOTIVE COMPONENT & MATERIAL SPECIFICATION

Self-Lubricating Silicone: Formulating Internal Oil Exudation for Automotive Connectors

Document Ref: WP-2026-AU136-20 | Compliance Baseline: SAE/USCAR-2 Class 3 Temperature Profiles | Reemane Elastomers Lab

1. Executive Summary: The Assembly Friction Loop

Modern automotive wire harnesses handle high-density data and power routing paths across internal combustion and electric vehicle architectures. As terminal counts per multi-pin block increase, mechanical mating actions face highly elevated insertion forces. High mating resistance leads to localized connector body buckling, terminal back-outs, and ergonomic strain on assembly line workers.

To eliminate manual grease application procedures—which risk dirt collection and contact contamination—automotive OEMs require automated internal lubrication pathways. Reemane engineered the RM-SL self-lubricating silicone matrix to solve this loop, incorporating a precision phase-separation mechanism that delivers lifetime ease-of-assembly alongside IP67/IP69K environmental ingress sealing.

> ***Harness Component Directive: Manual external grease coats degrade terminal contact paths over time; self-lubricating matrices exude a controlled micron-layer restricted to the elastomeric skin interface.***

2. Chemical Mechanism: Phenyl Fluid Migration Kinetics

The self-lubricating capability of the RM-SL polymer network relies on an intentional thermodynamic incompatibility. During base compounding, a high-molecular-weight, unreactive phenyl-methyl silicone fluid is evenly dispersed throughout a base methyl-vinyl siloxane gum matrix.

During the thermal addition-cure cross-linking stage, the base vinyl polymer chains weld into a dense three-dimensional cross-linked network. Because the unreactive phenyl fluid molecules lack cross-linking anchors and possess a distinct chemical structure, they undergo micro-phase separation. Driven by internal matrix compression, these fluid molecules migrate continuously outward through intermolecular voids, exuding onto the surface to establish a perpetual lubricating boundary layer.

3. USCAR-2 Compliance & Fluid Sealing Performance

Automotive electrical connectors positioned in harsh under-hood environments must satisfy rigorous performance thresholds specified by **SAE/USCAR-2 (Performance Standard for Automotive Electrical Connector Systems)**. Standard elastomers subjected to continuous heat aging experience severe compression set degradation, leading to fluid bypass leaks.

Reemane's RM-SL series meets USCAR-2 Class 3 operating metrics, sustaining continuous environmental deployment from -40°C up to +125°C. The outward phenyl oil pressure creates a continuous hydrophobic shield that actively repels splash water, salt spray, and atmospheric humidity. This performance prevents terminal corrosion failures without swelling the matching plastic connector housings.

4. Technical Specifications: RM-SL Self-Lubricating Matrix

Technical Parameter Index	Testing Protocol	RM-SL-50 (Standard)	Generic High-Bleed LSR
Hardness (Durometer)	ASTM D2240	50 ± 5 Shore A	50 Shore A
Tensile Strength	ASTM D412	7.8 MPa	6.2 MPa
Elongation at Break	ASTM D412	480%	400%
Oil Exudation Rate (48h @ 100°C)	Internal Gravimetric	**2.5% - 3.5%**	**≥ 6.0% (Excessive)**
Connector Mating Force Reduction	SAE/USCAR-2	**55% Decrease**	40% Decrease
Compression Set (22h @ 125°C)	ASTM D395 Method B	18%	28%

5. DFM Production Limits & Tooling Flash Prevention

Compounding oil-loaded silicone matrices alters the rheological behavior of raw compounds during injection cycles. The presence of unbound phenyl fluid lowers the internal shear viscosity of the compound inside hot runner blocks, increasing the risk of material flash along parting lines down to sub-micron clearances.

To eliminate flashing defects on fine seal lips, Reemane utilizes high-precision tool steel sets equipped with continuous vacuum venting channels. The mold cavities must maintain crisp, laser-matched shut-off lands. Furthermore, component demolding requires optimized ejector pin stroke parameters to prevent surface tearing, as self-lubricating rubber exhibits slightly modified green strength values immediately after vulcanization.

Optimize Your Automotive Harness Connection Performance

Drastically minimize multi-pin insertion forces, protect terminal pathways from moisture corrosion, and secure robust USCAR-2 Class 3 field safety. For custom seal configurations, mat seals, or high-bleed compound specification sheets, contact our technical component engineering division directly at sales@siliconefactories.com or visit our online resource database at www.siliconefactories.com.