

# Specialty Lubricants Solutions for Steering Components



LUBRICANTS.  
TECHNOLOGY.  
PEOPLE.



**MOVING YOUR WORLD**

## Expect More from Your Automotive Lubrication Partner

### Customer-Focused

At FUCHS we prioritize hands-on support, transparent communication, collaboration, and a performance-cost-balance that all work together to achieve our customer's goals.

### Holistically Oriented

We offer a comprehensive and OEM approved product portfolio with lubrication solutions for every automotive application. Our high-performance products are backed by 90 years of experience and the highest quality standards.

### Technologically Leading

FUCHS is your development partner for innovative lubrication solutions. Around one in ten FUCHS employees works in research and development to build our worldwide know-how network. FUCHS offers application testing on customer's supplied components and generates pre-validation data to help customers save money and accelerate their time to market.

### Globally Present

With employees in 50 countries, FUCHS offers global and local support all while maintaining one-face to the customer through our Global Key Account Management. Our automotive products are backed by the latest global IATF automotive quality certification.

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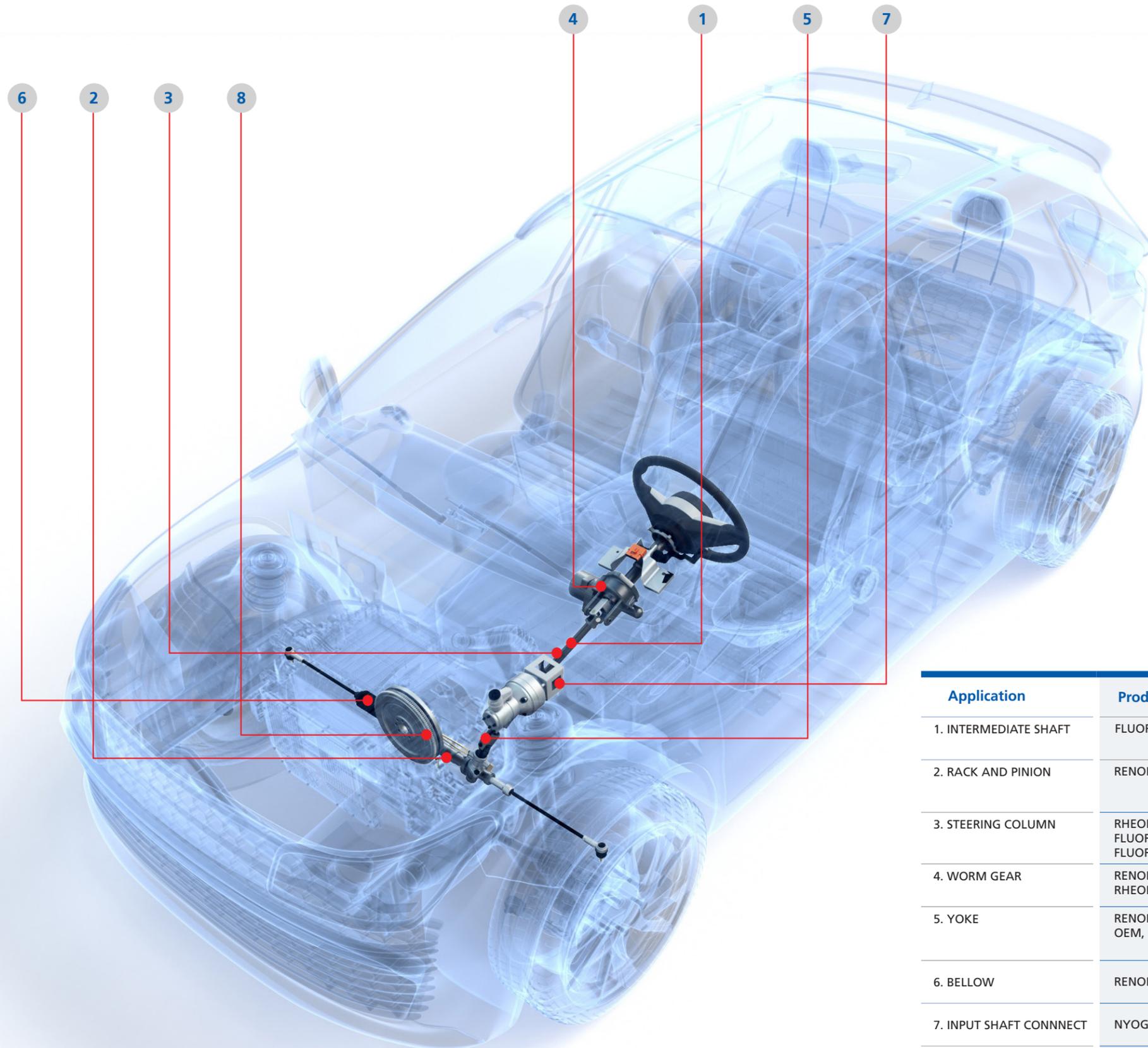
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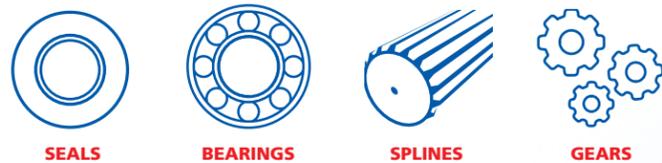
# Specialty Lubrication Solutions for Your Entire Steering System

As a holistic partner of the automotive industry, FUCHS provides lubrication solutions for all components of a vehicle – from brake and steering systems, driveshafts, axles, transmissions, and shock absorbers to interior components such as seats, dashboards, and sunroofs. In all areas, including steering, lubrication plays a vital role in increasing the life, efficiency, and reliability of the systems.

Steering systems are becoming increasingly more advanced as OEMs design the next generation of electric and autonomous vehicles that prioritize safety, comfort, control, feel and precision. For example, lubrication reduces friction, which in turn reduces the amount of power drawn on assist motors. Thus, extending the driving range of electric vehicles. Lubrication also reduces heat caused by friction, to protect and prolong the life of components, such as worm gears or seals. Thus, making them less susceptible to failure. This helps to avoid safety critical issues, warranty claims, and costly recalls.



## Components Lubricated



## Lubrication Advantages



Application	Product
1. INTERMEDIATE SHAFT	FLUOROCARBON GEL 866
2. RACK AND PINION	RENOLIT CX-SPS 0, RHELOUBE 393,
3. STEERING COLUMN	RHEOLUBE 362HB, NYOGEL 774VLF, FLUOROCARBON GEL 868MS-X, FLUOROCARBON GEL 868
4. WORM GEAR	RENOLIT CX-SPS 0, RHEOLUBE 363F, RHEOLUBE 462CF, RENOLIT ST-SW 1
5. YOKE	RENOLIT CX-SPS 0, RENOLIT JP 1619 N OEM, FLUOROCARBON GEL 875MS
6. BELLOW	RENOLIT CXS BGR
7. INPUT SHAFT CONNNECT	NYOGEL 774
8. BALL NUT	RENOLIT BNG 1

## Intermediate Shaft

For plastic-to-metal interfaces, a medium-viscosity, synthetic hydrocarbon grease enhanced by PTFE ensures good slip and low “stiction.” For metal-to metal interfaces, a heavier synthetic hydrocarbon grease is recommended. A lighter grease designed for sliding surfaces is recommended for tight tolerances between telescoping shafts.

Product	Chemistry	Temperature Range	Product Description
FLUOROCARBON GEL 866	PAO/ PTFE	-54 to 125 °C	A light viscosity grease intended for instruments with moving plastic parts, gears and slides.

## Rack and Pinion

Rack and pinion designs often feature high loads and tight tolerances. Lubricants formulated with extreme pressure additives withstand high loads to reduce friction to prevent wear. A lubricant with good adhesion and low temperature performance is recommended to ensure reliable operation. Plastic and steel compatibility should also be considered.

Product	Chemistry	Temperature Range	Product Description
RENOLIT CX-SPS 0	Synthetic Oil/ Calcium Complex Soap	-40 to 130 °C	A medium viscosity, plastic-compatible grease with excellent relubrication properties for components requiring low friction and great thermal management as well.
RHEOLUBE 393	PAO/ Lithium Soap	-40 to 125 °C	A heavy viscosity grease intended for CV joints.
RENOLIT JP 1619	Synthetic Oil/ Lithium Soap	-50 to 120 °C	A light viscosity synthetic hydrocarbon grease fortified with EP additives and corrosion inhibitors to improve adhesion and load carrying.



3 STEERING COLUMN

4 WORM GEAR



## Steering Column

If not properly lubricated, couplings, and ball bearings located at the end of the steering column, can transfer noise and vibration through the steering column up to the driver. Grease can quiet these applications and provide durability and wear protection. Load should be considered when selecting a grease. Heavily loaded designs require a heavy viscosity grease to ensure the proper wear prevention and mechanical damping properties.

Product	Chemistry	Temperature Range	Product Description
FLUOROCARBON GEL 868MS-X	PAO/ PTFE	-40 to 80 °C	A medium viscosity grease fortified with EP additives and rust inhibitors.
FLUOROCARBON GEL 868	PAO/ PTFE	-40 to 125 °C	PTFE thickened, medium viscosity, synthetic hydrocarbon grease for components requiring light tack and minimal change in damping characteristics with temperature.
RHEOLUBE 362HB	PAO/ Lithium Soap	-40 to 125 °C	A light viscosity grease fortified with PTFE, tackifiers, rust inhibitors, and UV tracers.
NYOGEL 774VLF	PAO/ Silica	-50 to 120 °C	A light viscosity grease fortified with a PTFE additive that offers good water resistance and damping characteristics.

## Worm Gear

Light weight synthetic hydrocarbon greases with advanced additive packages greatly reduce frictional torque between the gearing components. This allows for lower current draw over extended periods of use. They also improve low temperature torque performance, while providing wear protection and vibrational damping. Grease can also be used for its thermal management, corrosion protection, and wear mitigating capabilities.

Product	Chemistry	Temperature Range	Product Description
RENOLIT CX-SPS 0	Synthetic Oil/ Calcium Complex Soap	-40 to 130 °C	A medium viscosity, plastic-compatible grease with excellent relubrication properties for components requiring low friction and great thermal management as well.
RHEOLUBE 363F	PAO/ Lithium Soap	-50 to 125 °C	A medium viscosity grease fortified with PTFE for bearings, gears, and slides that require low friction.
RHEOLUBE 462CF	PAO/ Lithium Soap	-54 to 130 °C	A light viscosity grease with excellent low temperature performance and a low coefficient of friction for sliding applications.
RENOLIT ST-SW 1	Synthetic / Aluminum Complex Soap	-40 to 130 °C	A special light viscosity grease with a unique additive package for ageing resistance and low temperature capability.

## Yoke

The friction from the junction of the yoke and steering rack can transmit vibrations that are felt by the driver. Yokes require a grease with excellent damping characteristics to minimize noise and vibration. Lubricants with good film strength are ideal for these sliding conditions to reduce friction.

Product	Chemistry	Temperature Range	Product Description
RENOLIT JP 1619	Synthetic Oil/ Lithium Soap	-50 to 120 °C	A light viscosity synthetic hydrocarbon grease fortified with EP additives and corrosion inhibitors to improve adhesion and load carrying.
RENOLIT CX-SPS 0	Synthetic Oil/ Calcium Complex Soap	-40 to 130 °C	A medium viscosity, plastic-compatible grease with excellent relubrication properties for components requiring low friction and great thermal management as well.
FLUOROCARBON GEL 875M5	PAO/ PTFE	-20 to 125 °C	A heavy viscosity grease fortified with EP additives and rust inhibitors

## Bellow

Bellows protect the steering rack and pinion and tie rod end from external contamination and hence optimize gear performance. The grease helps seal these bellows which potentially operate over a wide temperature range.

Product	Chemistry	Temperature Range	Product Description
RENOLIT JP 1619 N OEM	Synthetic Oil/ Lithium Soap	-50 to 120 °C	A light viscosity synthetic hydrocarbon grease fortified with EP additives and corrosion inhibitors to improve adhesion and load carrying
RENOLIT CXS BGR	PAO/ Calcium Sulfonate Complex	-50 to 170 °C	A light viscosity, multi-purpose grease with superior water resistance.





8 BALL NUT

7 INPUT SHAFT CONNNECT

## Input Shaft Connect

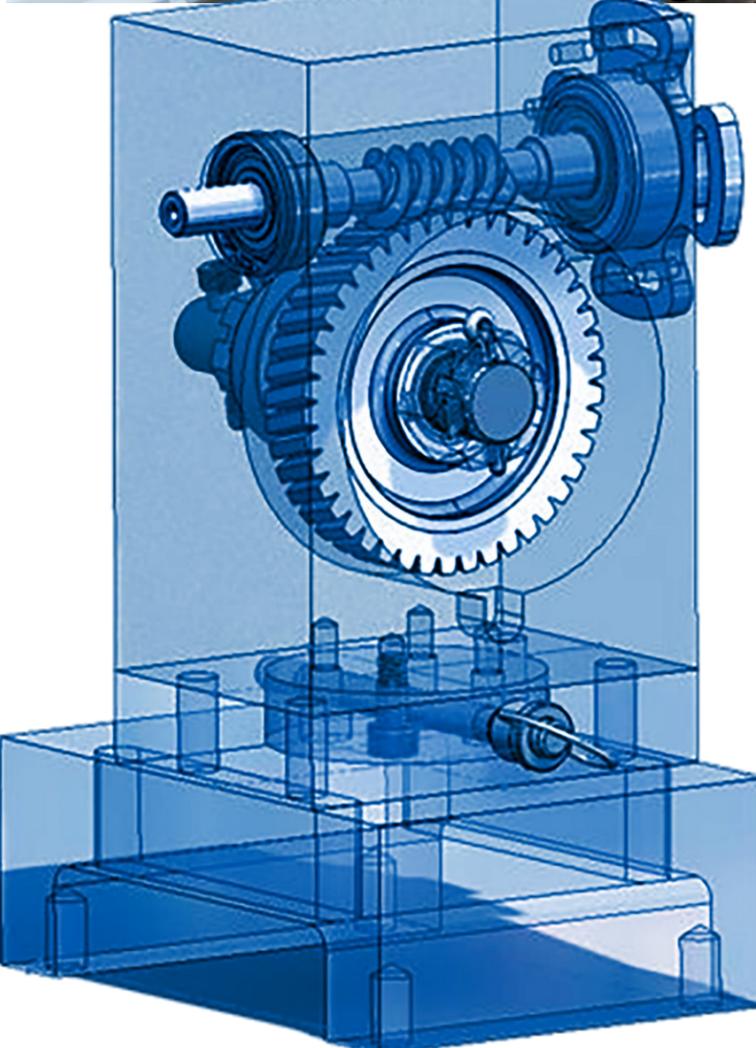
The input shaft connect is a universal joint which links the intermediate steering shaft with the rest of the steering system. This joint requires a mechanically stable, corrosion resistant and wide-temperature grease.

Product	Chemistry	Temperature Range	Product Description
NYOGEL 774	PAO/ Silica	-30 to 120	A medium viscosity grease intended for mechanical components requiring a light amount of damping.

## Ball Nut

The ball nut helps overcome friction and wear in steering gear through circulation of ball bearings between the worm and the nut itself. The grease helps overcome energy losses by further reduction in friction between the two metal surfaces and loading conditions.

Product	Chemistry	Temperature Range	Product Description
RENOLIT BNG 1	Synthetic Oil/ Lithium Soap	-40 to 130 °C	A low viscosity synthetic low friction coefficient grease with good EP and antiwear properties and low starting and running torque.



### Electric Power Steering Test Rig

This custom test rig is designed to simulate wear-in and normal operation of the worm and wheel assembly with a main goal of measuring frictional torque. With stability being the focus of the research, understanding these characteristics have aided FUCHS and its venture to design the next generation of Electric Power Steering (EPS) lubricants.

## Custom EPS Testing Capabilities

If an Electrical Power Steering (EPS) system is not properly lubricated, a great deal of heat is generated due to the sliding nature of the worm assembly. Lubricants are critical to reducing the amount of heat generated so that EPS systems can operate at higher loads without system failure or reduced torque.

Our custom EPS Test Rig is a multi-stage system that allows our engineers to simulate road conditions and life endurance tests on customer supplied EPS units while measuring frictional torque, heat generation, wear, and more. Our engineers use the data collected by this rig to formulate next-generation EPS greases that reduce frictional torque. Our EPS Test Rig is composed of three separate rigs that accurately simulate EPS operations:



#### Magnetic Brake System

Our magnetic brake system simulates an OEMs 'run-in' process. This is a high load, high speed, test entirely dedicated to removing high spots—or residual imperfections from the manufacturing process. When high spots are removed, it allows our engineers to understand how our lubricants will perform in an aged EPS system.



#### On-Road Conditions

The EPS rig uses a feedback loop with two server motors that rotate from 0-540 degrees at 30 rotations per minute. Engineers can then use the feedback loop to simulate specific loads at different wheel rotations. OEMs are constantly trying to create systems that operate at higher loads. Our rig can simulate loads of up to 120 newton-meters to simulate the different EPS load requirements. Using the rigs infrared camera, our engineers can see the temperature distribution of the entire gear assembly. This allows us to assess how well our lubricants are reducing the amount of heat generated by the motor under specific loads and wheel rotations.



#### Parking Check

This rig is a non-loaded parking check, also known as a Backdrive check. This uses a high-resolution torque transducer to assess gear-to-torque distribution when a wheel is turned all the way in one direction. With this information, our engineers can remove the peaks and valleys of that distribution data to obtain the average gear-to-torque distribution for the system. This test allows us to understand frictional characteristics in EPS systems and how they affect the "feel" of steering.

# The FUCHS Group

## Developing Tailor-Made, Holistic Solutions for the Most Demanding Challenges

Our international team of experts from across all sectors and industries focus solely on lubricants, so that our customers can focus on their businesses. It's our mission to ensure that we deliver technology that pays back.

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