

Since 1844

# Nye® LubeLetter

October 2020



## Lubrication



## Collaboration



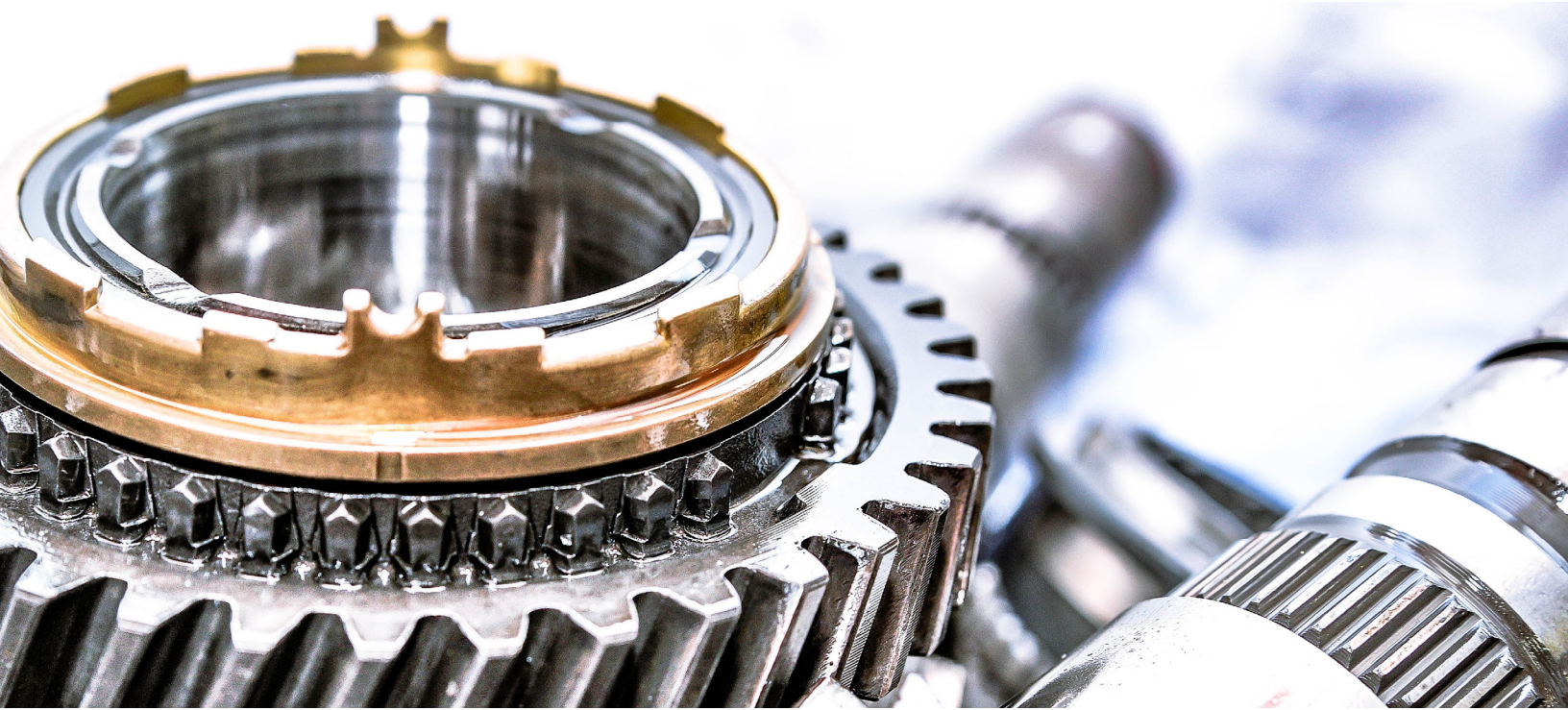
## Innovation





## Design Engineer's Guide - Selecting a Gear Box Grease

Gear box performance has been consistently focused on mechanical efficiency, load handling capacity, and reliability. Recently, there have been additional demands to develop lighter weight, more durable and compact designs.



Gear boxes are often used for high-load, speed and temperature applications. Elevated speeds and loads often increase temperature, which can impact the life of the lubricant and ultimately the performance of the device. Many devices cannot utilize an oil bath to remove heat and wear debris; grease can provide the necessary lubrication to reduce friction and wear, extending the life of the gear box. Nye's gear greases were designed to perform under these mechanically demanding conditions.

### The Advantages of Lubricating Gears and Gear Boxes

- Reduce Friction
- Decrease Gear Wear
- Diminish Noise Emission
- Improve Efficiency
- Extend Operational Life
- Control Temperature Rise

In addition to common metal gear applications, recent advances have allowed the use of lighter weight plastic gears for some applications. Plastic housings have also become more prevalent to support lighter weight design initiatives. Nye Lubricants has a complete line of synthetic, plastic compatible gear greases formulated specifically to address requirements for wear minimization under high-load conditions.

### Applications that Use Gear Box Grease



Industrial



Automotive



Power Tools



Outdoor Equipment

## How to Select Your High-Performance Gear Grease.

Nye Lubricants has a complete line of high-performance gear greases designed specifically to address application requirements for gear lubrication, high-load operation, temperature limits and material compatibility. Most Nye gear greases are formulated with anti-wear, anti-corrosion, and extreme pressure additives.

- **Rheolube® 380 & 380-G1**

These PAO/Ester blend, Li Soap thickened greases are intended for high-speed metal gearing applications such as power tools and starter motors. Rheolube® 380-G1 is a softer grease that replenishes oil between gears but is more prone to leakage than Rheolube® 380.

- **Rheolube® 374A**

Commonly referred to as Nye's landing gear grease, Rheolube® 374A is recommended for metal gears that operate at low speeds under a wide temperature range.

- **Rheolube® 363AX-1**

Rheolube® 363AX-1 is recommended for small gear trains. The grease offers excellent adhesion which helps it stay in place and useful on exposed gear trains.

- **Instrument Grease 794A**

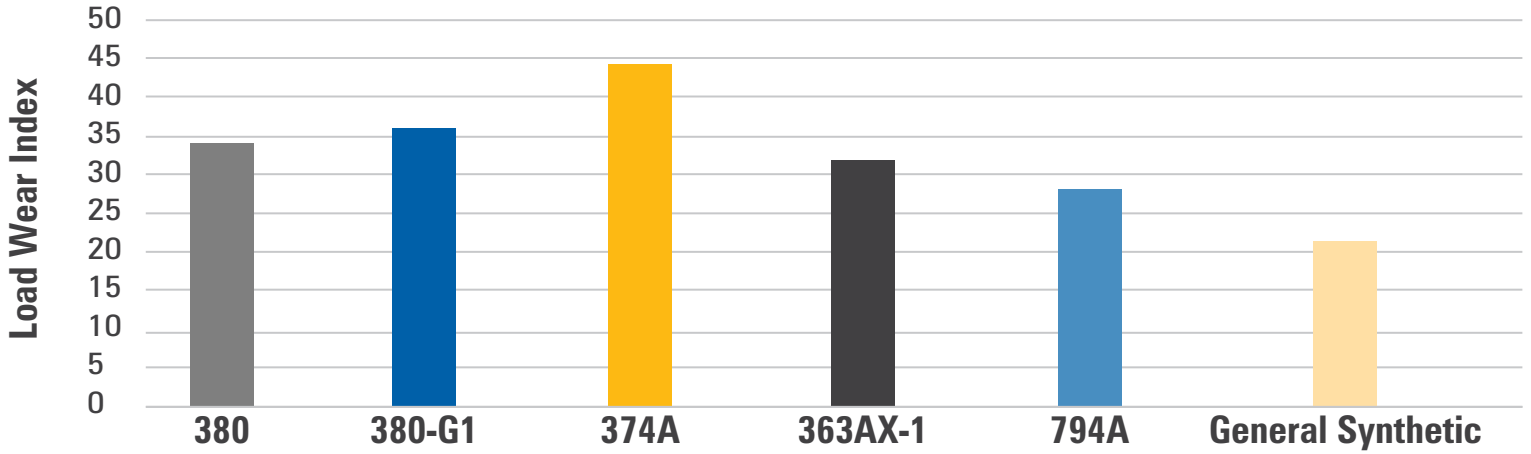
For appliance and other high-load, low-speed, metal gearing, Instrument Grease 794A is the recommended lubrication solution.

Lubricant Properties	Test Conditions	Rheolube® 380	Rheolube® 380-G1	Rheolube® 374A	Rheolube® 363AX-1	Instrument Grease 794A
Base Oil	–	PAO/Ester	PAO/Ester	PAO	PAO	PAO/Ester
Temperature Range	–	2	1	2	2	2
Kinematic Viscosity	40 °C ASTM D445	-50 to 130 ° C	-50 to 130 ° C	-54 to 177 ° C	-50 to 125 ° C	-20 to 150 ° C
Viscosity Index	ASTM D2270	137	130	159	145	105
NLGI Grade	–	2	1	2	2	2
Oil Separation	24 h, 100 °C+ ASTM D6184	4.5%	18.6%	3.3%	2%	0.6%
Plastic Gear Compatibility*	–	Better	Better	Better	Better	Better
Plastic Housing Compatibility*	–	Fair*	Fair*	Better	Better	Fair*
SRV OK Load	ASTM D5706	1400 N	800 N	2000 N	800 N	350 N
Load Wear Index	ASTM D2596	34.8	35.6	44.7	31.9	27.6

\*Esters are compatible with most plastic gear materials but may not be compatible with other plastics / elastomers. Nye offers Material Compatibility Testing

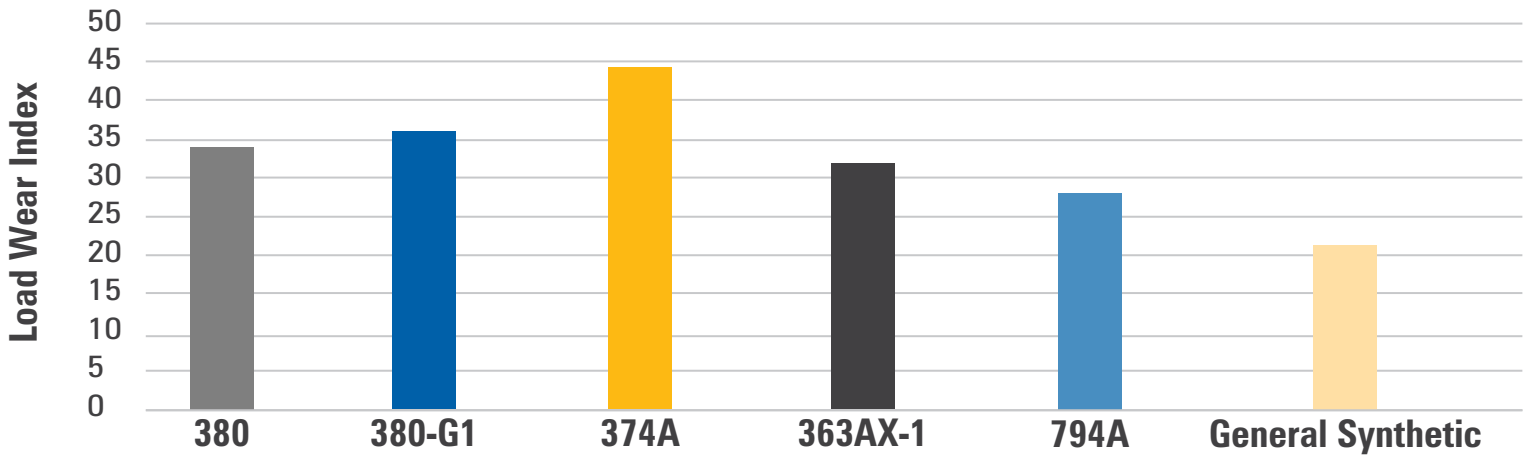
### SRV OK Load

The SRV OK Load test measures a grease's ability to withstand extreme pressure. During the test, the test load is increased every 2 minutes until the specimens weld together, indicating lubricant failure. *(Test Method: ASTM D5706)*



### Load Wear Index

The Low Wear Index test creates an index of the ability for a lubricant to minimize wear at applied loads. It is based on a calculation of wear at non-seizure loads on the way to determining the weld point. *(Test Method: ASTM D2596)*



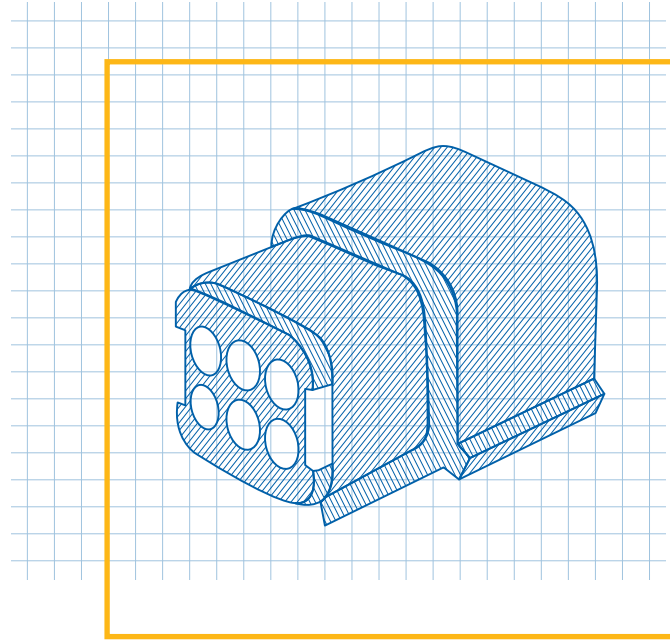


## NyeMed® 7560

NyeMed® 7560 is a medium viscosity, UV-dyed, synthetic hydrocarbon grease formulated for medical applications that may require a biocompatible connector lubricant. This grease contains additives proven to protect electrical contacts against moisture and corrosive substances, and reduce mating force of connectors, ensuring signal transmission.

### Advantages:

- Very good resistance to oxidation and moisture
- Does not swell most plastics and elastomers
- UV dye enhances tracing and visualization
- Wide temperature range (-40 to 120°C)



Properties	Test Conditions	NyeClean® 5057	Test Method
Base Oil	–	Synthetic Hydrocarbon	–
Flash Point	–	> 310 °C	ASTM D92
Base Fluid Apparent Viscosity	25 °C	767 cP	CTM*
	45 °C	260 cP	
Color/Appearence	–	Light Yellow, Clear	Visual
Grease Apparent Viscosity	25 °C, 50/s shear rate	27,500	CTM*
Density	25 °C	0.88g•cm <sup>3</sup>	CTM*
Oil Separation	24 h, 100 °C	1.5%	ASTM D6184
Evaporation	24 h, 100 °C	0.3%	ASTM D972

\*CTM: Nye Company Test Method

### ISO 13485:2016 Certified

Nye Lubricants operates a Quality Management System that complies with the requirements of ISO 13485:2016. Our process controls, documentation, and quality standards meet or exceed all requirements for the design, manufacture, and distribution of synthetic lubricants for medical devices.

## Backed By Biocompatibility Testing

Test	Standard	Result	Meaning
Cytotoxicity L929 Agar Diffusion (Direct Contact)	ISO 10993-5	Grade 0	No Cellular Reactivity
Skin Irritation (Direct Contact)	ISO 10993-10	Primary Irritation Index 0.0	Negligible Irritant
Acute Systemic Toxicity (Direct Injection)	ISO 10993-11	Negative	Pass

## Packaging Options

Nye greases are available in a variety of packaging sizes for both high-volume production dispensing and small volume dispensing.

- 30 cc syringe
- 55 cc syringe
- 153 cc syringe

If these packaging options don't suit your needs, we will work with you to find you the right dispensing option for your application.

Want to learn more or place an order? [Click here](#) to contact an engineer.



## Case Study: Reducing Noise in Electric Power Steering Systems

### Background

Noisy automotive components can have a negative impact on how consumers perceive the quality of a brand. As vehicles incorporate increasingly sophisticated electric designs, more lubrication points are required to ensure safe, noiseless, and smooth operation. A world leader in the manufacture and design of steering systems noticed that their new Electric Power Steering design had significant noise issues. The Tier 1 Supplier came to Nye's Channel Partner Newgate Simms in search of a new lubricant for their EPS input shaft after a competitor's grease was unable to sufficiently dampen noise. The Supplier needed a viscous grease that would control motion and eliminate noise and vibration to ensure drivers get the best possible steering experience.



### Challenge

- Can the lubricant eliminate noise coming from upper shaft teeth contact area and provide smooth operation within the required temperature range?

### Solution

#### NyoGel® 767A

*A silica thickened, heavy viscosity, synthetic hydrocarbon grease.*

- Compatible with most plastics and elastomers
- Reduces free motion and noise of relatively loose-fitting components
- Reduces vibration and harshness for a quality feel

Product	Chemistry	Temperature Range	Kinematic Viscosity (100 °C & 40 °C)	Oil Separation (24 h @ 100 °C)	Evaporation (24 h @ 100 °C)
NyoGel® 767A	PAO/Silica	0 to 125 °C	851.5 cSt 28185 cSt	0.1%	0.2%

## Results

After passing ambient cold temperature tests and other in-house testing, the automotive tier supplier found that NyoGel® 767A successfully eliminated noise in the contact area between the pinion and upper shaft teeth. The Supplier and the OEM were so pleased with NyoGel® 767A that they decided to use this solution on other steering projects that require motion control.



## Is Silicone Grease Bad for Automotive Components?

In the early 2000s, original equipment manufacturers (OEM) experienced cratering and fisheyes appearing on painted surfaces. The culprit? Light molecular weight silicone sprays used in automotive assembly plants. When light molecular weight silicone becomes airborne, it can land on unintended areas and ultimately lead to sheet metal contamination. Silicone sprays are typically transparent, making them hard to detect in the painting process, creating many headaches when trying to optimize the perfectly painted metal surface



Silicones are polymers that can take many forms including oils, rubbers, and resins. They are used in many everyday items, from cooking utensils to cosmetics. In lubricants, a silicone base oil is commonly used in greases for plastic gears, control cables, and seals because they are inert, compatible with most plastics and elastomers, and remain stable over a wide temperature range.

Some automotive OEMs have limited silicone use to specific facilities, and now many people are asking—is silicone really that bad? Silicone greases are like any other lubricant, suitable for some applications, but not all. There are many factors to consider when deciding whether to use a silicone lubricant.

## Migration

One of the deciding properties of silicone is its tendency to migrate, based on its low surface energy. The ability to migrate can be an advantage or a disadvantage depending on the application. In cables, for example, a lubricant with low surface energy is ideal. Lubricating cables housed in a sheath is challenging. On the other hand, low surface energy lubricants can migrate down and coat the cable's entire length effortlessly. However, if the application relies on the grease staying in place like in a headrest, a hydrocarbon grease with higher surface energy is ideal. It is important to note that a silicone base-oil that is properly formulated into a grease is less likely to migrate as a silicone oil alone will, if at all.

## Temperature

Like Nye's [Fluorocarbon Gel 880](#), most silicone lubricants perform exceptionally well at temperature ranges from around -40 to 200 °C. Lubricants with a wide temperature range are beneficial for exterior applications because they can withstand extreme environmental conditions. Additionally, because silicone lubricants are thermally stable, they provide lifetime lubrication in ball joints, struts, shocks, and other enclosed applications without grease fittings. Their surface energy also helps to rewet surfaces if the lubricant were to expel from high load areas.

## Material Compatibility

Silicone is an inert lubricant and does not react with most non-silicone elastomeric seals, or plastics used in automotive interior components. They are also widely used with o-rings because they will not swell or soften the ring. Silicone greases can be used as an assembly aid, as well as providing additional sealing capabilities.

## Load

Because of their high viscosity index and low surface energy, silicone greases do not create a robust hydrodynamic film to separate components and prevent wear. As a result, Nye does not recommend silicone greases for most high load applications, like metal-on-metal gearing.

## Electric Designs

As vehicles shift toward fully electric designs, an electrical failure could affect anything from brake lights to the steering system. At Nye, we do not recommend silicone greases for electrical automotive applications. It has been found that lower quality, light base oil viscosity silicone lubricants present the possibility of outgassing, potentially contaminating nearby switch contacts leading eventually to switch failure and continuity problems. If a silicone is to be used, we recommend higher viscosity base oil options that also bring the benefits of motion control and improved tactile feel.

Additionally, silicone lubricants are also a challenge where arcing conditions are present. Arcing occurs when a substantial current leaps across the gap between contacts. The arc produces a small burst of localized heat (up to 1000 °C), causing the silicone to degrade. When silicone oxidizes, it turns into a hard, insulative, sand-like material that prevents contacts from coming together. Any lubricant that is not clean burning will experience some oxidation, but this can be considered in grease formulations and the expected life cycle of the switch in question. Silicone greases do find some use in low voltage potentiometers, where the potential for arcing is low.

## Cost

Silicone greases are more expensive than hydrocarbon greases but less expensive than fluorinated greases. If a cost-effective lubricant that operates at high temperatures is required and the impact of possible silicone contamination is low, consider a silicone lubricant.

## Our Verdict

Silicone lubricants have excellent material compatibility, operate within a wide temperature range, and are cost-effective, making them appealing for many automotive applications.

## Silicone-Free Grease for Advanced Motion Control

Nye chemists have been hard at work formulating a new silicone-free, hydrocarbon grease for advanced motion control applications. This product is now available for sampling. If you are interested in requesting a sample, [Contact Us](#).





## Meet Nye - Robert Grizzetti

Robert has been with the Nye family for over 10 years. Robert earned his Chemical Engineering degree from the University of Rhode Island. He began his time with Nye in Technical Support. Within two years Robert assumed the role of International Regional Engineering Manager (IREM) for Japan. His responsibilities included account management and offering lubrication solutions to our Japanese customers. Currently a Senior Product Support Engineer, Robert coordinates the exchange of technical and commercial product information between headquarters and our sales team to ensure products meet customer specifications. As a member of Nye's Semiconductor team, Robert has extensive technical knowledge in lubricants for semiconductor and in-vacuum applications.



**Rob Grizzetti**  
Product Support Engineer

### ◆ How have new regulations surrounding PFOA and PFAS content changed the way lubricants are formulated for semiconductor and in-vacuum applications?

The new PFOA and PFAS regulations have impacted the availability of some raw materials, particularly those containing fluorocarbons. This includes certain PFPE oils, PTFE thickeners, and PTFE-fortified additives. This has necessitated the search for new raw materials that fall within PFOA and PFAS content guidelines. These limitations must be considered when formulating new lubricants without sacrificing the high quality and performance our customers expect.

The key to developing new lubricants is keeping our customer's needs in the forefront. This was the case when we developed NyeClean® 5057. Its purpose was to replace a competitor's fluorocarbon lubricant that is no longer manufactured for reasons including new PFOA/PFAS regulations. Their grease was used in multiple MRO applications in the Semicon industry. This gave us the opportunity to offer a new, PFOA/PFAS-compliant lubricant to, and in collaboration with, industry-leading Semicon OEMs.

◆ **You've been working closely with the semiconductor industry for almost ten years. How have you seen industry requirements change over time?**

I have seen increasing attention paid to reducing outgassing and particle generation. This may be due to the semiconductor industry's motivation to squeeze more nano-logic and processing power into silicon substrates. This has led to the development of Nye's new ultra-low outgassing and low particle generating products for the industry. There have also been realignments in our customer supply chain, especially in Asia, affecting end-use products that include sophisticated robot bearings, linear guides, ball screws and critical O-ring assemblies. Throughout these changes, Nye has worked closely with our customers to continue to move forward to support the industry.

◆ **What affect has COVID-19 had on semiconductor manufacturing and semiconductor suppliers**

Notwithstanding the effects of the pandemic, the procurement and design engineers I have spoken to say their manufacturing and design activities have increased over the last several months. Large manufacturing design centers and their suppliers are busy dealing with anticipated repercussions of new and pending fluorocarbon regulations. The demand for information and delivery of our products has not abated. We expect this trend to continue for the foreseeable future.

◆ **What is your favorite thing about working for Nye?**

I enjoy the challenge of helping to move projects and opportunities through to their completion. Several of these opportunities require significant testing and customer validation. This becomes challenging when there are no off-the-shelf lubricants that meet the requirements of a demanding application. I enjoy the satisfaction that comes when our Nye Team successfully provides a customer with a solution.



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for the last  
update of 2020**  
next month!

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