Nye® LUBRICANTS

LubeLetter

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The World Leader In Synthetic Lubricants

How To Choose The Best Lubricant for Electric Switch Contacts

Sometimes, the importance of proper lubricant selection is a lesson learned the hard way.

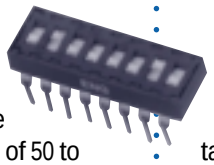
Brian Holley, Nye's national sales manager, cited two recent examples from the automotive industry — problems the Nye team was called in to help solve. After only two years, a lubricant selected for a multifunction switch had dried out, leaving non-conductive residue and premature switch failure in its wake. In another example, a low current/low contact force switch failed because the grease became too viscous at -40°C and the contact simply floated on top of the grease, unable to establish electrical contact.

"Fortunately, neither of these greases were from Nye," Brian said, "but both situations may have been avoided with proper guidance in selecting a lubricant."

Here are some tips on selecting lubricants for sliding contacts — accumulated over the 25 years Nye has been custom-formulating switch lubricants. Use them to help select the best lubricant for your application.

General purpose contact lubricants. Fundamentally, greases for sliding contacts are used to prevent the wear that is associated with any mechanical sliding. Look for a grease with the proper consistency (an NLGI Grade 1 or 2 grease) and good stay-in-place capability. Both are needed to prevent wear. A switch grease's ability to prevent wear is critical. Wear debris creates two problems. It can inhibit current flow when the contact is closed, increasing millivolt (mV) Drop. When the contact is open, conductive wear debris can cause open circuit resistance (OCR) problems. In either case, switch performance is compromised.

Consider the base oil carefully as well. Make sure it will remain fluid at the low temperature range of the operating environment and that it will not evaporate at high temperatures. Look for an evaporation rate below 1 percent after 24 hours at 100°C. Cycle testing at both ends of the operating temperature range is essential. In addition, the viscosity of the base oil should complement the contact force of the switch. Low current/low contact force applications require lighter base oils, typically 10 to 60 cSt at 40°C. High current/high contact force applications benefit from more viscous base oils, in the range of 50 to 250 cSt at 40°C.



Arcing contacts. The temperatures reached in an electric arc are high enough to degrade any organic molecule, so some amount of grease will burn whenever an arc occurs. In selecting a grease for use under arcing conditions, it is important to choose one that will degrade as innocuously as possible, that is, not leave behind residue that will compromise switch operation. Some thickeners and base fluids, the two basic ingredients in every grease, tend to be less carbonizing, or relatively "clean burning." Greases intended for arcing contacts should be formulated with these materials, which degrade with fewer by-products than traditional greases.

For low current/low load applications, a new grease technology should be considered. Traditionally, cleaner burning glycols were used to minimize carbon build-up. A new approach to eliminating problems associated with oxidation is to use non-burning perfluoropolyether-based greases. Dispersed in a non-flammable, ozone-safe, fluorinated solvent, they leave a thin film of lubricant, ideal for low load/low current applications. An additional benefit, this thin film does not attract dust and debris.

Utility switches. Distribution switch gear may remain unactuated for long periods of time, so the lubricant must be oxidatively stable and have excellent stay-in-place capabilities. In addition to a lubricating function, greases for breaker switches also serve as an environmental seal. Typically, look for a higher viscosity than found in a typical switch lubricant. Water resistance is also critical. The high temperatures found in industrial settings or induced by high current flow can also make wide-temperature capability equally important.

Selecting the right grease. General guidelines for selecting a switch grease can at least get you into the right ballpark, but selecting the proper grease for a specific switch application is the real challenge.

"Very subtle differences in grease formulations, which are sometimes counter-intuitive, can result in dramatic performance improvements," said Nye vice president George B. Mock, III, "which means that guidelines are helpful, but practical experience and thorough testing are the final arbiters."

Nye not only manufactures and custom-designs greases for electric switches, it also can pre-qualify lubricants for large volume manufacturers for electric switches. For more information about these products and services or to discuss a lubricant custom designed for your application, call Nye at (508) 996-6721.

Switch Lubricants: Nye Success Stories

Grease	Type	Temp Range (°C)	Application Notes
Rheolube 716A	GP	-54 to 150	Specified by The Big Three automakers for low temp serviceability and high temp stability in critical multifunction switches
NyoGel® 782G	ARC	-40 to 100	The winner in a recent life test against 10 different greases for an auto ignition switch, and the only lube that did not cause an increase in contact resistance
Rheolube 368	DIS	-40 to 125	A proven favorite for years in distribution switch gear
NyeTact 571 H-10	NB	-54 to 225	New non-burning perfluoropolyether grease for all contacts where mV drop and OCR can be a problem

GP = General Purpose; ARC= Arcing Contacts; DIS= Distribution Switchgear; NB=Non-burning Lubricant

A Site for Sore Eyes

You're invited to visit our newly enhanced web site. And don't leave empty handed.

In addition to company, product, and service overviews, the site offers technical notes on choosing lubricants for a wide variety of different applications. It also includes an electronic form which can be used to request product samples. Simply answer a series of questions on screen about your application, send it by e-mail to Nye, and Nye will forward a sample lubricant by mail designed for your application.

For more information on quality synthetic lubricants, visit our site at www.nyelubricants.com. We're open 24 hours a day.

Ausimont Partners with Nye To Reach Hard Disk Market

Ausimont USA, Inc., a world leader in fluorine chemistry, announced in June 1998 that it selected Nye Lubricants as its exclusive distributor of Fomblin® PFPE Lubricants to the hard disk magnetic storage device market in North America. The Fomblin line includes ZDOL, AM2001, and other products used to coat the surface of a disk.

"It is important to note that this partnership is so much more than just a distributorship," Ausimont's North American sales and marketing manager G. Michael Finelli said. "Together with Nye we will be able to offer unparalleled service and support in addition to new and improved products and services...needed for next-generation storage devices."

In this new partnership, "Ausimont will supply the fluorinated functional fluids and Nye will provide the application engineering expertise and broad knowledge of lubricant design and additive technologies," Mr. Finelli added.

The addition of ZDOL to Nye's product offerings means that disk drive manufacturers can now purchase from Nye all the lubricants used in a disk drive. Nye currently manufactures proprietary spindle and ball bearing greases for disk drives. It also sells NyeBar®, a fluorocarbon barrier film that is used to control lubricant migration.

"We also bring a breadth of very specialized technical experience in disk drive manufacturing to the Ausimont partnership," Nye engineering manager David Stone said. "We offer analytical and application testing capabilities, which are now used by some of the world's leading disk drive manufacturers. We believe our ability to customize Fomblin lubricants and design new products will offer a definite advantage to Ausimont's North American customers."

"We also plan to offer ultrafiltered Fomblin products for disk drive customers as a new enhancement of the Fomblin product line," Dave said. "Cutting-edge disk drive technology is less and less tolerant of any type of microscopic contamination in disk drive lubricants. Our clean-room ultrafiltration services can ensure that the Fomblin® ZDOL products continue to meet these more stringent cleanliness standards."

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Designing Miniature? Think Ultrafiltered.

Bill Galary, Nye's laboratory director, doesn't get tired of explaining the difference between filtered and ultrafiltered lubricants. After all, demand for Nye's ultrafiltration services has risen more than 40 percent in the past year — ample evidence that when manufacturers and designers of miniature components learn the difference, they see how ultrafiltered lubricants can improve the performance and extend the operating life of their devices.

Clean vs. super clean. During the manufacture of any grease contamination is inevitable. Carbon byproducts, dust, even tiny metal chips from containers that contain the raw materials used to formulate the grease are just some of the often microscopic particles that can find their way into a grease. Greases can be "cleaned" or filtered to remove these contaminants. Basically, the difference between filtered and ultrafiltered greases is the size and the amount of the particulate matter that remains in the grease after the cleaning process.

Mil-L-81322, for example, is a standard specification for a filtered grease. A Mil-L-81322 grease must have no more than 1,000 particles in the 24 to 74 micron range per cubic centimeter, and none greater than 75 microns. (The largest particle visible by the human eye is 40 microns, about the size of the diameter of a strand of human hair) In contrast, when a lubricant is ultrafiltered by Nye, it is certified to contain no more than 500 particles in the 10 to 34 micron range per cubic centimeter, and none greater than 35 microns — more than twice as "clean" as the Mil-spec grease. Special ultrafiltration procedures at Nye can meet even more stringent standards, eliminating all contaminants greater than 25 or even 20 microns.

One of four *Class 100 MINIenvironments recently installed at Nye.*

"The performance difference is really astounding," Bill commented. "As devices get smaller and smaller, even debris in the 75 micron range can cause a lot of performance problems."

It started with bearings. "Initially, our ultrafiltration service was in response to advances in bearing design," Nye technical director Paul Bessette said. "When bearing manufacturers learned how to make a complement of bearings to within a millionth of an inch of each other, the onus fell on the grease suppliers to provide greases that wouldn't jeopardize bearing run-out, or fatigue life. The grease had to meet a new standard in terms of cleanliness."

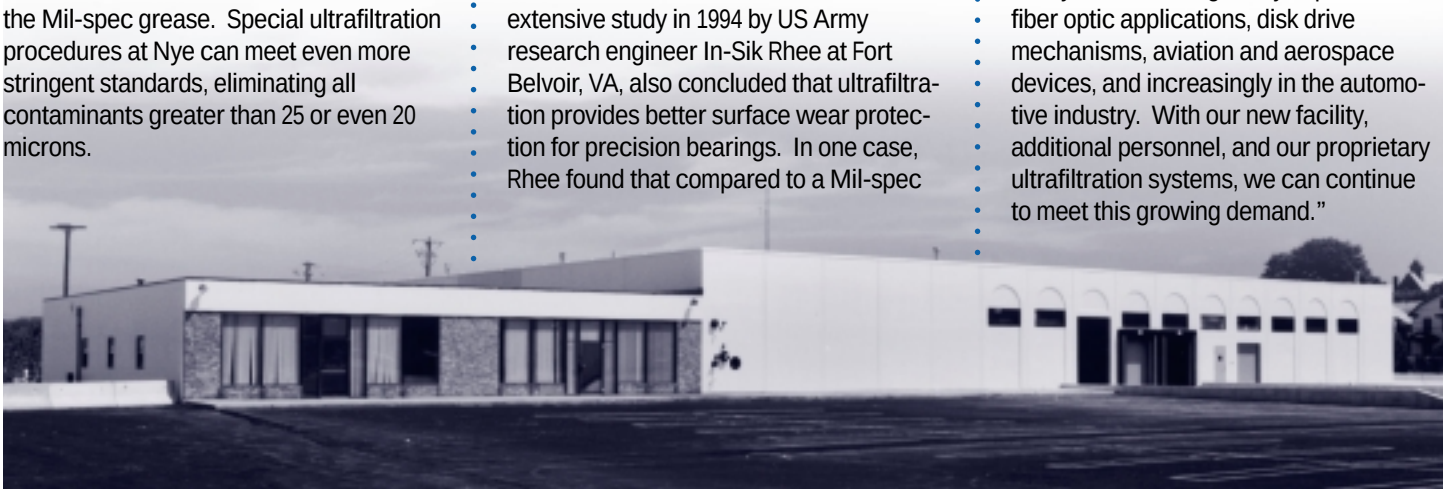
Several studies by bearing manufacturers — about 80 percent of whom now rely on Nye for ultrafiltration services — have demonstrated that ultrafiltered greases reduce vibration, noise, and wear. An extensive study in 1994 by US Army research engineer In-Sik Rhee at Fort Belvoir, VA, also concluded that ultrafiltration provides better surface wear protection for precision bearings. In one case, Rhee found that compared to a Mil-spec "clean" grease, the ultrafiltered version actually extended bearing life by 20 percent.

Fiber optics and switches. Fiber optic gels also benefit from ultrafiltration. These gels, originally developed by Nye, are used in connectors to "splice" fiber optic strands. A short gap was designed into the center of the connector to prevent one fiber from rubbing against the end of the other. The gap is filled with a gel with a refractive index that matches the fiber, to reduce signal loss through reflection or absorption. Ultrafiltration of the gels removes contaminants that would otherwise reflect or absorb light and adversely affect signal transmission.

Micro-switch manufacturers are finding that ultrafiltered greases are an important and cost-effective part of quality assurance. More and more automotive applications, for example, rely on micro switches to send information to a computer. If contaminants cause a switch to remain open when it should be closed, computers receive faulty information and operation is compromised.

Bigger is better. Nye pioneered the commercial availability of ultrafiltered lubricants more than 20 years ago. Nye has continually increased its capacity to provide these super-clean lubricants, including the recent addition of a new Clean Room for ultrafiltration.

"Part of our strategic plan has been to expand and enhance our capability to make specialty clean greases," Nye vice president George B. Mock, III, said. "They are becoming vitally important in fiber optic applications, disk drive mechanisms, aviation and aerospace devices, and increasingly in the automotive industry. With our new facility, additional personnel, and our proprietary ultrafiltration systems, we can continue to meet this growing demand."



Nye doubled its manufacturing space *with the purchase of a 33,000 square foot facility, which houses a Clean Room dedicated to the manufacture and packaging of ultrafiltered lubricants.*

From Sea to Shining Sea

To be able to work more closely with more customers is the driving force behind the addition of three new regional engineering managers to the Nye team.

"Nye has always been known for its willingness and ability to design custom lubricants, and the three engineers who recently joined us will enable us to introduce our unique one-on-one brand of service to many more customers — coast to coast," Nye vice president George Mock III said.

Robert Magill opened Nye's first California office. Bob brings more than 25 years of experience in the electronics and semiconductor industries to Nye. For 10 years, he managed electronic hardware and RF semiconductor design and development projects. For the last 15 years, Bob took his engineering expertise into the sales management and marketing arena, focusing on both OEM and distribution sales within the RF semiconductor and component market. In addition to providing service to Nye's West Coast customers, Bob will also continue to introduce Nye's products to other Silicon Valley companies, especially those in the fiber optics and magnetic recording medium industries.

Brian Cichoski became the fourth regional engineering manager at Nye's Detroit office, whose primary focus is the automotive industry. Prior to joining Nye, Brian was no stranger to automotive manufacturing. He was a sales engineer for a company that represented 10 manufacturers of electrical mechanical components designed for the Big Three and their suppliers. Brian looks forward to offering "technical solutions, not just products" to his customers at Nye, he said.

Back in Massachusetts, Dan Shea recently joined the Nye team as the second regional engineering manager for Nye customers throughout New England and eastern New York. With a degree in chemical engineering and more than 15 years of field experience in the US and Japan, Dan brings an extensive background in polyester film and reprographic products to Nye, where he now enjoys "a more dynamic and diverse customer base and product line," Dan said.

Nye's three new regional engineering managers pause for a photo at the Company's recent quarterly meeting. Brian Cichoski joins the Detroit office; Robert Magill will man Nye's new West Coast office; Dan Shea works out of Nye's home office in Fairhaven, Massachusetts.

New Reference Book For Design Engineers

Technical director Paul Bessette and engineering manager David Stone of Nye Lubricants contributed the chapter "Liquid Lubricants" to a newly published reference guide, Space Vehicle Mechanisms: Elements of Successful Design, edited by Peter L. Conley.

"Liquid Lubricants" discusses base oil technology, synthetic grease design and performance, test methods, volatility and lubricant migration, and lubricant compatibility with elastomers and plastics.

"While the book is written from the vantage point of aerospace requirements, it gives excellent insights into the subject matter, which makes it relevant for design work in many industrial settings," Dave said.

The book also contains chapters on materials, including stainless steel, structural composites, spring materials, and solid lubricants; components, including ball bearings, electric motors, and slip rings; and testing, including structural, thermal, and reliability tests.

In his preface, Mr. Conley notes, "Although somewhat disguised as a technical reference, this is really a book about design, and the design freedom that can result only from knowledge of both the mechanism and its place in a complex system."

Space Vehicle Mechanisms ($99 plus shipping and handling) can be ordered by mail or phone by contacting Stephanie Friedman, John Wiley & Sons, 605 3rd Avenue, 4th Floor, New York, NY 10158, Tel: (212) 850-6306. VISA accepted.

Nye® LUBRICANTS

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