Nye® Lubeletter

The World Leader In Synthetic Lubricants **Volume 27 Number 2**

Nye Unveils UniFlor™ and Global Mission for Performance Lubricants

UniFlor™ is more than the new trademark for Nye's fluorinated oils and greases. It's an epithet for the Company's plan to become the world's leading supplier of fluorinated lubricants within the first five years of the new millennium.

UniFlor isn't a battle cry or a line drawn in the sand, however. Nye has chosen a strategy as unique as the perfluoropolyether (PFPE) polymers that make up a fluorinated lubricant: cooperate rather than compete with manufacturers of PFPE fluids. The strategy is already being implemented. Nye is now purchasing and stocking PFPE fluids from PFPE manufacturers around the world. By doing so, it has positioned itself to offer the world's most extensive line of PFPE lubricants — as well as custom-formulation capabilities no other synthetic lubricant company offers. Whether customers need an off-the-shelf PFPE grease to quiet squeaky plastic parts in a dashboard, an original PFPE oil for a precision bearing in a satellite, or any type of PFPE raw material, they can find it under the Nye UniFlor banner.

"The timing is right," said Nye executive vice president George B. Mock, III. "Highly engineered devices in almost every industry are getting smaller, faster, lighter, and hotter — and the use of plastics is proliferating. All these design parameters underscore the need for PFPEs."

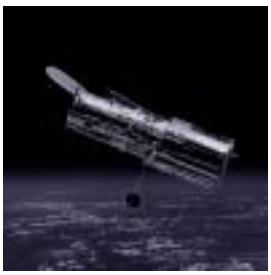
"UniFlor represents more than 25 years of PFPE experience, an extended family of proven PFPE products, and direct access to each of the world's PFPE fluids," George added. "Our goal is to make UniFlor a 'household word' among design engineers — and an integral part of any component that needs to perform long and well in severe environments."

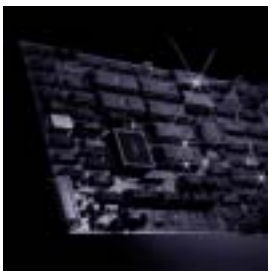
The PFPE world. PFPEs are the jewels of synthetic lubricants. Chemically, they are polymers, composed of carbon, fluorine, and oxygen. Tribologically, they're near-magical. Thermally and oxidatively stable, PFPEs withstand temperatures to +250°C, are nonflammable, and resist harsh chemicals, fuels, fuel oil, and brake fluids. They're also safe for use on plastics and elastomers.

While all PFPEs share these general characteristics, each PFPE manufacturer produces a unique PFPE molecule, the result of different base materials and polymerization processes. Consequently, each type of PFPE fluid has a different pour point, low temperature capability, volatility, viscosity, and Viscosity Index — all critical considerations in the field of lubrication. By stocking all types of PFPE fluids, Nye can choose the most appropriate fluid — or even blend two different fluids — to formulate the best lubricant for the application at hand. Proper base fluid selection and formulation are two critical areas where Nye's long history in the world of PFPEs serves as a real advantage for the customer.

The experience advantage. Nye's experience with PFPEs stretches back to 1974 when the Company offered its first fluoroether grease, just a few years after PFPEs entered the lubrication arena.

UNIFLOR™
Performance To The Limit




New Brand, Proven Products. *Formerly called Nye Fluoroether Grease or Nye Fluoroether Oil, the UniFlor brand already has more than 75 proven fluorinated lubricants. They're used in dozens of automotive applications, space vehicles, precision and high-temperature industrial bearings, wide-temperature electrical connectors, office equipment, and home appliances. For more information about UniFlor, contact Nye at 508-996-6721.*

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In fact, Nye was the first company to have a complete family of fluorinated greases qualified under military specification. Since that time, the Company has worked closely with design engineers from every industry that uses PFPE lubricants. Early on, it developed fluorinated lubricants for precision bearings in aviation and aerospace applications. It made an early debut in the telecommunications industry with a fluorinated grease for DIP switches on circuit boards. Hydrocarbon-based greases were being ravaged during a solvent bath; the PFPE grease by Nye solved the problem.

In the automotive industry, Nye designed PFPE bearing greases for some of the first exhaust pumps for lower emissions. Soon after, it formulated a brake-fluid-resistant PFPE grease that is still specified by major manufacturers for antilock braking systems. Today, more than a dozen automotive components — among them, switches, connectors, potentiometers, sensors, and gear boxes — use PFPE lubricants by Nye.

More recently, Nye has added its PFPE greases to home appliances: latches and turntables in microwave ovens, hand-held professional hair dryers, and timer switches in washing machines and dishwashers. And three years ago, Nye successfully introduced NyeCorr, a PFPE grease thickened with polytetrafluoroethylene, to the corrugating industry — to make sure critical, high-temperature bearings last the life of the rolls in single facers, the machines used to press the flutes into paperboard.

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New brand, new challenges. While UniFlor™ is a new brand name, Nye's PFPE product line is hardly new. It consists of more than 75 tested and proven lubricants the Company has designed over the last
25 years for: gears, slides, ball and lead screws, rolling element and sintered bearings, control cables, switches, connectors, sensors, and potentiometers.

There are new UniFlor products, however. With the UniFlor introduction, Nye is unveiling a new category of products, formulated from a PFPE base fluid that has not been actively marketed, even by its manufacturer. Called the UniFlor 8700 Series (see table), these PFPE lubricants are designed specifically for wide-temperature, high-load, metal-on-metal applications.

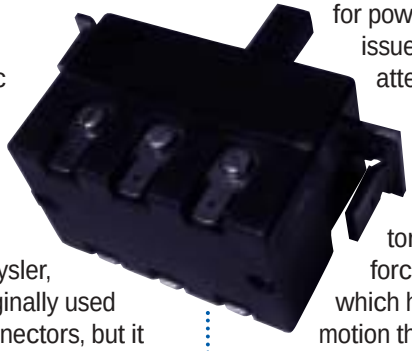
With a full line of PFPE lubricants, the challenge now is not aggressive product development. It's helping more engineers understand the utility of PFPE lubricants for demanding applications — and the advantages of working with Nye.

"Our UniFlor strategy is simple: let people do what they do best," said Nye president and CEO Dr. Gerald I. Madden, who has been active in the technology and development of PFPE lubricants for more than 15 years. "The companies that manufacture the PFPE base fluids do something we can't do. And they do it well. Nye's expertise is in formulating, pre-qualifying, and marketing PFPE oils and greases. Working together is a win-win situation. We both sell our products. More importantly, we make life easier for customers, who can now get both the raw material best suited for their application and extensive lubricant design experience from a single source."

A Quick Glance at Nye's UniFlor Family of Fluorinated Oils and Greases

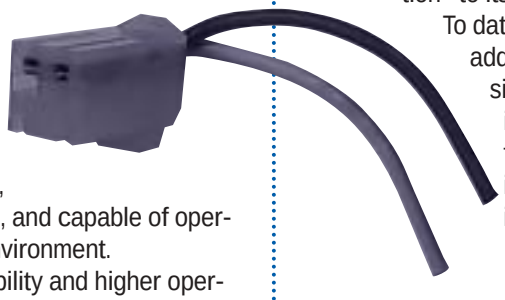
UniFlor Series	Service Temp. (°C)	Base Oil Visc. @40°C (cSt)	Base Oil Pour Point (°C)	Base Oil Visc. Index	Typical Applications
8100	-54 to 250	25 to 400	-56 to -28	105 to 150	Multipurpose, economical, PFPE lubricant for gears, slides, light-duty bearings especially when wider temperature and plastic and elastomer compatibility is required
8500	-54 to 250	65 to 230	-60 to -41	178 to 255	High-speed, high-temperature PFPE bearing lubricant that performs exceptionally in low-temperature, low-starting torque applications
8600	-20 to 250	345 to 510	-25 to -20	135	Wide-temperature, viscous lubricant or sealant for industrial bearings and vacuum applications
8700	-70 to 250	25 to 200	-75 to -53	150 to 210	Wide-temperature, high-load PFPE bearing lubricant with ultra-low volatility that offers excellent resistance to oxide-induced catalysis
8900	-90 to 250	90 to 355	-90 to -63	303 to 360	Extreme-temperature PFPE lubricant for very small, delicate precision instruments, sensors, potentiometers, actuators, and bearings where low-temperature and low torque are critical design parameters

Temperature, Insertion Force Drive R&D for New Connector Lube



For more than 10 years, NyoGel 760G — a salt-water resistant, synthetic hydrocarbon grease by Nye — has been a lubricant of choice among automotive connector manufacturers. Approved by DaimlerChrysler, Ford, and GM, it was originally used to lubricate tail lamp connectors, but it has since found its way into ECM, speed sensor, EGR, air bag, starter and more than 50 other connectors.

One major change that has affected automotive connector lubrication since NyoGel 760G was introduced in the late 1980s is the proliferation of connectors on or near the engine block. NyoGel 760G's high-temperature limit of 125°C disqualifies it for such applications. Consequently, Nye engineers set out to develop a new automotive connector grease, one that is economical, plastic-compatible, and capable of operating in a 150°C environment.



Plastic-compatibility and higher operating temperatures are fairly easy goals to reach using perfluoropolyether (PFPE) base oils, which can survive temperatures as high as 250°C and do not attack plastics and elastomers. However, since PFPEs aren't the most economical solution, Nye began experimenting with several new synthetic hydrocarbon fluids. Recently, by combining a group of antioxidants, a thickener, and a new synthetic hydrocarbon oil, Nye has created a very promising experimental connector grease for hot, underhood applications. In thermal gravimetric laboratory tests, the new grease has shown very little degradation under 500 psi of pure oxygen — nearly doubling the life of NyoGel 760G.

At about the same time that these experiments were being conducted, a major connector manufacturer asked Nye to work with them to develop a connector grease to reduce insertion/withdrawal forces for power connectors — an issue that is also gaining attention in the automotive industry. More aware of the problems of fretting corrosion, manufacturers of tin-lead connectors are boosting the spring force of pins and blades, which helps prevent the micro-motion that leads to fretting corrosion. However, higher spring force makes mating more difficult. In fact, the force required to mate some multi-pin power connectors raises OEM — and OSHA — concerns about carpel tunnel syndrome.

Well on its way to a new connector grease, Nye engineers are now seeking to kill two birds with one grease — by adding "significant insertion force reduction" to its new grease agenda. To date, special lubricity additives are producing significant reductions in the coefficient of friction, but some blips in contact resistance in accelerated testing by the connector manufacturer still need to be resolved.

Nye expects to selectively distribute the experimental grease in the first half of 2000 for beta testing, aiming for a new product release by the end of the year. Companies interested in more information about this or other connector greases may call Nye electrical engineer Kevin Akin at (508) 996-6721.

New Awards, Upcoming Presentations

The National Lubricating Grease Institute (NLGI) recently named Nye Technical Director Paul A. Bessette the recipient of its Clarence E. Earle Memorial Award for "The Influence of Grease Thickener on Apparent Viscosity of Lubricating Greases," a paper Paul presented at the 1998 NLGI annual meeting.

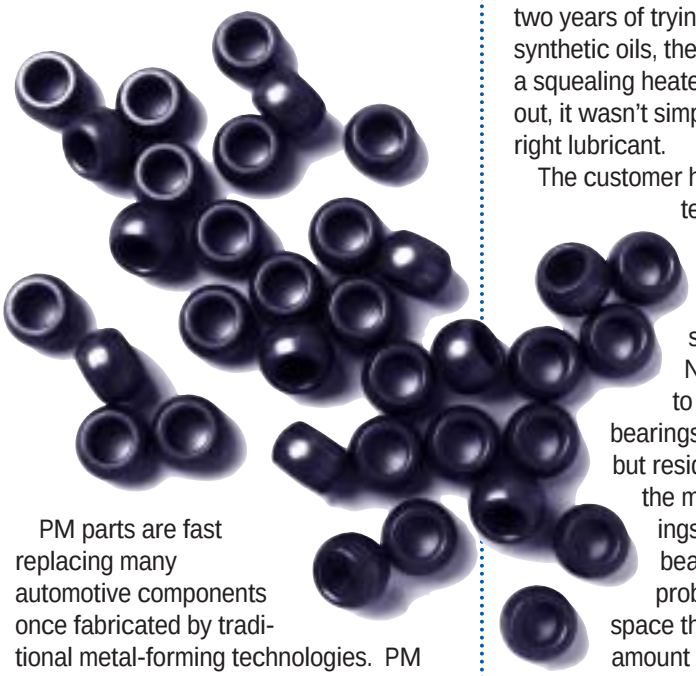
The award was conferred in October in Tucson, Ariz., where Paul presented another paper, "The Development of An Improved Contact Lubricant Based on a Six-Ring Polyphenyl Ether," an exposition on the development Rheolube 523H2-UV, a new noble-metal connector lubricant Nye introduced in 1999.

In a related development, David Stone, engineering manager of Nye Optical Products, was accepted as a presenter at Photonics West, North America's largest optoelectronics event, to be held at the San Jose Convention Center from January 22 to 28, 2000. Dave will offer a "poster session" on the engineering qualities of optical gels. Nye will also exhibit in the LASE Pavilion at Booths 1346-1348.

Paul A. Bessette, Technical Director

Getting Most Out of Sintered Bearings Starts With What Goes In

The list reads like a Who's Who in the automotive industry: BMW, Daimler-Chrysler, Fiat, Ford, GM, Honda, Nissan, Volkswagen, Volvo — and first-tier suppliers Bosch, Delphi, Valeo, and Visteon. What do they have in common? They're all customers of one of the world's leading manufacturers of powdered metal (PM) components.



PM parts are fast replacing many automotive components once fabricated by traditional metal-forming technologies. PM gears, connecting rods, impellers, flanges, bearings, and hundreds of other parts are now found in engines, transmissions, pumps, cockpit accessories, steering, brake and suspension systems. Why? Design engineers realize that powdered metallurgy is one of the most cost-effective ways to mass produce long-lived, simple or intricate metal parts with excellent dimensional accuracy.

Spotlight on bearings. Powdered metal or sintered bearings get special attention at Nye because of the unique lubrication issues they present. One of the earliest PM applications, sintered bearings are porous, so they can be filled (in a vacuum chamber) with a lubricant. In theory, the heat from the rotating shaft causes the oil within the bearing to expand to the shaft/bearing interface, where it reduces friction and prevents wear. Sometimes, however, theory doesn't match practice.

Case in point. One first-tier automotive supplier sent Nye a complement of sintered bearings for an HVAC motor. The customer wanted an oil that would lubricate and dampen noise, particularly during cold-temperature start-ups. After two years of trying a full range of synthetic oils, the manufacturer still had a squealing heater at 10°F. As it turned out, it wasn't simply a matter of finding the right lubricant.

The customer had noted that the sintered bearings sent to Nye were "dry," that is, not lubricated. However, through a soxlet extraction process, Nye was able to remove oil from the bearings — not lubricating oil, but residual process oil used in the manufacture of the bearings. Process oil left in the bearings can pose two problems. First, it takes up space thereby reducing the amount of lubricant the bearing can hold. Ideally, you want as much lubricant as possible in the "self-lubricating" bearing. Worse, if the lubricant of choice is a polyalphaolefin, ester, or polyglycol, the process oils, with their poor thermooxidative stability, exacerbate degradation of the lubricant.

Nye, therefore, recommended more than a lubricating oil for the sintered bearing. It recommended a complete impregnation process: extract process oils; use a linear perfluoropolyether oil as the lubricant to assure good low-temperature performance; impregnate the bearing in a vacuum chamber for 24 hours @ 100°C to ensure a full complement of oil within the bearing; and minimize or eliminate post-impregnation centrifuging, which not only removes surface oil but may remove oil from within the bearing as well.

Using sample bearings impregnated under these guidelines at Nye, the customer eliminated the low-temp noise problem — and easily met life expectancy requirements. Nye is now consulting with the customer's bearing manufacturer about the prescribed impregnation process.

A service is born. "Sintered bearings present a unique subset of issues when it comes to lubrication," said Nye technical director Paul A. Bessette. "While we don't want to get into the business of bearing impregnation, we do feel we can help customers by developing a process that works!"

To begin the process, Paul recommends sending 50 to 100 bearings to Nye, along with a detailed description of the application, operating environment, and life requirements. Nye will recommend an oil and outline an impregnation process that optimizes the life and the performance of the bearings. The process can then be adopted with confidence by the bearing manufacturer.

Nye Earns QS-9000

With its recent upgrade to QS-9000/ISO 9001, Nye Lubricants can now proudly display its registration to its automotive customers.

"This is just part of our ongoing commitment to the automotive industry," said Nye quality manager Tom Gray. "The Big Three require QS-9000 of Tier One suppliers, and Tier One companies want their vendors to understand QS-9000. We couldn't think of a better way to understand it than to earn it."

Registered with the British Standard Institute, Nye is one of only two synthetic lubricant companies in the United Sates to hold this automotive seal of approval. Next step, Tom is already reviewing requirements for ISO/TS-16949, a new world-wide quality system announced this year.

Nye®

12 Howland Road Fairhaven, Massachusetts 02719 USA
Phone 508-996-6721 Fax 508-997-5285 E-Mail techhelp@nyelubricants.com

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