



Lubeletter AUTOMOTIVE

The World Leader in Synthetic Lubricants

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Nye Revs Up Application Testing Services, Seeks New Partnerships

Nye Lubricants is seeking new opportunities to work closely with customers to qualify custom lubricants for challenging applications.

"A value we bring, particularly in the automotive industry, is our ability and willingness to roll up our sleeves and work with design engineers to formulate lubricants that solve problems," Nye president George Mock said. Where we can really set ourselves apart is by sharing the test burden, and coming up with pre-qualified candidates. This shortens the design cycle and saves customers money — and warranty costs down the road."

Nye is currently working with a Tier One switch manufacturer, conducting lubricant tests with a test rig designed by the customer (See Page 2). Exploring similar partnerships, Nye's application engineering manager Kevin Akin visited several First Tier switch and terminal manufacturers in February to exchange ideas.

Nye's mechanical engineers are engaged in an ongoing, ball-joint R&D project. Working with both OEMs and their suppliers, Nye is testing several experimental ball joint greases — with some interesting findings (See Page 3).

Engineer Tracy Montour joined Nye's R&D team in March 2000 to expand the Company's capacity for application



testing. Nye plans to hire yet another applications engineer this year. Tracy has worked on formulating a grease that squelches the noise made by a seat massager, a luxury option from a European automaker. She has also helped pre-qualify greases for clutch bearings, adjustable brake pedals, and steering columns, as well as an oil for sintered bearings in an HVAC motor. In addition, she is part of a team that is completing work on a new line of damping greases, a special category

of grease that automakers now use to control free motion and noise in more than 30 automotive parts. Nye's new generation of damping greases targets high-shear, high-load applications, where current damping greases tend to be short-lived.

"Application testing does more than help our customers," George added. "It makes us better suppliers. When we are involved first-hand in industry design issues, the more knowledge we bring to lubricant design."



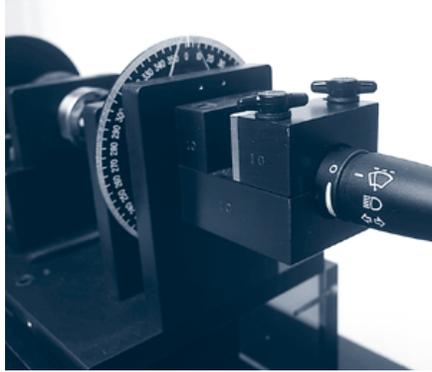
Nye Revs Up Switch Testing

Capabilities to Pre-Qualify Switch Lubricants Keep Expanding

Since the early 1980s when many switch manufacturers began turning to synthetic lubricants for wide-temperature capabilities, Nye has been testing switch lubricants to ensure they meet customers' requirements. Typically, customers send new switches to Nye, and Nye sends samples of pre-qualified lubricants back to the customer for final testing and selection.

Nye has offered actuation life-testing and environmental tests for automotive switches for more than 20 years. In 1994, Nye expanded its testing capabilities with the installation of a menu-driven Data Acquisition System that conducts a broad range of electrical tests under simulated operating environments.

Force testing. More recently, Nye purchased a proprietary test stand to help gather data a Tier One supplier needs to satisfy OEM requirements. The rig measures the force required to actuate multifunction switches, which control headlamps, directional signals, as well as the steady and intermittent speeds of windshield wipers. The test is a critical part of the design process because the force required to operate a switch is specified by the OEM — and is directly related to the type of lubricant on the detents. If the lubricant is too stiff, the torque requirements may be too high. Tests are conducted at different temperatures, because temperature affects grease performance. Even a relatively soft grease can be problematic at colder temperatures, when the viscosity of base oils thickens, driving up torque requirements. At high temperatures, the resistive heat inside a multifunction switch can deform plastic detents just enough to cause stiction — a problem that can be resolved by milling high-



Nye purchased this proprietary test stand to measure how much lubricants reduce the force required to actuate multifunction switches.

temperature lubricity additives into the grease to coat plastic surfaces.

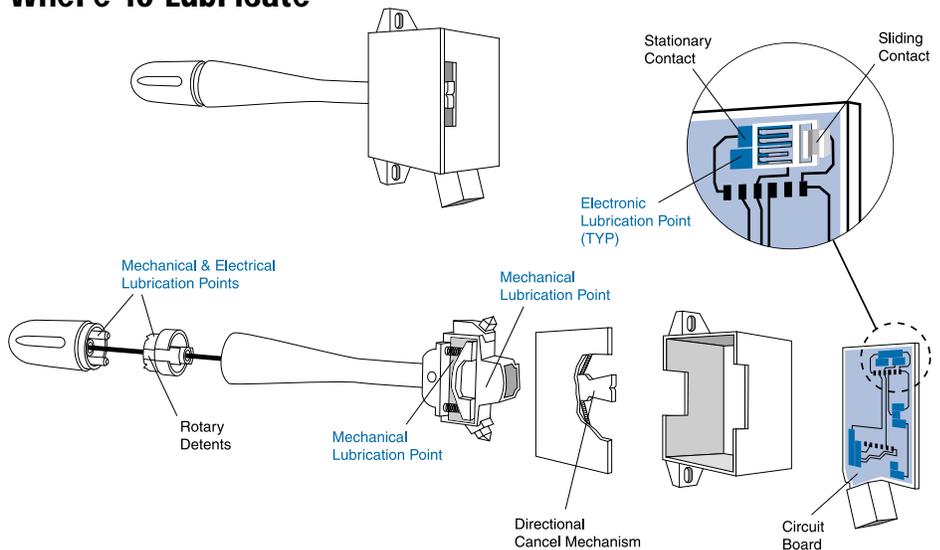
"The partnership improves our ability to recommend the right lubricant and reduces the time it takes the customer to specify a lubricant — a win-win opportunity for both companies," said Nye's application engineering manager Kevin Akin. "This is exactly the kind of long-term partnership we want to form with other major automotive suppliers."

Sound and Future. Aware that noisy plastic parts signal perceived quality problems, Nye plans to add noise testing to its menu of services. With new, sensitive sound meters, Nye will be able to measure a grease's effect on the acoustical performance of switches and other components.

Nye already has its next switch tester on the drawing boards — one that will test switch lubricants before the customer develops a prototype.

"We are hoping to make a modular switch tester that allows us to manipulate contact geometries, contact modes, contact force, loads, voltages, amperages, and contact plating systems based on a customer's design specifications. The test stand will use coupons, not actual switches, to simulate the switch and its operating environment. Theoretically, lubricant design and switch design can go on simultaneously and interactively, shortening design cycles and producing a better end product," Kevin said.

Where To Lubricate



Switch contacts and mechanical components require lubricants to prevent wear and ensure long life. The "mechanical lubes" can also damp noise and impart a "quality feel" economically.

Nye Revs Up Ball Joint Testing

In Search of The Perfect Ball Joint Grease

Sometimes ball joints swivel smoothly and quietly for years in spite of salt water, road grime, and thousands of miles of jarring jolts. Sometimes they don't. Last summer alone, two OEMs issued recalls for ball joint problems and, according to Nye's national sales manager Brian Holley, "Every ball joint manufacturer we've contacted in the past year has said, 'Please help.'"

Tough job. Tribologically, ball joint lubrication is a challenge. Unlike a ball bearing where rolling elements move in one direction lubricated with a generous amount of grease, the tight-fitting, ball-and-socket joint is subject to angular motion in nearly every direction with comparatively little room for grease. When the ball does move in the socket, the pressure against the cup forces grease out of the interface, placing extra demand on the thin lubricant film that remains.

Three years ago, a supplier of ball joints to Ford tested Nye's Fluorocarbon Gel 880, a wide-temperature, water and salt-water resistant grease that has been specified by OEMs since in the late 1980s for parking brake cables. With Fluorocarbon Gel 880 ball joints survived a bench test of 4.5 million cycles and still felt like new. Though specified, the grease was not home free. In the field, Ford reported a "popping" sound from the ball joints. Of note, the popping was a "perceived quality" issue, not a safety problem.

Back to the lab. Working with Ford, Nye began a study of the popping problem. An infrared investigation of the grease from a used ball joint revealed that some of the grease applied to the rubber seal to help keep contaminants out and Fluorocarbon Gel 880 in, had infiltrated the socket,



Nye has used the Instron 5566 to pre-qualify lubricants for master cylinders, steering columns...and now for ball joints (inset). The Instron performs tensile, compression, shear, peel, tear, flexural, and other tests on a wide variety of materials and components.

which could compromise ball joint operation.

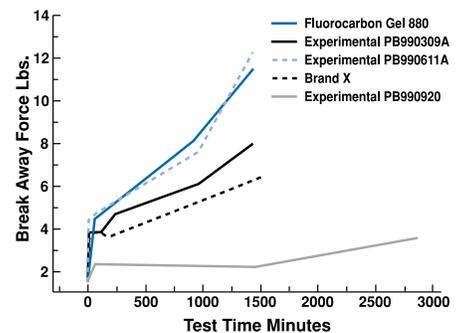
More importantly, studies show that the popping sound is related to how long a ball joint remains idle before actuation. If the ball joint is continually actuated, there is no popping. Letting the ball joint stand overnight, as it would in an owner's garage, changes that. A study using an Instron 5566, a tension/compression test system, showed that break-away force increases with standing time: The greater the break-away force, the more likely the ball joint is to "pop." A force displacement curve shows that a high initial break-away force that quickly drops to a level well below the peak yields an audible "pop." If the load drops off more gradually, however, there is no pop. Notably, the break-away peak and its drop-off level are a function of the lubricant (as well as cup force and standing time).

Tentative conclusions. With a better understanding of these dynamics, new ball joint greases can be tailored more precisely to operating conditions. For example, compared to other ball joint

greases, Nye Experimental Grease PB990920 virtually flattens the break-away force vs. standing time curve (See Figure 1), which eliminates the peak-and-sudden-drop condition that causes the popping.

Experimental ball joint greases by Nye are now being tested by manufacturers. Companies who want to participate in this "search for the perfect ball joint grease" should contact Brian Holley in Detroit at 248-597-0077.

Stopping the Popping Figure 1.



A new experimental grease by Nye, PB990920, significantly reduces break-away force, one factor that produces a "popping" sound when actuating ball joints that have been idle for an extended period.

New Higher-Temp Ester Greases

Rheolube 716HT, the first of a new generation of ester greases, contains a proprietary antioxidant that pushes the grease's upper temperature limit to 175°C — 25 degrees higher than traditional ester greases.

Rheolube 716HT is an NLGI Grade 2 blend of complex esters gelled in a lithium soap with a useful temperature range of -54°C to 175°C. It is fortified to reduce noise and wear and contains a UV-tracer to facilitate inspection during production. It can provide a very economical and more robust alternative to perfluoropolyether greases, which used to be the only option for temperatures in excess of 150°C for an extended period. While PFPEs can survive temperatures up to 250°C, they



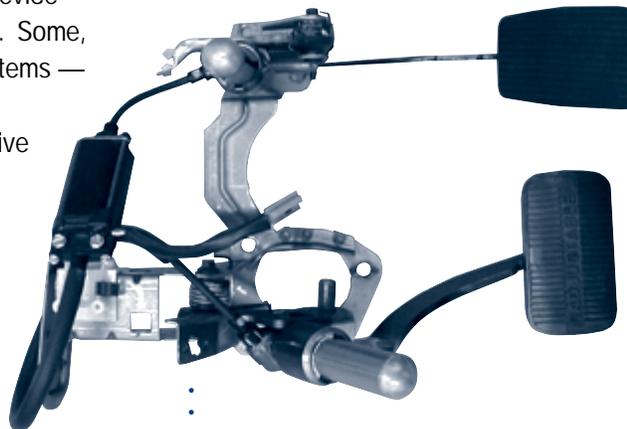
Rheolube 716HT provides the high-temperature capability needed to pass 3X life-cycle testing for multifunction and headlamp switches.

can be overkill for some applications. PFPEs also don't mix as well as esters with antiwear additives, nor do they stand up as well under heavier loads.

New Grease For Pedal Positioning Systems

Every new mechanical device deserves its own grease. Some, like adjustable pedal systems — a new technology that earned Teleflex Automotive Group a PACE Award in 1999 — deserve two.

Adjustable pedal systems, powered by a single electric motor, typically travel about three inches along a shaft from a full-forward to a full-back position. The shaft as well as a spring, which returns the pedal to zero position, require a grease to prevent wear and ensure smooth, quiet performance across broad temperatures for the life of the device.



***Safety and Comfort.** Most experts recommend drivers position themselves at least 10 inches from the steering wheel air bag, and adjustable pedals, like the one by Teleflex Automotive Group, enable persons shorter than 5 feet, 2 inches as well as pregnant women to create that critical safety distance.*

Nye's new Rheolube 365F fills the bill. It's a lithium-soap, synthetic hydrocarbon grease with special lubricity additives, antioxidants, corrosion inhibitors, and an operating temperature range of -40°C to +125°C. It's also tacky enough to stay put — and not drip on carpeting.

NyoGel 774, a damping grease, is used on the device's plastic gears and cables to reduce mechanical noise.

Rheolube 365F and NyoGel 774 are available in a variety of containers from syringes to drums. Evaluation samples are available for qualified customers.

Nye Welcomes Leah to "Major League"



When Leah Karibian moved from a position as account manager for Coca Cola Bottling Company of Michigan to John McCarthy and Associates, where she sold adhesives and woven fabric to DaimlerChrysler and several automotive suppliers, she said she knew she had moved "from the minor to the major leagues." Leah joined Nye's team as its fifth automotive engineering manager in March 2000, and her familiarity with auto interiors makes her a natural with First Tier OEM interior accounts. Leah's e-mail address is karibian@nyelubricants.com.



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