

Lubeletter

Synthetic Lubricant News from Nye Lubricants, Inc.



Nye is planning on introducing its new very low outgassing lubricants at **Semicon-West 2010** in San Francisco, CA from July 13-15. Come visit us at Booth 6175.

NyeClean™ 5060 has received NSF H1 Food Grade approval. The registration number is 142528.

Robert Grizetti is the latest addition to Nye's team of engineers in Technical Support. He is a Chemical Engineer from the biotech industry and will be supporting our customers and Channel Partners in the European market.

Product Releases:

Fluorocarbon 868MS-X - PTFE thickened, light viscosity, synthetic hydrocarbon grease for automotive and industrial components which require a very light tack and minimal change in damping characteristics with temperature

OCK 451-LPC - Version of the OCK-451-LP with an cohesion additive to allow the gel to have a stronger bond with the lens and the LED.

NyoGel® 670-G3 Yellow - A silica thickened, medium viscosity, synthetic hydrocarbon grease intended for sliding, bearing and gear train applications - Dyed version to aid in production.

NyeTact® 561J-20-AG - Dispersion with a silver passivator additive created to prevent tarnish and corrosion of silver plated connectors.

AND-757 - Diester and lithium soap grease for gears, speed reducers, slides, cams, pulleys, conveyors, cables, springs, actuators, business machine, electrical switch, and electrical contacts.

Synthetic Gear Lubricants Gone Green

With the Global Industry moving towards environmentally friendly "Green" lubricants some very challenging issues have been created for lubrication in gearing applications. Over the last decade gears have been pushed to design limits as they are required to run at higher speeds, heavier loads, and for longer periods of time. Along with new materials and improved manufacturing processes, Synthetic Lubricant Technology has helped to achieve these higher industry expectations.

Synthetic lubricants have found a home in the gearing industry based on several important advantages they have over conventional petroleum lubricants. While both petroleum lubricants and polyalphaolefins (PAO) are derived from hydrocarbon feedstocks, PAO is synthesized to a specific molecular weight range and processed to remove any impurities. This process imparts several intrinsic properties onto the PAO like reduced volatility and a lower pour point. These two properties improve both the high and low temperature capabilities as they lower the evaporation and increase the lubricant's functionality in colder environments (key to automotive gearing applications). In the power tool industry great advances have been made by using synthetic lubricants as they have been able to optimize the motor efficiency because of the reduced internal drag. This allows for lower wear on the gear and an extended operating life for the tool.

Predicting Gear Performance and Wear

The thoughts often heard from Gear Design Engineers are that they would really like some way to predict how a lubricant will work in their application. Outside of the FZG gear tests, which are very expensive tests, there are not many industry focused test methods that can provide "hard" data for gearing applications outside of testing an actual gearbox.

This is where one of Nye's strengths lies as we have a long history of performing application and pre-qualification testing for customers. Our applications group is made up of

design engineers from a variety of industries which provides us with the ability to develop new test equipment and methods to help service our customers. Through the use of an SRV 4 Tribometer from Optimol Instruments we have developed a method that simulates the FZG test conditions.

Green Lubricants: Conventional, Synthetic, and Future Trends in Lubricants.

Synthetic lubricants have shown that they offer better wear protection, last up to five times longer, and have less probability of creating carbon deposits than petroleum products. They also have higher viscosity indexes which are an indication of how the fluid viscosity characteristics of the oil will change across a temperature range. The major synthetic lubricant families that have been used in modern gearing applications include PAO, Ester, Polyglycol, Polyphenylether (PPE), Silicone, and Perfluoropolyether (PFPE). Each of these lubricant families has specific attributes.

Most of these lubricants do not readily biodegrade (see Figure below) and would not be considered "Green". Synthetic Esters however, do have very good biodegradability as well as low toxicity which makes them desirable as a "Green" lubricant.

Figure: OIL BIODEGRADABILITY

Type of Oil	Percent Biodegraded
Mineral Oil	15-35%
White Mineral Oil	25-45%
Natural & Vegetable Oil	30-100%
PAO	5-30%
Phthalate Ester	5-80%
Trimellitate Ester	5-80%
Polyol Ester	55-100%
Diester	55-100%
Complex Ester	80-100%

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Synthetic Esters offer an alternative to conventional oils with strong environmental benefits such as biodegradability and renewability. They are synthesized through a chemical reaction of an alcohol and a fatty acid. The characteristics of the Synthetic Ester, such as Viscosity, Pour Point, Lubricity, and Oxidative Stability, can all be altered and controlled through the selection of the alcohol and fatty acid.

One of the great strengths of esters is that they have very high polarity (affinity for metal) which separates them from Mineral Oils and PAO's, both of which are very non-polar. Polar lubricants are very effective in the Boundary lubricant regime as they tend to form strong bonds with metal surfaces which will reduce friction and wear.

To further improve on the environmentally friendly nature of Ester lubricants, advances have been made to reduce their global impact. Through these improvements, increases in biodegradability, very low toxicity, and clean emissions have resulted. These new fluids are called Complex Esters and look to be the future of synthetic lubricants for many applications including gearing.

Complex esters are comprised of alcohol end-capped complex fluids that typically contain a monofunctional acid and alcohol. Even in the highest viscosities these fluids still offer 80%+ biodegradability using the CEC Test (done in water for 28 days or until CO2 evolution plateaus). Other advantages include good load carrying capability, excellent Viscosity Indexes, and low Pour Points. Because complex esters are shorter chained molecules (even for high viscosities) they tend not to shear into smaller molecules which means they will provide a consistent lubricant film strength.

Overall, the flexibility of Ester lubricants fits right in place with both the demanding gearing applications of tomorrow and the "Green" needs of the future. Nye has been hard at work on new developments in this area using Synthetic and Complex Esters including some new grades which are FDA approved for H1 Incidental Food Contact. With all of these new technologies and the innovation that Nye has illustrated since 1844, we look forward to the future and how we can help the gearing industry with their lubrication needs.

Bridging the Gap between Hydrocarbon and Perfluoropolyether Connector Greases

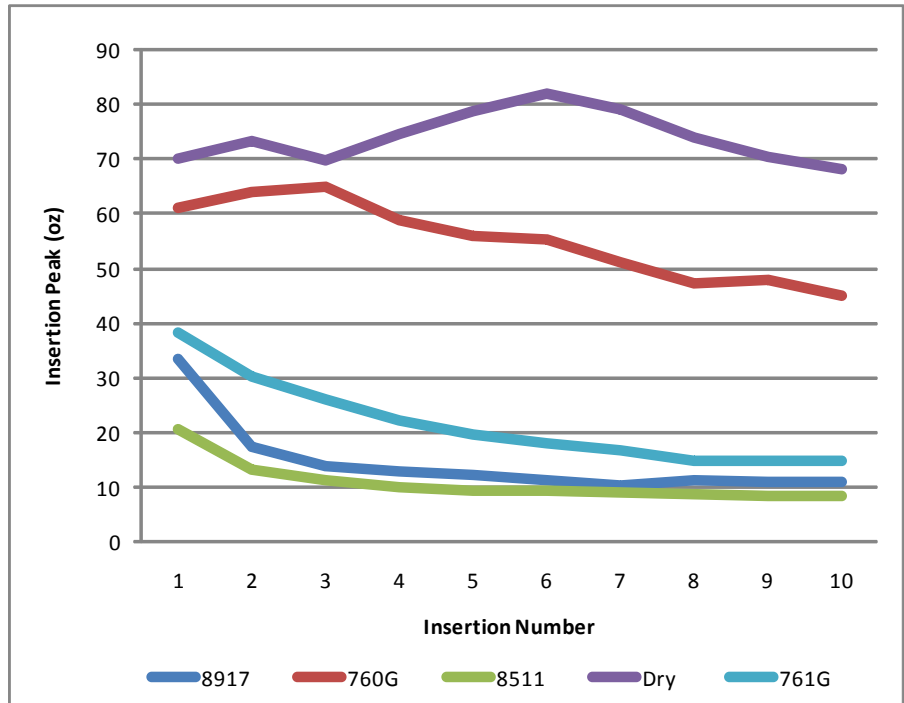
Nye developed Rheotemp™ 761G which is a polyurea thickened, medium viscosity, synthetic hydrocarbon grease fortified with a copper passivator and UV tracer for use in electrical contacts. This grease was designed to bridge the temperature gap between NyoGel® 760G (operating temperature limit 125°C) and the Uniflor™ 8917 and 8512 greases (upper operating temperature limits of 225°C). In addition to bridging the temperature gap, Rheotemp™ 761G (operating temperature range of -40°C to 175°C) was designed to meet the insertion force and resistance requirements of SAE/USCAR-2, revision 3, the performance standard for automotive electrical connection systems.

The need to reduce insertion force has become as important as avoiding spikes in resistance (see figure below). The risk of injury to workers in the automotive industry where they often have to mate connections in hard-to-reach positions is

a constant concern. Consequently, connector manufacturers must address the ergonomics of secure connector mating, a key requirement for good electrical performance. In the competitive automotive industry, strict connector design requirements such as long life, protection against oxidation and fretting corrosion, optimal electrical performance, and low insertion force are coupled with the mandate to reduce costs. Rheotemp™ 761G helps meet these objectives.

Nye has also developed a dispersion of the Rheotemp™ 761G which also contains a silver passivator to protect silver connectors from tarnishing. The dispersion is sold as NyeTact® 561J-20-AG and is a 20% dispersion in a isoparaffinic solvent. Nye has worked with a leading manufacturer of electrical contacts to evaluate the NyeTact® 561J-20-AG and they have found it to be very effective in protecting their silver contacts.

Figure: Insertion force data of 6.35mm tin connectors filled with various Nye greases



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