AUTUMN, 1977

NYE lubeletter

FROM: WILLIAM F. NYE, INC., P.O. Box G-927, New Bedford, Mass.

THE QUESTION OF COMPATIBILITY

Lubricants and Plastics

At low speeds and light loads, plastic components in small devices may operate quite satisfactorily without a lubricant. When operating conditions get even a little bit more severe, however, friction, resultant surface heating and rapid wear can be markedly reduced by use of a selected oil or grease. A key difference between plastics and metals is thermal conductivity - a metal can readily conduct away the heat of friction, while plastics, with conductivity only a small fraction of that of a metal, can quickly reach a temperature inducing surface melting. A proper lubricant can not only reduce friction and resulting heat, but can serve to conduct heat away from the area of contact. Oils will carry away more heat than a non-flowing grease and may be preferred.

Lubricants for plastics can be relatively uncomplicated. The basic need is for a base fluid to meet the operating temperature range of the application. Antioxidants are useful, but rust inhibitors are obviously unnecessary. The great array of anti-wear and extreme-pressure additives, most of which react chemically with a metal surface, are not appropriate yet a lubricity additive can be beneficial.

The key question with lubrication of plastics has turned out to be compatibility — put more dramatically, will the lubricant (or something in it) dissolve the plastic? Even on a microscopic scale, solvation or attack by lubricant components leads to crazing, weakening and cracking at stress points.

Many standard construction plastics do not cause such troubles. Nylons, phenolics, diallyl phthalate and the terephthalate polyesters do not appear to be problems, nor is polytetrafluoroethylene. Polyethylene and polypropylene are not usually vulnerable to lubricant attack. Care must be exercised, however, with polystyrene, polyvinyl chloride, a-b-s resins, polycarbonate, polysulfone and polyphenylene oxides. The acetal resins (polyformaldehydes) are not so vulnerable to solvation or crazing from lubricants, but they are quite sensitive to build-up of acidic constituents in the lubricant. Any order of magnitude change in pH in the lubricant toward the acidic could create a problem.

The most versatile synthetic lubricant families for plastic compatibility have been the synthetic hydrocarbons and the silicones. With proper care for additives and temperature constraints, safe and effective lubricants can be recommended for almost any combination of plastic on plastic, or plastic on metal. Either of these lubricant groups can be used at temperatures to -65°F. or below and to 250°F., the maximum permissible temperature for most plastics used in small device construction.

Often lubricants are needed not so much to reduce friction as to reduce noise; and a range of noise damping greases, again principally silicones or synthetic hydrocarbons, have been used with great success.

We invite inquiries on any special problems with plastics. Please specify temperature range and plastic type on the Response Coupon on page 3.

FOR WORMGEARS AND SPEED REDUCERS

An Advanced Synthetic Hydrocarbon Wormgear Oil

If there were ever a natural match between oil and application, it has to be the synthetic hydrocarbon and the worm gear.

Worm gears are tough on lubricants. They inherently involve heavily-loaded, sliding, metal-to-metal contact. The heavier the load, the higher the operating temperature, and more recent advanced gear set designs have involved gear loads which seriously challenge the stability of existing worm-gear lubricants. Any new worm gear oil must also reflect, however, the need for bronze-compatible additives, since the most common metal combination is bronze-on-steel. The chemically-active "EP" additives which could lubricate heavily-loaded steel-on-steel would attack a bronze surface.

Synthetic fluids have been successfully used as worm-gear oils, in particular the polyglycols. The more recently-developed synthetic hydrocarbons, however, offer even better wide-temperature capabilities and provide flexible vehicles for a new generation of worm gear lubricants. We can now offer Nye Synthetic Oil 189B, a high viscosity synthetic hydrocarbon with carefully selected additives as an advanced worm gear oil.

This new oil will afford operability from -30°F. (or below) to at least +250°F. and is an excellent candidate for "lubed-for-life" gear transmissions. Low temperature characteristics are unique for such a high viscosity oil with a pour point of -35°F. and a channel point of -55°F. Capability at high temperature is enhanced both by (1) an oxidation stability far superior to that of either natural petroleum oils or polyglycols and (2) a superior viscosity-temperature relationship with significantly less reduction in viscosity and film strength as temperatures rise.

A complex combination of lubricity and anti-wear additives, stable to bronze at operating temperatures, gives excellent high-load lubricating properties either for bronze-on-steel or for steel-on-steel.

Nye Synthetic Oil 189B promises reduced sludging and gear wear and, extended lubricant life for wormgear applications over an extended temperature range. No changes in seals, paints or other coatings is needed if you have been using traditional petroleum oils.

If you are in a "severe service" status with your wormgear application, and your present lubricant is not performing, this advanced worm gear oil could provide a quick fix. We will gladly provide evaluation samples at no charge.

ELECTRIC CONTACTS

Potentiometer Lubrication

A potentiometer is a variable resistor, an electrical switch controlling the flow of electrical current. The currents involved represent low voltages and very low amperages, such that arcing is uncommon among potentiometer designs. A sliding electrical contact is inherently involved in a potentiometer circuit, and lubrication of the sliding surfaces has been a continuing challenge as temperature extremes have expanded and the nature of the mating surfaces have elaborated.

The earlier common potentiometers were wire-wound, involving a noble metal wiper sliding across a wound wire surface of a similar metal. More recent sliding combinations involve a metal wiper on a conductive plastic or a ceramic-metal matrix, the latter presenting a lubrication problem comparable to that of greasing an emery wheel.

Perhaps 75% of U.S.-made potentiometers are lubricated with some variety of silicone-based lubricant — a puzzling statistic in that the silicone molecule is normally deadly to electrical contact situations — under arcing it degrades to an abrasive silica; on sliding or stationary separable contacts in computer or telephone switching mechanisms, it transforms into an insulative polymer film.

Yet, a dozen major potentiometer manufacturers have learned from years of evaluations that their devices are dependent on selected formulations involving silicones, usually greases. At Nye, we have responded to this situation with several advanced silicone greases, based on our NyoSil, a halogenated silicone oil with an extreme wide temperature range, from -100°F. to +450°F. The most interesting of these greases is FluoroGel 813, consisting of the formulated oil gelled with a fluorocarbon polymer. The polymer has a discrete particle size, such that one could reasonably predict its piling up to create electrical interruption or "noise" in potentiometer operation.

Yet this hasn't happened; this fluorocarbon-gelled grease is our best-accepted potentiometer lubricant. The major problem we have encountered with it is dispensing it through fine orifice hypo tubes or related automatic dispensing equipment, where aggregation can occur. If this problem occurs, a ready alternative is a new organically-gelled grease, using the same base oil, our NyoGel 781B.

Alternative ester-based greases are available where there is any arcing potential. We can recommend materials for any potentiometer applications and welcome your inquiries.

IN PREVENTING OIL CREEP

Less is Better

NEW SOLVENT SYSTEM PROPOSED FOR FLUORINATED BARRIER FILMS

With the best of the fluorinated barrier films, less is better. This is the conclusion of an elegant study summarized at the May, 1977, meeting in Montreal of the American Society of Lubrication Engineers by scientists from the U.S. Naval Research Laboratory. Their report suggests new opportunities for economical use of the barrier films for control of lubricant migration in fine instruments and for protection of non-lubricated electrical contacts from contamination by surface creep.

This Navy report reviews experiments with a range of solvents and solvent mixtures among the few highly fluorinated solvents which can be used with the barrier film polymers. Their conclusion: a solution of the polymer at roughly 0.2 weight percent concentration in a mixture of a perfluorinated cyclic ether (90%) and trichlorotrifluoroethane (10%) gives the smoothest, most durable and most effective non-wettable surface.

Especially interesting in this study were the reported modes of film formation as specific solvents were observed as they evaporated. With one group, containing xylene hexafluoride, the evaporating solution retracted from the film edge and formed a thick central film. Other solvents dried with a flattening in the center creating thicker edges and occasionally a surface of many small thinner zones separated by slightly thicker boundaries. The above-mentioned 90/10 mixture dried to give a smooth, uniform surface without retraction or edge effect.

Our NyeBar Type W incorporated this 90/10 solvent mixture with the fluorinated barrier film polymer present at 0.18 wt. %. Dilution beyond the Type W level to as low as 0.1% has been tried with good success and significant economies; a variety of uses in small appliances have developed especially in timing devices requiring clean contacts for repeated and reliable electrical signaling.

Samples of any specific concentration can be provided on request.

MULTI-VIS. & MULTI-PURP.

Silicones Service Expanded

With the co-operation of Dow-Corning Corp., Midland, Michigan, we now can afford a considerably expanded silicone oil distribution and blending service. We serve any smaller volume needs for the Dow-Corning DC200, DC510, DC550 and DC710 oils, along with an extensive list of specialty silicone fluids, including dielectric grades, release fluids, and special emulsions.

Besides the standard viscosity grades as prepared by Dow-Corning, we can blend to any specific viscosity between 1 centistoke and 1 million centistokes for the methyl silicones (DC200) and from 50 to 30,000 centistokes for the phenylmethylsiloxane polymers (DC510). Viscosity tolerances of ±5% or ±10%, depending on viscosity level, are standard, although much closer tolerances can be afforded on special request.

Although we have not as yet been able to extend this broad distribution service to the silicone greases, we are regularly preparing special semi-fluid consistencies, again to specified apparent viscosity ranges, for several commercial greases based on the phenylmethyl silicone fluids.

A price list is available for this expanded group of silicone oils listing several container sizes from 8 ounces to 1 gallon.

IMMISCIBLES

Silicone FluoroGels as Sealants

The combination of the extremely stable polysiloxane molecule with its excellent viscosity-temperature relationship and polytetrafluoroethylene polymers with their exceptional lubricity, oxidation stability and chemical resistance has created a series of unusual lubricant/sealants in our FluoroGel series.

One of the more important aspects of their "chemical" resistance is water repellency; even hot water/glycol mixtures in an automotive cooling system can be withstood by these greases with no weak link represented by the gelling agent, as in many traditional sealants. At the same time, the lubrication of an elastomeric seal, frequently as important a requirement as sealing capability, is enhanced by the high lubricity fluorocarbon in the finished grease.

Applications are limited only by imagination, and inquiries are invited.

SCREAMING AND YELLING IN YOUR MACHINE SHOP?

Metal-Working Pain-Relievers

If your plant has a machine shop specializing in the tougher metalworking jobs, they may find good use there for two very unusual metalworking lubricants produced in England by Rocol, Ltd., Leeds, whom we represent in this country.

Rocol R.T.D. Compound is an advanced metalworking paste specifically designed to adhere firmly to the tool or work piece providing a tough pressure-resistant film for reducing wear, tearing, cracking and splitting where extreme pressures bear on the tool or work piece. It has proved especially effective in those metal cutting or forming operations involving stainless, high tensile and work hardening alloys.

Rocol Ultracut is a liquid variation on the R.T.D. formula. It is used neat for all cutting operations where improved lubrication is required and where a mobile thin fluid is preferred to a paste. Where speeds are high and cooling is required, Ultracut should be added to the cutting oil. Normally the addition of 200 grams to one gallon is sufficient.

We can send samples and a brochure on these products on request.

VIBRATION UNDER LOAD

Fretting and Fretting Corrosion

When metal parts in loaded contact are subjected to low amplitude vibration, attendant scuffing or chafing can result in severe wear and oxidation, or "fretting corrosion". It may occur between components fixed relative to one another during operation, or it may occur when limited relative motion is required. Theories on the phenomenon suggest a combined effect of initial metal tearing by interlocking asperities in the metal surface followed quickly by oxidation of the debris. In the manner of a lapping compound, the residual oxides advance damage through their own abrasive action. Metal surfaces develop a patchy appearance colored as the metal oxide-in the case of steel on steel, like red mud.

A substantial reduction in fretting damage can be obtained through use of a proper lubricating fluid. We are proposing a series of synthetic hydrocarbons with oxidation-stable lubricity additives for fretting corrosion problems. These oils would provide a separating medium as would any fluid of sufficient film strength. Beyond this, the orientation of the long-chain polar radicals combined in the lubricity additive molecule would produce a rugged absorbed surface film to buffer metal asperity contact. It is also hypothesized that in the presence of trace moisture, these additives can react with metal oxides to produce low-shear soaps. Wear debris would thereby be transformed into a self-lubricating barrier between the fretting parts.

We invite your description of your fretting problem and will send one of these fortified oils for your evaluation.

RESPONSE COUPON

CUT ALONG THE ABOVE LINE AND MAIL IN YOUR COMPANY ENVELOPE TO:

WILLIAM F. NYE, INC. - P.O. BOX G-927, NEW BEDFORD, MASSACHUSETTS 02742, Tel. (617) 996-6721

(Make Sure Your Correct Address Appears On The Reverse Of This Coupon)

SEND LITERATURE ON THE FOLLOWING:

SPECIAL REQUESTS OR COMMENTS:

Send at no charge or obligation a lubricant sample especially selected to meet the following needs:

Type of Mechanism _____

Components to be Lubed _____

Materials of Construction _____

Ball or Sleeve Bearing (if either)? _____ Sintered Metal? _____

Preference for Oil _____ Grease _____ Dry-Film _____

Is Oil Creep a Problem? _____

Will Lube Touch Plastics? _____ Type: _____

Elastomers? _____ Type: _____

Lowest Operating Temperature _____ °C/°F.

Highest Operating Temperature _____ °C/°F.

Desired Life at High Temperature _____

Present Lube _____

If unsatisfactory, in what way? _____

COMBINING ZIP AND ZAP

Electrically-Conductive Greases

Many people, when lubricating electric contacts for the first time, expect that only an electrically conductive lubricant will serve the need. This is not usually so, however, since the extremely thin films in which contact lubricants do their job leave plenty of access for metal-to-metal contact and current flow; or, if a lube film remains, it is sufficiently thin that current can be transmitted by a phenomenon called the "tunnel effect".

Yet, electrically conductive lubricants do have a special and significant place. One specific area we've been exploring is their ability to drain static electricity from ball bearings in computer equipment. Many specialty switchgear applications require conductive greases, also.

The most common approach to conductivity in a grease is the introduction of a fine silver powder as a filler. Its high metallic conductivity gives good electrical results; its usefulness in reducing friction is less inspiring and in many situations unacceptable. We've been trying a different approach to imparting a useful degree of conductivity, using an unusual amorphous (and, fortunately, non-staining) variety of carbon as a gelling agent in selected synthetic-based oils. A non-melting, stable gel with all the wide-temperature capability of the chosen synthetic fluid is the result. The grease thus produced won't have the high conductivity of a metal-filled grease, but it is far from being an insulator. Anyone with an unusual need can get a sample of this unusual series of lubricants. For ball bearings specifically, ask for NyoGel 756; or describe your particular need, and we'll send a carefully chosen alternative. One precaution — these materials are very, very black.

ADJUSTING FOR COLD START

Switch Strategy

Once in a rare while, things get less rather than more complicated. This has been the case with our entry into electric switchgear lubricants. The straightforward use of higher and higher viscosity, wide-temperature-stable synthetic isoparaffins, with viscosity level tempered by the low temperature operating target of the particular application, is proving a dependable solution to many switch lubricant problems. The lubricants are greases, gelled with a lithium soap. They are relatively additive-clean, leading to application in arcing as well as non-arcing situations.

These greases are in our new Rheolube 360 series, range in base oil viscosity (at 100°F.) from 17 centistokes, with low temperature capability to -80°F., to 500 centistokes with a low temperature limit of -10°F. High temperature usefulness is between 250°F. and 300°F. Problems of gumming, carbonization, cold weather freeze-up, contact wear, contact seizure and fretting corrosion can be relieved by use of these new formulations. Describe your switch application on the Response Coupon on page 3; we'd appreciate the opportunity to send an evaluation sample of a selected grade of Rheolube 360.

from: **WILLIAM F. NYE, INC.**
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MASSACHUSETTS 02742
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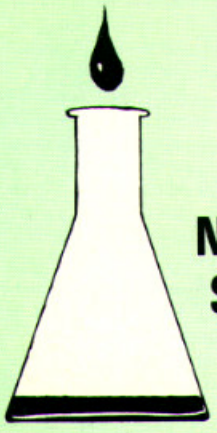

New Developments in Specialty Lubricants