

NYE

WINTER 1984

lubeletter

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

MOLECULAR FLEXIBILITY

The Linear Fluoroethers

A New Family of Synthetic Lubricants

For twenty years we have attempted to provide for our customers new lubricants from a comprehensive array of the synthetically-derived functional fluids. A tantalizing prospect for several years has been a very new family of fluorinated oils, closely akin chemically to the perfluoroalkyl polyethers (which have been around since the early 1960's), but so different in physical properties that they constitute an entirely new vehicle for designing specialty lubricants. These are linear fluoroethers consisting of tetrafluoroethylene linked through oxygen atoms with no alkyl side chains. They are exceedingly difficult to make; their synthesis is chemically challenging with polymerization being initiated by ultra-violet light. They were originally developed two decades ago but only in 1983 have they become available in a sufficiently dependable supply that we can feel right about offering them.

Linear Fluoroether Oils

The special qualities of these fluids are:

- an extremely wide liquid range, from -90°C to 250°C.
- excellent thermal and oxidative stability to over 200°C, approaching that of the perfluoroalkyl polyethers.
- a curiously low vapor pressure, resulting in impressive low volatilities for such relatively low viscosity fluids.
- a startlingly high viscosity index, approaching that of the dimethyl silicones.
- good film strength and lubricating ability.
- resistance to aggressive chemicals, solvents and oxidizers comparable to other fluorinated fluids.

We presently can supply three viscosity grades, with properties summarized below:

	Nye Fluoroether Oil 497	Nye Fluoroether Oil 498	Nye Fluoroether Oil 499
Viscosity at 210°F.	5.6 cs.	25 cs.	45 cs.
100°F.	17.7 cs.	90 cs.	140 cs.
Viscosity Index	317	320	345
Flash Point	None	None	None
Pour Point, °F.	-130	-112	-89
Evaporation Loss, 22 hrs. at 300°F.	7.3%	0.7%	0.1%

Add to the above data total thermal and oxidative stability to over 200°C., and many of our customers, who have struggled with various compromises among wide temperature lubricants to meet their special needs, will see real opportunities for improving their situation.

A fourth and heavier viscosity oil is expected to be available early in 1984.

These are expensive oils, reflecting the difficulty of their synthesis. A 4 fluid-ounce bottle of Nye Fluoroether Oil 499 has to sell for \$235.00. Larger volumes might permit lower pricing; however, we are still looking at an order of magnitude \$7,000 for a single gallon. (One gallon of any of these fluids weighs over 15 pounds.) It is not practical to follow our usual practice of offering free samples of these lubricants at no charge; however, we can supply a 1/2 fluid ounce (27 gram) vial of any of the oils for \$30.00.

Linear Fluoroether Greases

Take the oxygen atoms out of a linear fluoroether oil and you are left with polytetrafluoroethylene of non-stick frypan fame. As discussed in the article on page 3, certain molecular weights of these fluorocarbon polymers can serve as gelling agents for functional fluids to produce a variety of specialty gels and greases. Their use with the linear fluoroethers is especially beneficial, since as gellants they compromise none of the spectacular properties of these unusual oils, but rather permit their ready use in the non-migrating grease form.

We are especially excited about the chemically-resistant, ultra-wide temperature sealant prospects for a fluorocarbon gel of the forthcoming high viscosity linear fluoroether oil.

If you are dealing with lubricant needs which could benefit from the new linear fluoroether oils and greases, send us your name and address and we will include you on a special mailing list for bulletins and sample prices on the oils, greases and other specialty products which we expect to make available for commercial evaluation and use over the coming months.

THE STATE OF THE ART

Lubricants For Stationary Separable Electrical Connectors

The votes are not all in yet; indeed there are new candidates every day and new voters registering constantly. The state of the art for lubrication of electrical connectors is in flux and it may be useful to review here the elaboration of the Nye product line of connector lubricants.

The outstandingly-stable polyphenyl ethers have for many years served as a standard against which lubricants for stationary separable electrical connectors should be measured. A single oil, the four-ring ether, with a 100°F viscosity of 363 centistokes (Nye Synthetic Oil 438) is presently the only commercially-available grade. A formulation going back twenty years consists of this polyphenyl ether oil blended with paraffin wax, diluted in a solvent solution (NyeTact 518).

Application of lubricants on electrical connectors is usually accomplished from solvent solutions or dispersions. By dissolving a small percentage of the lubricant in a fast-evaporating, non-flammable solvent such as trichlorotrifluoroethane, the resulting light liquid can be applied by brushing or dipping. The solvent evaporates, effectively "plating" onto the connector surfaces a thin lubricating film. Thickness of the film can be controlled by adjusting the concentration of the oil in the solvent.

Care must be taken to ventilate the production area adequately to remove solvent vapors from the workplace.

The high cost of polyphenyl ethers, along with some compatibility problems with plastic connector mountings, has led to consideration of alternative base oils for connector lubricants.

Where operating temperatures do not exceed 100°C, synthetic hydrocarbons have shown good comparative performance with polyphenyl ethers. The most widely used synthetic hydrocarbon connector oil in this country is our Nye Synthetic Oil 174A, a heavy 1000 centistoke oil (at 100°F). It is available as a 10 (weight) percent solution in trichlorotrifluoroethane as our NyeTact 517. A more interesting and more recently-developed formulation is NyeTact 502, which incorporates a small proportion of an innocuous inorganic gelling agent into the oil film to minimize any eventual migration or creep.

A newer developmental connector oil, our Nye Synthetic oil 633, is based on a relatively high viscosity (250 cs. at 100°F.) polyol ester base fluid.

The latest edition of our special catalog on Lubricants for Switches and Electric Contacts contains bulletins on most of the lubricants mentioned above. Write for your copy.

Synthetic Hydrocarbons For Impregnation Of Porous Metal Sleeve Bearings

The synthetic hydrocarbons have come a long way in the last few years in establishing a sound position as impregnating oils for sintered metal bearings. Their wide temperature fluidity, superior oxidation stability, plastic compatibility and the impressive lubricating qualities of a paraffinic hydrocarbon combine to make them sound choices for many difficult porous metal sleeve bearing applications.

Perhaps the most serious, pervasive and frustrating problem with the lubrication of impregnated sleeve bearings is oil migration. The worry is not so much lubricant starvation, since the bearing holds a fair volume of fluid, but rather contamination of the surroundings. Control of bearing porosity can have some effect on this problem. Judicious use of barrier films can sometimes help, but this is an expensive and frequently impracticable option for production line use.

The synthetic hydrocarbons, however, because of their availability in a wide range of viscosities and because of their high viscosity index, have in a few recent cases shown significant promise for at least reducing some migration headaches.

Lower viscosity oils creep faster and more readily than do those of

higher viscosity. As temperatures rise in bearing operation, oil viscosity drops and any creep tendency is exacerbated. The traditional petroleum and ester-based impregnating oils have had a 100° F viscosity of about 60 centistokes. If a device could tolerate a higher viscosity oil at room temperatures, this combined with a synthetic hydrocarbon's excellent viscosity index (a parameter of viscosity change with temperature) would mean appreciably higher viscosity and a reduced creep threshold at the higher operating temperatures.

Our stable of formulated synthetic hydrocarbon bearing oils includes viscosities from 18 centistokes to 765 centistokes (at 100° F). Nye Synthetic Oil 188B, with a 100° F viscosity of 114 centistokes would be the first candidate we would propose for situations where lighter oils create migration problems, and Nye Synthetic Oil 192C, with 160 centistokes at 100° F, would be a heavier fallback.

If motor power or other moving forces permit consideration of high viscosity oils in your application, we suggest an evaluation and we will send 1-quart samples on request.

SUPERCLEAN SERVICES

Extended Frontiers For Grease Filtration

Many ball and needle bearing applications are so delicate and precise that solid particles only a few microns in size in the bearing lubricant result in an unacceptably rough ride. William F. Nye, Inc. has been elaborating its Super Clean Service and can provide oils, even of viscosities as high as 500 centistokes at 100° F., filtered to 0.45 microns. Our usual specification for permissible particle size is Cleanliness Level 100 of MIL-STD1246A and more stringent levels of cleanliness can be provided upon special request. These oils are packaged in specially-cleaned amber glass bottles ranging up to one gallon in size.

Greases can be filtered also. Filters capable of removing particles as small as 3 microns have been successfully employed, even in clay-gelled greases, such as the widely-used MIL-G-81322-type products. There had been some apprehension that filtration of greases with this type of gellant would cause de-gellation; however, we checked penetration and oil separation before and after with the following results:

	Unfiltered grease	Filtered grease
Particulate Contamination Analysis per FTM791a, Method 3005.3 10 to 34 microns 34 microns or larger	850 particles/cc 200 particles/cc	150 particles/cc 0 particles/cc
Penetration worked penetration, 60 strokes	293	297
Oil Separation 30 hours at 177°C.	3.40%	3.70%

Most lithium soap-gelled greases can be successfully filtered; and we regularly clean up silica-gelled gryroscope greases using a 3 micron filter. The one gellant family which we know is not subject to fine filtration is that of the fluorocarbons, where particle size of the fluorocarbon polymer is such that de-gellation could be expected.

We would appreciate any opportunities you might send us to clean up your lubricants.

FLUIDS TO STAND ON

Ultra-High-Viscosity Silicones For Damping Needs

Ultra high viscosity silicone fluids have served some very special and critical needs as "damping media" in a wide variety of mechanical devices. Volume needs were never great, however, and the major silicone oil manufacturers have over the years dropped such fluids from their product lines. William F. Nye, Inc. has attempted to fill this gap with two families of ultra-high-viscosity fluids - dimethylpolysiloxanes and phenylmethylpolysiloxanes.

Silicones are polymers of siloxane which is one silicon atom and one oxygen atom. The best known "polysiloxanes" are the dimethyls whereby two CH₃ or methyl groups are positioned on each silicon atom. The longer the polysiloxane chain the higher the viscosity of the resulting fluid. The viscosity of hexamethyldi siloxane is 0.65 centistokes at 25°C. The great range of viscosities of dimethylpolysiloxanes represent increasingly long chains until ultra high viscosities, still liquid at room temperature, are obtained.

The most viscous of these fluids are awesome to handle. They are vivid examples of glacial flow. In the "dimethyl" family we stock the 1,000,000 centistoke and 2,500,000 centistoke fluids and can readily

blend to order anything between 600,000 centistokes and 3,000,000 centistokes. One courageous individual ordered and received a quantity of a 10,000,000 centistoke fluid, but we are not sure we can provide this on a regular basis.

When a few of the methyl groups on a dimethylpolysiloxane are replaced with the conjugated 6-carbon ring or phenyl group, the molecule becomes less symmetrical and very unusual low temperature properties are evidenced. At the same time radiation and oxidation stability at high temperature are improved. The "phenylmethyl" fluids can be used at temperatures up to 500° F.

The phenylmethylpolysiloxanes can be supplied in ultra-high viscosities also up to several million centistokes, although we presently stock for quick shipment only the 30,000, 60,000 and 100,000 centistoke grades.

Write for data, samples or special needs among this unusual group of functional fluids. Potential applications include dashpot use in relays and meters and fluid clutches and drives.

CLASSICAL GREASES

Traditional Petroleum-Based Greases For High-Speed Bearings

Certain products have proven themselves over such a long period of time that they survive and prosper even in competition with a host of newer materials using new and far more impressive technologies. Nothing succeeds like success, and this applies to two very special petroleum-based bearing greases recently added to our product line. They were brought to our notice by several precision bearing manufacturers who see a lot of lubricants in many different applications. They consequently have a particularly useful vantage point from which to judge comparative lubricant performance. Over a period of twenty years, these two greases have survived as benchmarks for long-life performance in smaller high-speed bearings. Small bearings don't use a lot of lubricant, however; and the major petroleum companies making these greases found their volume markets adjusting to newer products. Declining volumes led to their being slated for discontinuance. William F. Nye, Inc. can serve as a rescue squad in such situations, and we have licensed manufacture of these two greases. You may recognize them as old friends:

Regal Starfak 2, formerly made by Texaco, Inc., is being made under the label **Nye Rheolube 350-SBG-2**.

BRB Lifetime, formerly made by Mobil Oil Corp., is being made under the label **Nye Rheolube 757SSG**.

Both greases are soap-gelled using low to medium viscosity highly-refined petroleum oils as base oils. Low temperature usefulness extends to -20° F. or below depending on available torque. Both greases are of NLGI Grade 2 consistency. High temperature use extends to 100° C. or beyond for limited periods. Dropping (melting) point for both greases is 300° F. minimum.

Either of these greases would be candidates for providing effective lubrication for high-speed, medium-to-heavy load anti-friction bearings, spherical roller bearings and needle bearings. Bulletins are available on request.

THE CASE OF THE DISAPPEARING SHEAR

Fluorocarbon Gel Greases - Additions To The Family

Greases are oils gelled to keep them where they belong. The gelling agent can be an intruder, serving little or no lubrication function and possibly compromising base oil qualities such as cold temperature usefulness or oxidation stability. Traditional greases may introduce an element of shear resistance or an increased torque requirement to lightly-loaded devices - a light oil can usually reduce friction; the gel structure of a companion grease must be internally sheared before it can do the same.

The use of low molecular weight polytetrafluoroethylene as a gelling agent can minimize or even eliminate most of these contradictory elements and at the same time contribute its own lubricity and film strength to the final product. We have developed over several years a family of such "Fluorocarbon Gels", using a comprehensive variety of synthetic oil families. Several of the more widely used of these greases, along with two newly-developed synthetic hydrocarbon-based Fluorocarbon Gels, are described in a new product bulletin.

The particular greases included are:

Product	Base Oil	Intended Use
Fluorocarbon Gel 810	Polyphenyl ether	For extreme high temperature
Fluorocarbon Gel 811	Polyol ester	For wide temperature and medium to high loads
Fluorocarbon Gel 813	Halogenated silicone	For ultra-wide temperature and light to medium loads
Fluorocarbon Gel 821	Synthetic hydrocarbon	For plastic compatibility and easy start in extreme cold
Fluorocarbon Gel 824	Synthetic hydrocarbon	For high film strength at high temperature

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:

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. If an electric contact,

Highest Operating Temperature _____ °C/°F. is arcing expected? _____

Desired Life at High Temperature _____

Present Lube _____

If unsatisfactory, in what way? _____

SPECIAL REQUESTS OR COMMENTS:

A CHLOROFLUOROCARBON GREASE

NyoGel 713: A Specific For Hypochlorite Corrosion

The corrosive effects of certain chlorine-containing chemicals, such as sodium hypochlorite, are well-known to handlers and packagers of swimming pool chlorination compounds, bleaching and sanitizing chemicals and related products. This chemical aggressiveness extends even to the destruction of traditional hydrocarbon-based lubricants if they are used on processing or packaging equipment handling such chemicals.

Nye NyoGel 713 is a non-melting synthetic grease which can resist the corrosive attack of sodium hypochlorite and which has performed well in lubricating processing and tableting equipment for this chemical. This grease is based on chlorofluorocarbon oils, which are the oils which gained fame during World War II in lubricating equipment handling the viciously corrosive gases involved in uranium enrichment for the Manhattan Project. These oils are chemically inert, resisting attack by many aggressive chemicals. They have good thermal stability and, being non-flammable, are completely resistant to oxidation.

Load-carrying properties of Nye NyoGel 713 are enhanced by fortification with molybdenum disulfide. An evaluation sample and product bulletin are available at no charge on request.

A NEW GENERAL CATALOG

The Precision Lubricant Sourcebook

For years we despaired of putting out a "general catalog" of Nye lubricants. From time to time we managed a collection of representative product data sheets, but this of course fell short of providing present or future customers with a comprehensive idea of the products and services Nye can provide. The great difficulty in writing a catalog was not deciding what to put in but deciding what to leave out. Further, the product line kept changing; new products were constantly being introduced to meet unusual new problems.

Yet, the job has finally been accomplished after many months of arduous and painful decision-making, and we offer free to all a copy of Nye's Precision Lubricant Sourcebook. This thirteen-page catalog is divided into eleven application sections:

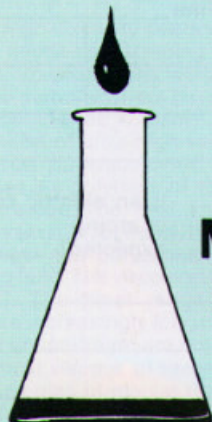
- Lubricants for Rolling Bearings
- Impregnating Oils for Porous Metal Bearings
- Greases for Gear Trains and Wormgears
- Damping Greases
- Instrument Greases
- Instrument Oils
- Non-Spreading Oils
- Lubricants for High Temperature
- Lubricants/Sealants with Chemical and Solvent Resistance
- Food Machinery Lubricants
- Electric Contact Lubricants

In addition, a section describes Nye's re-packaging service for Dow Corning silicone oils, greases and compounds. Among other specialties reviewed are the barrier films to prevent oil creep, a comprehensive "functional fluids" service, and our capabilities in custom formulations. A copy of the Precision Lubricant Sourcebook is yours for the asking, and we hope it will serve a good purpose until we can work up the courage to go at it again.

from: **WILLIAM F. NYE, INC.**
P. O. BOX G-927
NEW BEDFORD
MASSACHUSETTS 02742
Return Postage Guaranteed

a new

NYE[®] lubeletter



New Developments in Specialty Lubricants