

## SYNTHETIC OILS COMMONLY USED AT NYE

Synthetic Oils	Temp Range (°C)	Key Characteristics/Typical Applications
<b>Alkylated Naphthalenes (AN)</b>	-30 to 180	Compared to PAO and diesters, offer improved hydrolytic, thermal, and oxidative stability. Good blendstock for polyalphaolefins requiring high stability under extreme conditions.
<b>Pennzane® from Shell (MAC)</b>	-45 to 125	Highly specialized fluid that combines the low vapor pressure of a PFPE with the lubricity and film strength of a PAO. Typically used in aerospace and critical vacuum applications.
<b>Perfluoropolyethers (PFPE)</b>	-90 to 250	Extremely stable, nonflammable, chemically inert, low vapor pressure fluids. Used in extreme environments and to avoid plastic and elastomer compatibility problems.
<b>Polyalphaolefins (PAO)</b>	-60 to 125	Stable, lubricious fluids compatible with most plastics and elastomers. A drop-in replacement for petroleum, it's used in countless applications in many industries.
<b>Polyglycols</b>	-40 to 125	Good load-carrying ability, compatible with most elastomers, non-carbonizing. Often used in arcing switches.
<b>Polyphenylethers (PPE)</b>	+10 to 250	Radiation, chemical, and acid-resistant fluids. Traditionally used for noble-metal connectors and high-temperature mechanical components.
<b>Silicones</b>	-70 to 200	Stable fluids with good wetting characteristics. Commonly used with plastic gears, control cables, and seals.
<b>Synthetic Esters</b>	-65 to 150	Excellent wear resistance, stable, affinity for metals, handles heavy loads. Great for loaded bearings.

## COMPATIBILITY OF SYNTHETIC BASE OILS

G	Good
F	Fair
P	Poor
S	Soluble
W	Weakly soluble
V	Varies with grade
I	Insoluble

	Plastics														Elastomer										Solvent						
	Acetal (PDM)	ABS	Phenolic (PF)	Polyamide-imide (PAI)	Polyamide (nylon) (PA)	Polycarbonate (PC)	Polyester	Polyetherimide	Polyethylene (PE)	Polyimide (PI)	Polyphenylene oxide (PPO)	Polystyrene	Polyulfone (PSU)	PTFE	Polyvinyl chloride (PVC)	Terephthalate (PBT)	Buna S	Butyl	EPDM, EPR	Fluoroelastomer	Natural Rubber	Neoprene	Nitrile	Silicone	Water	Water plus detergent	Isopropanol	Methanol	Mineral Spirits	Fluoralkane	Hydrofluorocarbon
<b>Synthetic Hydrocarbon</b> Includes: polyalphaolefin (PAO) Viscosity Index (VI) = 125-250	G	G	G	G	G	G	G	F	G	G	F	G	G	F	G	P	P	P	G	P	G	G	F	I	W	I	I	S	I	I	I
<b>Polyglycol</b> Polyether Viscosity Index (VI) = 160-220	G	P	G	G	G	P	P	G	F	G	P	G	P	G	P	P	P	G	G	P	P	F	G	V	W	V	V	S	I	I	I
<b>Ester</b> Diester, polyolester Viscosity Index (VI) = 120-150	G	P	G	G	G	P	P	G	F	G	P	P	G	P	G	P	P	F	G	P	P	F	F	I	W	I	I	S	I	I	I
<b>Silicone</b> Dimethyl-, phenyl-, halogenated Viscosity Index (VI) = 200-650	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	P	I	W	I	I	S	I	I	I
<b>Multiplyalkylated Cyclopentane</b> Pennzane from Shell Viscosity Index (VI) = 135	G	G	G	G	G	G	G	F	G	G	F	G	G	F	G	P	P	P	G	P	P	G	F	I	W	I	I	S	I	I	I
<b>Perfluoropolyether</b> PFPE Viscosity Index (VI) = 100-350	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	I	W	I	I	I	S	V	V
<b>Polyphenylether</b> PPE Viscosity Index (VI) = 40-60	G	P	G	G	G	P	P	G	F	G	P	P	G	P	G	P	P	F	G	P	P	F	F	I	W	I	I	S	I	I	I

## GREASE GELLANTS COMMONLY USED AT NYE

Gellants are selected for their water and salt-water resistance, thermal stability, thickening efficiency, lubricity, and shear stability.

Organic Soaps	Organic Non-Soaps
Lithium	Urea
Lithium Complex	PTFE
Sodium	<b>Inorganic</b>
Sodium Complex	Bentonite Clay
Calcium	Silica
Calcium Complex	Hydrophobic Silica
Aluminum Complex	Metal Oxide

## GREASE STIFFNESS ANALOGS

NLGI Grade	Penetration (worked, 60x)	Analog (unworked)
000	445 - 475	Ketchup
00	400 - 430	Applesauce
0	355 - 385	Brown mustard
1	310 - 340	Tomato paste
2	265 - 295	Peanut butter
3	220 - 250	Veg. shortening
4	175 - 205	Frozen yogurt
5	130 - 160	Smooth paté
6	85 - 115	Cheese spread

## LUBRICANT ADDITIVES COMMONLY USED AT NYE

Additive Type	Capabilities
Antioxidant	Prolongs life of base oil
Antiwear (EP)	Chemically active protection of loaded metal surfaces
Antirust	Slows rusting of iron alloys
Anticorrosion	Slows corrosion of non-noble metals
Filler	Thermal/electrical conductivity, special physical properties
Fortifier (EP)	Solids burnish into loaded surface under extreme pressures
Lubricity	Reduces coefficient of friction, starting torque or stick/slip
VI Modifier	Reduces rate of change of viscosity with temperature
Pour Point	Improves lower temperature limit
Dye	Visual/UV markers as inspection/assembly aids

## KINEMATIC VISCOSITY OF COMMON FLUIDS

KV (cSt @ 25°C)	Material
20,000,000	—
5,000,000	— Gum Rubber
10,000	— Honey
1,000	— Castor Oil
100	— SAE 10 Motor Oil
3	— Milk
1	— Water
.40	— Acetone

## CALCULATING THE APPROXIMATE UNIT COST OF SYNTHETIC GREASE IN U.S. DOLLARS

	Amount of Grease Per Device (dia. in mm.)	Volume (cc)	lbs./100,000 Units		Grease Cost Per Device	
			Low Density (1gm/cc)	High Density (2gm/cc)	LD@\$10/lb. (1gm/cc)	HD@\$100/lb. (2gm/cc)
•	1	0.0003	0.066	0.13	\$0.000006	\$0.00013
•	2	0.0021	0.46	0.93	\$0.000005	\$0.0009
•	3	0.007	1.54	3.09	\$0.00015	\$0.003
•	5	0.033	7.3	14.6	\$0.0007	\$0.015
•	10	0.26	57.3	114.6	\$0.006	\$0.11



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