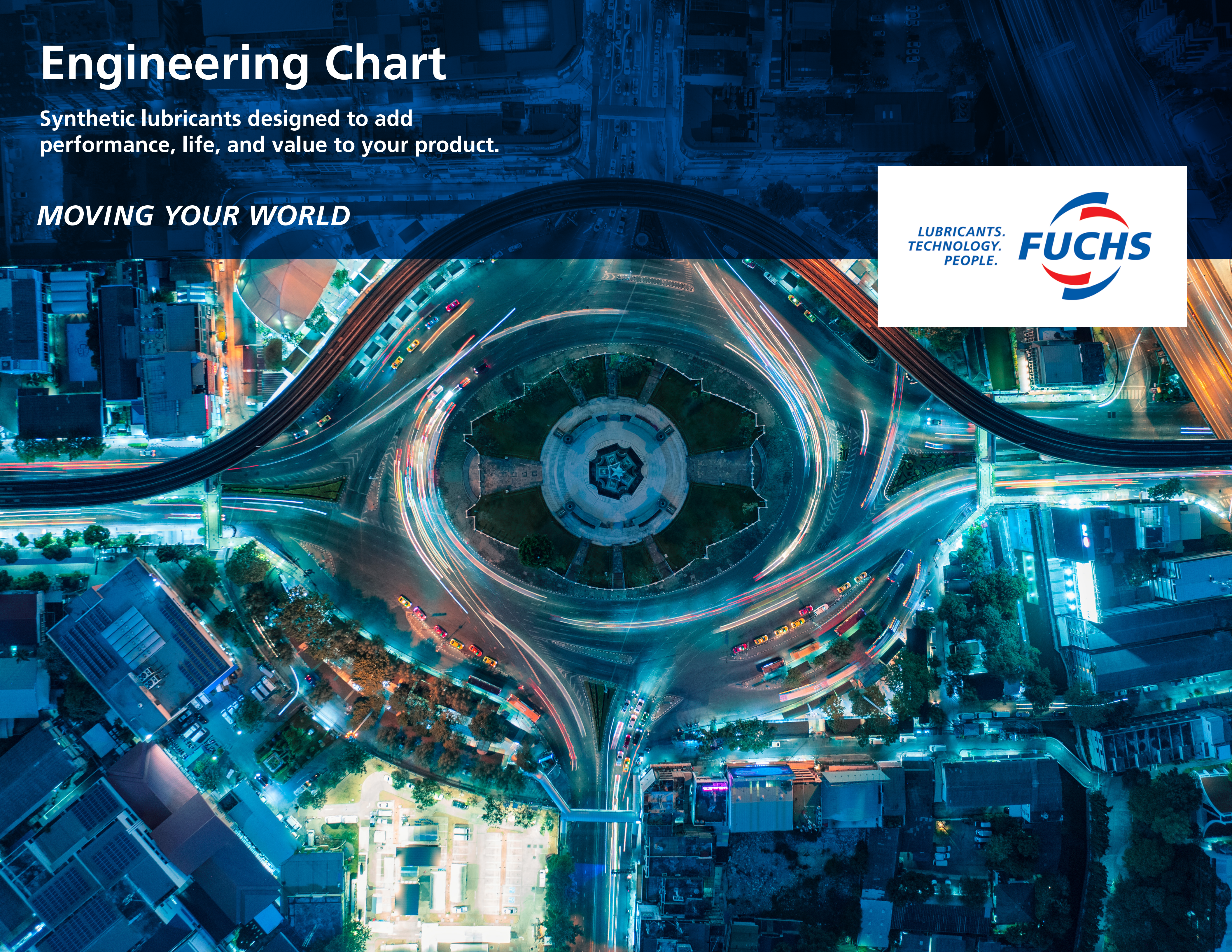
Engineering Chart

Synthetic lubricants designed to add performance, life, and value to your product.

MOVING YOUR WORLD

LUBRICANTS.
TECHNOLOGY.
PEOPLE.
FUCHS



SYNTHETIC OILS COMMONLY USED

Synthetic Oils	Temperature Range °C	Key Characteristics/Typical Applications
Alkylated Naphthalenes (AN)	-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.
Multiply-Alkylated Cyclopentanes (MAC)	-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.
Perfluoropolyethers (PFPE)	-90 to 250	Extremely stable, nonflammable, chemically inert, low vapor pressure fluids. Used in extreme environments and to avoid plastic and elastomer compatibility problems.
Polyalphaolefins (PAO)	-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.
Polyglycols	-40 to 125	Good load-carrying ability, compatible with most elastomers, non-carbonizing. Often used in arcing switches.
Polyphenylethers (PPE)	+10 to 250	Radiation, chemical, and acid-resistant fluids. Traditionally used for noble-metal connectors and high-temperature mechanical components.
Silicones	-70 to 200	Stable fluids with good wetting characteristics. Commonly used with plastic gears, control cables, and seals.
Synthetic Esters	-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:

Base oil	Acetal (POM)	ABS	Phenolic (PF)	Polyamide-imide (PAI)	Polyamide (nylon) (PA)	Polycarbonate (PC)	Polyester	Polyetherimide	Polyethylene (PE)	Polyimide (TPI)	Polyphenylene oxide (PPO)	Polystyrene	Polysulfone (PSU)	PTFE	Polyvinyl chloride (PVC)	Terephthalate (PBT)
Synthetic Hydrocarbon Includes: polyalphaolefin (PAO) Viscosity Index (VI) = 125-250	G	G	G	G	G	G	G	G	F	G	G	F	G	G	F	G
Polyglycol Polyether Viscosity Index (VI) = 160-220	G	P	G	G	G	P	P	G	F	G	P	G	P	G	P	G
Ester Diester, polyolester Viscosity Index (VI) = 120-150	G	P	G	G	G	P	P	G	F	G	P	P	P	G	P	G
Silicone Dimethyl-, phenyl-, halogenated Viscosity Index (VI) = 200-650	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
Multiplyalkylated Cyclopentane Viscosity Index (VI) = 135	G	G	G	G	G	G	G	G	F	G	G	F	G	G	F	G
Perfluoropolyether PFPE Viscosity Index (VI) = 100-350	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
Polyphenylether PPE Viscosity Index (VI) = 40-60	G	P	G	G	G	P	P	G	F	G	P	P	P	G	P	G

Elastomer and Solvent:

Base oil	Buna S	Butyl	EPDM, EPR	Fluoroelastomer	Natural Rubber	Neoprene	Nitrile	Silicone	Water	Water plus detergent	Isopropanol	Methanol	Mineral Spirits	Fluoroalkane	Hydrofluorocarbon	Hydrofluoroether
Synthetic Hydrocarbon	P	P	P	G	P	G	G	F	I	W	I	I	S	I	I	I
Polyglycol	P	P	G	G	P	P	F	G	V	W	V	V	S	I	I	I
Ester	P	P	F	G	P	P	F	F	I	W	I	I	S	I	I	I
Silicone	G	G	G	G	G	G	G	P	I	W	I	I	S	I	I	I
Multiplyalkylated Cyclopentane	P	P	P	G	P	G	G	F	I	W	I	I	S	I	I	I
Perfluoropolyether	G	G	G	G	G	G	G	G	I	W	I	I	I	S	V	V
Polyphenylether	P	P	F	G	P	P	F	F	I	W	I	I	S	I	I	I

GREASE GELLANTS COMMONLY USED

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	**In-Organic Non-Soaps**
Sodium Complex	Bentonite Clay
Calcium	Silica
Calcium Complex	Hydrophobic Silica
Aluminum Complex	Metal Oxide

GREASE STIFFNESS ANALOGS

	Penetration (worked, 60x)	Analog (unworked)
000	445 - 475	Ketchup
00	400 - 430	Yogurt
0	355 - 385	Mustard
1	310 - 340	Tomato Paste
2	265 - 295	Peanut Butter
3	220 - 250	Butter
4	175 - 205	Ice Cream
5	130 - 160	Fudge
6	85 - 115	Cheese

LUBRICANT ADDITIVES COMMONLY USED

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	—	Putty
5,000,000	—	Taffy
10,000	—	Chocolate Syrup
1,000	—	Castor Oil
100	—	Gravy
3	—	Milk
1	—	Water
.40	—	Almond Extract

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 Low Density (1gm/cc)	lbs./100,000 Units High Density (2gm/cc)	Grease Cost Per Device LD@$10/lb. (1gm/cc)	Grease Cost Per Device HD@$100/lb. (2gm/cc)
●	1	0.0003	0.066	0.13	$0.000006	$0.00013
●	2	0.0021	0.46	0.93	$0.00005	$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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