CLASSIFICATION OF LUBRICANTS

Wide variety of lubricants may be arranged according to the following classification methods:

- ⊡ **General classification of lubricants**
- ⊡ **Classification of lubricants by application**
- ⊡ **Classification of lubricants by additives**

General classification of lubricants

Mineral lubricants

⊡ **Fluid lubricants (Oils)**

Mineral fluid lubricants are based on mineral oils. Mineral oils (petroleum oils) are products of refining crude oil. There are three types of mineral oil: paraffinic, naphtenic and aromatic.

Paraffinic oils are produced either by hydrocracking or solvent extraction process. Most hydrocarbon molecules of paraffinic oils have non-ring long-chained structure. Paraffinic oils are relatively viscous and resistant to oxidation. They possess high flash point and high pour point.
Paraffinic oils are used for manufacturing engine oils, industrial lubricants and as processing oils in rubber, textile, and paper industries.

Naphtenic oils are produced from crude oil distillates.
Most hydrocarbon molecules of naphtenicnic oils have saturated ring structure. Naphtenic oils possess low viscousity, low flash point, low pour point and low resistance to oxidation.
Naphtenic oils are used in moderate temperature applications, mainly for manufacturing transformer oils and metal working fluids.

Aromatic oils are products of refining process in manufacture of paraffinic oils.
Most hydrocarbon molecules of aromatic oils have non-saturated ring structure.
Aromatic oils are dark and have high flash point.
Aromatic oils are used for manufacturing seal compounds, adhesives and as plasiticezers in rubber and asphalt production.

⊡ **Semi-fluid lubricants (greases)**

Semi-fluid lubricants (greases) are produced by emulsifying oils or fats with metallic soap and water at 400-600°F (204-316°C).
Typical mineral oil base grease is vaseline.
Grease properties are determined by a type of oil (mineral, synthetic, vegetable, animal fat), type of soap (lithium, sodium, calcium, etc. salts of long-chained fatty acids) and additives (extra pressure, corrosion protection, anti-oxidation, etc.).
Semi-fluid lubricants (greases) are used in variety applications where fluid oil is not applicable and where

thick lubrication film is required: lubrication of roller bearings in railway car wheels, rolling mill bearings, steam turbines, spindles, jet engine bearings and other various machinery bearings.

⊡ **Solid lubricants**

Solid lubricants possess lamellar structure preventing direct contact between the sliding surfaces even at high loads.

Graphite and molybdenum disulfide particles are common Solid lubricants. Boron nitride, tungsten disulfide and polytetrafluorethylene (PTFE) are other solid lubricants.

Solid lubricants are mainly used as additives to oils and greases. Solid lubricants are also used in form of dry powder or as constituents of coatings.

Synthetic lubricants

⊡ **Polyalphaolefins (PAO)**

Polyalphaoleins are the most popular synthetic lubticant. PAO's chemical structure and properties are identical to those of mineral oils.

Polyalphaoleins (synthetic hydrocarbons) are manufactured by polymerization of hydrocarbon molecules (alphaoleins). The process occurs in reaction of ethylene gas in presence of a metallic catalyst.

⊡ **Polyglycols (PAG)**

Polyglycols are produced by oxidation of ethylene and propylene. The oxides are then polymerized resulting in formation of polyglycol.

Polyglycols are water soluble.

Polyglycols are characterized by very low coefficient of friction. They are also able to withstand high pressures without EP (extreme pressure) additives.

⊡ **Ester oils**

Ester oils are produced by reaction of acids and alcohols with water.

Ester oils are characterized by very good high temperature and low temperature resistance.

⊡ **Silicones**

Silicones are a group of inorganic polymers, molecules of which represent a backbone structure built from repeated chemical units (monomers) containing Si=O moieties. Two organic groups are attached to each Si=O moiety: eg. methyl+methyl ($(CH_3)_2$), methyl+phenyl ($CH_3 + C_6H_5$), phenyl+phenyl ($(C_6H_5)_2$).

The most popular silicone is polydimethylsiloxane (PDMS). Its monomer is $(CH_3)_2SiO$. PDMS is produced from silicon and methylchloride.

Other examples of silicones are polymethylphenylsiloxane and polydiphenylsiloxane.

Viscosity of silicones depends on the length of the polymer molecules and on the degere of their cross-linking. Short non-cross-linked molecules make fluid silicone. Long cross-linked molecules result in elastomer silicone.

Silicone lubricants (oils and greases) are characterized by broad temperature range: -100ºF to +570ºF (-73ºC to 300ºC).

Vegetable lubricants

Vegetable lubricants are based on soybean, corn, castor, canola, cotton seed and rape seed oils.
Vegetable oils are environmentally friendly alternative to mineral oils since they are biodegradable.
Lubrication properties of vegetable base oils are identical to those of mineral oils.
The main disadvantages of vegetable lubricants are their low oxidation and temperature stabilities.

Animal lubricants

Animal lubricants are produced from the animals fat. There are two main animal fats: hard fats (stearin) and soft fats (lard). Animal fats are mainly used for manufacturing greases.

Classification of lubricants by application

- **Engine oils**
- **Gear oils**
- **Hydraulic oils**
- **Cutting fluids (coolants)**
- **Way lubricants**
- **Compressor oils**
- **Quenching and heat transfer oils**
- **Rust protection oils**
- **Transformer oils (insulating oils)**
- **Turbine oils**
- **Chain lubricants**
- **Wire rope lubricants**

Classification of lubricants by additives

- **Extreme pressure (EP)**
- **Anti-wear (AW)**
- **Friction modifiers**
- **Corrosion inhibitors**
- **Anti-oxidants**
- **Dispersants**
- **Detergents**
- **Compounded**
- **Anti-foaming agents**
- **Pour point depressant**

Source : http://www.substech.com/dokuwiki/doku.php?id=classification_of_lubricants