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# Guide to Selecting UCON Fluids and Lubricants

## Including Applications & Features

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## High Performance Polyalkylene Glycol Base Stocks and Formulated Fluids and Lubricants

The broad line of UCON™ fluids and lubricants includes a wide range of base stocks and formulated products that differ significantly from petroleum, animal, and vegetable oils. These polyalkylene glycol (PAG)-based synthetic products can be varied and controlled in formulations and used to a degree not possible with natural oils or lubricants. They are used in applications from hydraulic fluids to quenchants, and from machinery, gear and bearing lubricants, to compressor lubricants.

The versatility of UCON fluids and lubricants results from unique physical and performance properties. For example...

- **Viscosity** – UCON fluids and lubricants are commercially available in a series of viscosities ranging from 12 to more than 65,000 centistokes at 40°C. They show less change with temperature than petroleum oils, because of their higher viscosity indices. Viscosities of UCON products are virtually unaffected by high rates of shear.
  - **Pour Point** – Most UCON products have low pour points, and do not require pour point depressants.
  - **Lubricity** – UCON lubricants have outstanding overall load carrying capacity, film strength, and anti-wear properties.
  - **Stability** – UCON fluids and lubricants are oxidatively stable, which contributes to long service life. Even under high temperature conditions, the fluids retain the qualities of efficient hydraulic fluids, lubricants, and heat transfer media.
  - **Flash Points** – UCON fluids and lubricants generally have higher flash points than petroleum oils of the same standard viscosities. This provides a greater margin of safety and permits higher temperature service.
  - **Miscibility** – UCON fluids are available as water-soluble, water-insoluble and oil-soluble products. For more information on the latter, please refer to our brochure UCON Oil Soluble Polyalkylene Glycols.
  - **Cleanliness** – UCON fluids clean valves, orifices and other surfaces as they operate. Further, when they decompose, soluble by-products are formed rather than sludge, varnish, gums or tars.
- **Friction control** – PAGs can provide excellent friction control due to their excellent film forming.
  - **Air release** – Fluids formulated with PAGs as the primary base oil can have very low air release times. This may allow equipment builders to design smaller reservoir sizes, reduce the risk of cavitation and also lower the rate of fluid oxidation.
  - **Gas Solubility** – Water soluble UCON fluids show less viscosity dilution than hydrocarbon oils when in contact with methane, propane and similar hydrocarbon gases.
  - **Noncorrosive to Metals** – UCON fluids and lubricants are noncorrosive to iron, steel, brass, bronze, and aluminum under normal operating conditions. Inhibitors can be incorporated to control corrosion, even in the presence of water.
  - **Elastomer Compatibility** – UCON fluids are compatible with common elastomers. Please refer to our comprehensive Elastomer Compatibility piece for more information.
  - **FDA Status** – UCON fluids and lubricants have numerous clearances under FDA Food Additive Regulations.



## UCON Base Stocks

UCON base stocks are polyalkylene glycols (PAGs), which are polymers derived from ethylene oxide, and propylene oxide and butylene oxide.

**LB Fluids** are alcohol-started base stocks of all oxypropylene groups (m=0) with one terminal hydroxyl group. They are water insoluble and available in a variety of molecular weights and viscosities.

**50-HB Fluids** are alcohol-started base stocks containing equal amounts, by weight, of oxyethylene and oxypropylene groups with a single terminal hydroxyl group. They are water soluble at ambient temperature and are available in a variety of molecular weights and viscosities.

**75-H Fluids** are diol-started base stocks containing 75 weight percent oxyethylene and 25 weight percent oxypropylene groups with two terminal hydroxyl groups. They are water soluble at temperatures below 75°C and are available in a variety of molecular weights and viscosities.

**OSP Fluids** are new base oils and performance additives derived from butylene oxide as one of the polymer building blocks. They are available in viscosities ranging from 18 to 680 cSt at 40°C. OSPs are soluble in most API Group I-IV base oils and are especially effective as deposit control additives, friction modifiers, viscosity index boosters and offer exceptional air release properties.

## How to Choose the Proper UCON Fluid or Lubricant

Selection of the proper UCON fluid or lubricant can be based primarily on viscosity, pour point, cloud point, water or gas solubility, lubricating properties, oxidation stability, or a combination of these and other physical, chemical, or performance properties. The following are considerations when selecting UCON fluids or lubricants.

**Viscosity** – Viscosity is often the key property in the selection of any lubricant. Due to their higher viscosity index, when selecting or comparing UCON fluids to replace a petroleum product, the viscosity comparison should be made at the operating temperature, rather than at SAE or ISO standard temperature grades.

**Operating Temperature** – If prolonged operation above 40°C is expected, choose UCON lubricants containing antioxidants or stabilizers.

**Solubility** – Choose the UCON fluid or lubricant with the right solubility properties. LB fluids are water insoluble, which makes them useful for mechanical lubrication. 75-H and 50-HB fluids are water soluble, which makes them useful as process fluids or as lubricants where contact with the end-product is possible and ease of washability is essential. OSP fluids are oil soluble, which allows for compatibility with and ease of conversion from API Group I-IV base oil formulations. Also take note of the unique gas solubilities of UCON products.

**Additives** – The performance of UCON formulated products is enhanced through the use of additives, including extreme pressure modifiers, corrosion inhibitors, dyes, and other additives for special requirements.



## Applications for UCON Fluids and Lubricants



### **Hydrolubes (Fire-Resistant Hydraulic Fluids)**

UCON hydrolubes were developed to meet the demand for relatively low-cost, fire-resistant hydraulic fluids. They are balanced formulations of a glycol-water base, thickened with a water-soluble UCON lubricant. They contain additives to improve lubrication properties and provide resistance to both liquid- and vapor-phase corrosion. UCON hydrolubes have been tested to the Standard 6930 Flammability Classification of Industrial Fluids and approved by FM Approvals as “FM Approved” products.

### **Hydraulic Fluids**

UCON hydraulic fluids provide the lubricity and performance required of industrial hydraulic fluids that must operate over a wide temperature range. Excellent low-temperature properties permit outdoor use year-round. They are more resistant to oxidation than mineral oils as well as to sludge or varnish formation. UCON hydraulic fluids have high viscosity indices and their viscosities are unaffected by high rates of shear.

### **Coating Fluids**

UCON LB Series base fluids can be compounded with selected rust and oxidation inhibitors to serve as lubricating and protective coatings for hydraulic brake parts and similar equipment prior to and during assembly. They are compatible with DOT 3 brake fluids, but not silicone-based fluids. UCON coating fluids have no adverse effect on braking system elastomers and provide lubrication during assembly of braking parts.

### **Metalworking Fluids**

UCON metalworking fluids are used as lubricity bases for formulating water-soluble cutting and grinding fluids and in forming operations, such as drawing, stamping, and rolling. They can be used alone or in combination with extreme-pressure additives. UCON metalworking fluids exhibit inverse solubility – they become less soluble in water as the temperature of the solution increases. In contact with a hot tool or workpiece, the polyalkylene glycol comes out of the solution and coats the metal surfaces with a concentrated lubricant film, providing greater lubricity and heat removal.

### **Heat Transfer Fluids**

UCON fluids offer better heat transfer characteristics than petroleum oils of comparable viscosity. They offer excellent thermal and oxidation stability and are widely used in open, vented heat transfer systems. UCON fluids feature high flash and fire points and, when used properly, have minimal tendency to sludge, carbonize, and foul heat transfer surfaces. They have higher thermal conductivity than petroleum oils and contain no PCBs.

### **Gas Turbines**

UCON Fluids have inherent high thermo oxidative stability, good air release properties and low coefficient of friction. Combination of these properties help formulators to use UCON fluids for turbine oil formulations that reduce the potential for varnish formation in heavy duty gas turbines. Varnish build-up in today’s smaller, more powerful gas turbines is the root cause behind many turbine shutdowns and resulting lost power generation capacity. UCON fluids provide solution to mitigate varnish formation and thus improve equipment operating life.

### **Fuel Additives**

Dow has the capability to synthesize custom products, a capability supported by our backward integration in propylene oxide and butylene oxide. Dow sourced materials are in use today as carrier fluids and as chemical intermediates to deposit control additives.

### **Process Fluids**

UCON fluids are uniquely suited for use in the heat treating or processing of plastics, elastomers, thread, or fabricated parts where compatibility of the fluid with the processed part is important. UCON process fluids transfer heat rapidly and uniformly and can be used in open baths up to 204°C. Because they are water soluble, only a water rinse is required to remove residual fluid from parts or other processed material.



### Mill and Calendar Lubricants

Large-scale mills and calendars used by the rubber, textile, paper, and plastics industries require lubricants for large-diameter journal or sleeve bearings, anti-friction bearings, and several types of gearing. While petroleum lubricants are often suitable for moderate temperature operation, at elevated temperatures (calendar roll temperatures above 177°C), these fluids can form carbonaceous residues, contributing to lubricating problems and increased maintenance. UCON calendar lubricants are formulated for high temperature service, and are supplied in several viscosity grades to offer greater flexibility in high temperature equipment than petroleum products.

### Solder Assist Fluids

Water-soluble UCON fluids are well-suited as base fluids for many applications in the

electronics industry, including solder assist fluids. Excellent thermal and oxidative stability make them ideal for formulations used in printed circuit board manufacturing and assembly. Inhibited fluids provide high temperature stability, high flash and fire points, and low foaming tendencies.

### Quenchants

UCON quenchants are a series of nonflammable, aqueous solutions containing special polymers and corrosion inhibitors for quenching both ferrous and nonferrous metals. They can replace water, oil, or brine solutions and are the preferred quenching media for both low- and high-hardenable, plain carbon, and alloy steels. UCON quenchants provide much wider flexibility in quench severity than water or oil, thus reducing cracking, distortion, and residual stress in quenched parts. Use of UCON quenchants is permitted by most major industrial and military specifications. UCON Quenchant A is classified as a Type I quenchant (per current AMS 3025 requirements) for aluminum heat treating in the aerospace industry. UCON quenchants have been tested to the Standard 6930 Flammability Classification of Industrial Fluids and approved by FM Approvals as “FM Approved” products.

### Marine Lubricants

There continues to be a growing use of lubricants in the marine industry that are considered safer for the environment than traditional hydrocarbon oils. Furthermore, specifications and also government policies continue to evolve which favor the use of environmentally friendly lubricants. Polyalkylene glycol lubricants can offer favorable environmental profiles for many applications in the marine industry such as hydraulic fluids, stern drives and gear lubricants. One key benefit of PAGs is their excellent hydrolytic stability which is significantly better than natural or synthetic esters. Hydrolysis of a lubricant can cause a deterioration of fluid performance and longevity and presents a risk of equipment damage. Some PAGs also offer high levels of biodegradability. Furthermore a unique attribute of water soluble PAGs is their non-sheening behavior. No other major base oil chemistry offers this feature today.

### Compressor Lubricants

UCON LB Series and 50-HB Series base stocks are used extensively in the formulation of compressor lubricants. A complete line of formulated UCON compressor lubricants is also available. Centrifugal, reciprocating, rotary-screw, sliding vane, and other types of compressors have been lubricated with UCON lubricants in a variety of applications, including helium, nitrogen, hydrogen, carbon dioxide, natural gas, ethylene, stack gases, landfill gas, and fluorocarbon refrigerant. They offer excellent lubricity, high temperature stability, resistance to sludge and varnish formation, good additive response, and adaptable solubilities.

### **Machinery, Gear & Bearing Lubricants**

Dow offers two series of formulated lubricants for gear lubrication: UCONALL™ lubricants and UCON food-grade lubricants. UCONALL lubricants are fully formulated, extreme-pressure lubricants for enclosed industrial gears. They are formulated to provide excellent lubrication, thermal and oxidative stability, and extended service life, while eliminating many of the problems associated with petroleum gear lubricants. With viscosity indices generally exceeding 170, these lubricants provide excellent viscosity-temperature properties; which eliminates the need for seasonal changeover due to climatic temperature changes. UCONALL lubricants are available in a broad viscosity range for many industrial gear applications, including helical, herringbone, bevel, spiral bevel, spur, and worm gear designs.

### **Food-Grade Lubricants**

UCON food-grade lubricants are fully formulated, extreme-pressure lubricants developed for industrial machinery where incidental food contact from lubricants may occur. All of the components of these lubricants are identified in FDA Regulation 21 CFR 178.3570 and/or 21 CFR 178.3910. UCON food-grade lubricants offer improved performance over food-grade white oils and non-food-grade-rated petroleum oils by providing excellent lubricity, increased oxidative and thermal stability, high viscosity indices and low pour points. They provide the same energy savings and temperature reductions as industrial-grade UCONALL lubricants. UCON food-grade lubricants pass twelve load stages of the FZG spur gear test.

### **High-Temperature Lubricants**

UCON lubricants offer unique properties that provide key advantages in industrial lubrication at high temperatures. At elevated temperatures, most lubricating oils tend to decompose or oxidize into sludges and carbonaceous residues, resulting in high wear rates and inefficient operation. UCON lubricants generally do not form deposits, sludges, or varnishes at high temperatures. Total or clean burn-off can be achieved without sludge and residue formation. UCON lubricants are ideal liquid carriers for solid lubricants, such as graphite or molybdenum disulfide, used in high-temperature applications. This combination is highly desirable in kiln-car bearings, on oven chains and drives, and to lubricate gears on hot glass machinery.

### **Special Uses**

Special uses for UCON fluids and lubricants include, chemical intermediates, ink and dye solvents, plasticizers and solvents, foam control agents, cosmetic fluids and emollients, and demulsifiers. Contact Dow to learn more about these and other applications.

### **Supporting Services**

The Dow sales and technical team for UCON fluids and lubricants stands ready to support you with product selection, formulation, and application assistance; product physical properties and performance data; regulatory information; handling and storage information; as well as Material Safety Data Sheets and other product safety information.

To learn more, contact Dow at the number for your area, listed on the back of this brochure. Or visit us online at [www.ucon.com](http://www.ucon.com)





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