THERMAL-LUBE

FIRE-RESISTANT HIGH PERFORMANCE WATER-GLYCOL HYDRAULIC FLUID

XL5146

March 2023

XL5146 provides a safer working environment for those applications where hydraulic piping might rupture and spray fluid onto hot surfaces and ignite with resultant hazard to plant personnel and equipment.

XL5146 is recognized worldwide as an FM Approved Industrial fluid and is approved by the Canadian Centre for Mineral and Energy Technology (CANMET) for use in underground mining applications. Reduced fire hazards improve personnel safety in storage, handling, and use, which could lower insurance premiums.

XL5146 is a proven water-glycol fluid for use in high pressure systems. With a viscosity index (VI) of 192 and a pour point of -63°C, **XL5146** can be used year-round, where other fluids may require 2 or 3 viscosity grades to operate through different seasons.

FEATURES

- Lubricating agents provide good anti-wear characteristics.
- Corrosion inhibited to protect ferrous and non-ferrous components; both liquid and vapor phases.
- **XL5146** is 100 percent soluble in water, making equipment and shop cleanups easier than with conventional hydraulic fluids.
- Formulated with 35-40 percent water and specially selected performance-enhancing additives, **XL5146** is readily biodegradable, therefore minimizing disposal problems and reducing plant maintenance costs.
- Low pour point -63°C.
- Low pump wear. Protects pumps and system components from premature wear and failure means lower maintenance costs and less downtime.
- Extends equipment life, reduces downtime and maintenance costs. When proper fluid and equipment maintenance procedures are followed, **XL5146** remains clean, does not produce sludge, and lasts longer than conventional fluids.
- Classified by the USDA as H-2, **XL5146** can be used in federally inspected meat, poultry, and egg processing plants as a hydraulic fluid in locations in which there is no possibility of the lubricant or lubricated part contacting edible products.
- Under OECD Guideline 420 for Acute Oral Toxicity Testing, **XL5146** is classified as a “compound which does not present a significant acute toxic risk if swallowed.”
- Ease of start up over a broad operating range.

255 Ave Labrosse, Pointe-Claire, Québec, Canada H9R 1A3

T: +1.514.694.5823; www.thermal-lube.com

FIRE-RESISTANT HIGH PERFORMANCE WATER-GLYCOL HYDRAULIC FLUID

XL5146

PERFORMANCE CHARACTERISTICS

High-Pressure Capabilities – The superior performance of **XL5146** has been demonstrated by independent laboratory tests at 5000 psi, and in-service field trials and commercial applications at greater than 5000 psi (345 bars). Visual and quantitative measurements show little indication of wear of pump parts or motor components.

Excellent Fire Resistance – XL5146 extends the superior fire resistance characteristics of water-glycol fluids into the high-performance arena. Since a water-glycol fluid will not burn until the water has evaporated, there is much less fire hazard from a spill or leak onto a hot metal surface. In addition, there is considerably less flame and smoke associated with **XL5146** than with other fire-resistant synthetic hydraulic fluids, such as polyol or phosphate esters. **XL5146** is a FM Approved Industrial Fluid as tested against standard 6930.

Cost-Effective – Outstanding antiwear performance has been demonstrated in both low and high-pressure applications. The use of **XL5146** provides cost savings, both initially and in make-up, for the best overall cost vs. performance. The fluid has been used as long as two years without changeout. Cost effectiveness also includes longer-lasting, better-performing hydraulic system components.

Environmental Safety – This diethylene glycol-water-based fluid requires no special handling and can be managed using standard waste treatment procedures. **XL5146** does not contain any phenol. Any discharge should be reviewed with the local POTW before commencing operations.

Seal and Hose Compatibility – Historically, water-glycol fluids have exhibited excellent compatibility and service life with standard hydraulic seals and hose elastomers. **XL5146** affords similar elastomer compatibility with commonly used materials, such as Viton, high-nitrile Buna N, EPDM, butyl, silicone, and halogenated elastomers (e.g., Aflas, Kalrez, etc.).

NOTE: Urethanes and Buna S (SBR) elastomers are not compatible with **XL5146**.

Plastics Compatibility – Due to variations that can exist between plastics in the same generic family, it is important to test the compatibility of any plastic components (such as reservoir sight glass) exposed to the hydraulic fluid under end-use conditions.

PERFORMANCE TEST RESULTS

Viscosity Properties – Because of its relatively low pour point (-63°C) and high viscosity index (192), **XL5146** can be used over a wide temperature range with only a minimal impact on the bulk fluid viscosity. The viscosity index and pour point of **XL5146** is compared to typical ISO 46 grade mineral oil, phosphate ester, and polyol ester hydraulic fluids in Table 1. **XL5146** has a comparable viscosity-temperature profile to typical competitive fluids, as described in Figure 1.

255 Ave Labrosse, Pointe-Claire, Québec, Canada H9R 1A3

T: +1.514.694.5823; www.thermal-lube.com

FIRE-RESISTANT HIGH PERFORMANCE WATER-GLYCOL HYDRAULIC FLUID

XL5146

TYPICAL SPECIFICATIONS	
Viscosity cSt (ASTM D445) @ -18°C @ 0°C @ 40°C @ 65°C	 1300 340 46 22
Viscosity Index (ASTM D2270)	192
Pour Point (°C) (ASTM D97)	<-60
Specific Gravity at 20/20°C	1.09
Colour	Red
Corrosion Protection (ASTM D665A)*	Pass
Water Content (% weight)	38.0 – 40.5
pH @ 25°C	8.8-9.4
Alkalinity mL of 0.1N hydrochloric acid needed to neutralize 100ml of fluid to a pH of 5.5	160-200
Water Content, weight %	34-38
Thermal Conductivity at 100°F (est.) (BTU/ft/hr/°F)	0.26
Coefficient of Thermal Expansion per °C (est.) at 20°C at 55°C	 0.00065 0.00067
Vapor Pressure at 38°C, psia	1.1
Flash Point, ASTM D 93 or ASTM D92, (°C)	None

* **NOTE:** Not recommended for use with zinc, galvanized iron, or cadmium.

Figure 1 • Viscosity vs. Temperature for Hydraulic Fluids

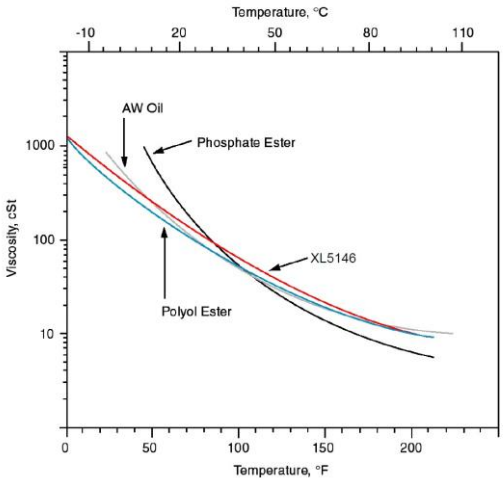


Table 1 ASTM 2882

Hydraulic Fluid	Pour Point, °C	Viscosity Index
Mineral Oil	-34	90-120
Phosphate Ester (Trialkyl)	<-70	90-145
Phosphate Ester (Triaryl)	-5 to -35	<0-35
Polyol Ester	-26	150-185
XL5146	-63	192

Pump Wear Performance – In a modified ASTM D2882 Test, as the data in Table 2 indicates, **XL5146** is significantly superior to conventional water-glycol and exhibits wear characteristics similar to those of phosphate/polyol esters and AW oil.

255 Ave Labrosse, Pointe-Claire, Québec, Canada H9R 1A3

T: +1.514.694.5823; www.thermal-lube.com

Fluid	Total Wear (mg)
Phosphate Ester	5
XL5146	10
Polyol Ester	10
Antiwear Hydraulic Oil	24
Conventional Water-Glycol	65

1. Test Conditions:
   Tests were conducted over 100 hr at 2000 psi (13.8 MPa) and 1200 rpm using a vane pump equipped with a 30 L/min ring. Comprehensive cleaning procedures.
   Pass Criteria: **≤100 mg total wear**

In the *Fuel Injection Shear Stability Test* (ASTM D 3945), **XL5146** shows no viscosity loss at shear rates up to 106 sec-1.

High-Pressure Axial Piston Pump Test, **XL5146** was also evaluated independently in a Sunstrand Series 22 axial piston pump using a modified Water Stability Test employed by Southwest Research Institute. As indicated in Table 3, no significant flow degradation (0.8%) was observed over the full test duration. (A flow degradation of 10% constitutes failure.) Furthermore, test parts showed negligible wear after running 225 hours with **XL5146** as shown in Figure 2.

Table 3. High Pressure Axial Piston Pump Test[1] Results

Time, hr	Flow Rate, gal/min (L/min)
1	24.9 (94.4)
75	24.9 (94.4)
125	24.9 (94.4)
225	24.7 (93.6)

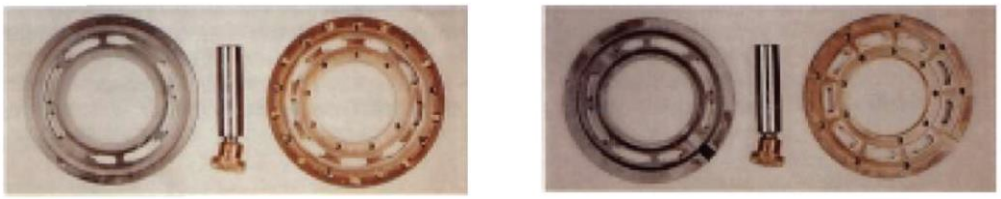
1. Test Conditions:
   - Sunstrand 22-2132 Variable Displacement Axial Piston Pump
   - Input Speed - 3100 rpm
   - Load Pressure - 5000 psi (345 bars)
   - Temperature, Reservoir - 120°F (49°C)
     Loop - 170°F (77°C)

Pass Criteria: <10% flow rate decrease

255 Ave Labrosse, Pointe-Claire, Québec, Canada H9R 1A3

T: +1.514.694.5823; www.thermal-lube.com

Figure 2. Sunstrand Series 22 Axial Piston Pump Parts Running 225 hr



Side 1 Side 2

High-Pressure Hydrostatic Drive Test, **XL5146** proved itself to be a very stable fluid with excellent lubrication properties under the high-pressure conditions of the following test.

PACKAGING:

XL5146 is available in 20L pails, 205L drums, 1100L semi bulk containers and bulk shipment as required.

WATER-GLYCOL HYDRAULIC FLUID CONVERSION PROCEDURE

XL5146 Mineral Oil Compatibility

Water glycol hydraulic fluids are not compatible with low mineral oil hydraulic fluids. Water glycol hydraulic fluids depend on ionic species with affinities for metal surfaces to provide anti-wear properties. Oily films interfere with the anti-wear chemistry of water glycol. The main anti-wear additive in most anti-wear mineral oil hydraulic fluids is zinc dialkyldithiophosphate.

These zinc-based additives react with the fatty acids contained in all aqueous glycols, thus blocking the need for water glycol additives and the formation of a white soap, which can block filters and colanders. Mineral oils are soluble in water glycol fluids only in small concentrations. The oxidation products of mineral oils are more polar than the mineral oils themselves and, therefore, are more easily suspended in water glycols.. This sludge continues to oxidize and can clog filters, strainers and valves. They also interfere with hydraulic water glycol additives.

255 Ave Labrosse, Pointe-Claire, Québec, Canada H9R 1A3

T: +1.514.694.5823; www.thermal-lube.com

FIRE-RESISTANT HIGH PERFORMANCE WATER-GLYCOL HYDRAULIC FLUID

XL5146

The proposed change procedure is designed to:

Minimize competitive interference of mineral oils and their additives through proper drain and rinse procedures

Avoid blocking of the filter, strainer and valve and consequential damage to the system, avoiding the formation of "soap" and the removal of mineral oil sludge

Recommend special design and equipment considerations

Recommend maintenance of the hydraulic system to prevent leaks, promote both system maintenance and efficient operation

Special design and equipment considerations:

Water glycol hydraulic fluids are different, chemically and physically, from other mineral oil hydraulic fluids. The following differences have some impact on conversions of existing systems.

Water glycol hydraulic fluids have:

Higher vapour pressures than mineral oils

A higher tendency to drive air than most mineral oil hydraulic fluids.

Higher densities than mineral oils

The following issues should be considered when reviewing the above document and during the conversion process:

- The inside of the tanks must be left unpainted and/or the old paint must be removed
- Even compatible joint materials should be replaced whenever possible, as used seals can be damaged or may react unpredictably when they are exposed to a combination of otherwise compatible fluids
- Zinc and cadmium plated parts must be replaced
- Due to the higher density and vapor pressure of water glycols, take care to avoid poor suction conditions on hydraulic pumps and losses of marginal fluid load and velocities, i.e., strainers in existing tanks must be removed
- Accumulators should, whenever possible, contain a bladder to separate air and hydraulic fluid

255 Ave Labrosse, Pointe-Claire, Québec, Canada H9R 1A3

T: +1.514.694.5823; www.thermal-lube.com

FIRE-RESISTANT HIGH PERFORMANCE WATER-GLYCOL HYDRAULIC FLUID

XL5146

CONVERSION PROCEDURE

To convert a hydraulic petroleum oil system to **XL5146** hydraulic fluids, follow the accepted engineering practices below.

Here is a recommended procedure for switching from petroleum oils to water-glycol:

- Drain the oil from the system completely. This includes the tank, pipe lines, cylinders, accumulators, filters or any other equipment in which oil could be trapped.
- Clean the system of sludge and residual deposits and remove paint from inside the tank unless the paint has been tested and is resistant to solvent action from water glycol hydraulic fluids.
- Disconnect the filter.
- Rinse the system with a minimum amount of water-glycol fluid used. Rinse first while operating without load or at minimum operating pressure, then bring the fluid to normal temperature and operate all parts. The practice of operating on the rinse fill for several hours can be used to ensure full circulation and take full advantage of the solvent cleaning characteristics of the water glycol hydraulic fluid.
- Drain the rinse load as thoroughly as possible, while it is still hot and without letting it settle. This rinse liquid can be retained for later use in the preparation of other machines for service or for make-up purposes after removal of suspended solid contaminants and residual petroleum oil.
- Install a clean filter cartridge. Replace filter elements with zinc or cadmium plated parts with suitable substitutes. Do not use a highly adsorptive filter medium, such as clay or Fuller's earth, as these filters can change the composition of the fluid by removing essential additives. Examine pump parts, 0 rings, seals and auxiliary equipment. Replace worn pump parts. Repair leaking pipe joints. Replace damaged seals, seals and packaging. Replace cork shaft seals and other water-sensitive packaging and materials.
- Reconnect the system and tighten all connections.
- Fill with **XL5146** hydraulic fluid.
- Run at reduced pressure to ensure proper lubrication of the hydraulic pump; then set to normal operating conditions.

255 Ave Labrosse, Pointe-Claire, Québec, Canada H9R 1A3

T: +1.514.694.5823; www.thermal-lube.com