



Power Flo

Environmentally Approved Hydraulic Fluid

Power Flo is a premium, high pressure, water soluble, environmental hydraulic fluid, which provides a more responsible environmental option than conventional mineral oil or vegetable oil based hydraulic fluids. In applications where hydraulic piping may rupture and spray, or leak hydraulic fluid into sensitive environments, Power Flo is readily biodegradable, and dissolves entirely, protecting fish and fowl from oily slicks. Power Flo's technical performance is equal to or better than premium mineral oil hydraulic fluids in service.

RECOMMENDED USES

Power Flo is recommended for use in precision industrial and mobile hydraulic systems operating at system pressures up to 7000 psi at 50°C (**Note:** higher operating pressures and temperatures may be possible).

Power Flo is recommended for use in stationary or mobile hydraulic systems operating in sensitive environments where spills or leaks may occur.

Power Flo high pressure hydraulic fluid is a Group 1 Factory Mutual approved fire-resistant fluid.

FEATURES

- Readily Biodegradable
- Low order of Toxicity
- Water Soluble
- High Viscosity Index, Low Pour Point
- Not WHMIS controlled
- NON TDG controlled

BENEFITS

- **>85% in 28 days.** Incidental drips or leaks degrade in the environment leaving no lasting effects.
- Reduced environmental liability, reduced clean-up costs
- Rated by USFW as "Essentially Non-Toxic."
- Not harmful to fish or wildlife
- Easy Clean-up
- Will not form slicks or sheens when released into water. Dissolves, disperses and degrades. Will not foul shorelines or plant life.
- Resists viscosity change with temperature. Works better than mineral oil at operating temperature extremes. Pour point of -63 degrees C.
- Worker Acceptance
- Lower Freight Costs

All technical information, recommendations and statements contained herein are based on tests we believe to be reliable. It is offered in good faith but with out guarantee. We make no warranty expressed or implied as to the suitability of our product for any particular use in operations not under our direct control. Liability is limited to the net purchase price of the product.

- Eco-Logo Approved
- Your evidence of due diligence choosing a Government of Canada approved environmental product
- Fire Resistant
- Worker and Asset Protection

TYPICAL TECHNICAL PROPERTIES

Property	Method	Typical
Colour & Appearance	Visual	Clear, Blue
Viscosity, cSt @ 40 °C	ASTM D-445	46
Viscosity Index		192
Water by Karl Fischer Titration, %	ASTM D-1744	39
Pour Point, °C	ASTM D-97	-63
pH	FLA 003	9.0
Reserve Alkalinity, (mL 0.1N HCl to neutralize 100mL of fluid to pH 5.5)	FLA 011	180
100 Hour Pump Stand Test, mg wear / hour	ASTM D-2882	0.10
100 Hour Vickers Pump Stand Test, mg wear /hour	20-VQ-5	0.13

NOTES

20-VQ-5 Pump Stand Test Conditions:

Pump Pressure	3000 psi
Pump Speed	1200 rpm
Flow Rate	5 GPM
Temperature	65°C

The Vickers 20-VQ-5 Pump Stand Test has been developed to provide hydraulic fluid performance data in combination with ASTM D-2882.

PACKAGING

Power Flo Environmental hydraulic fluid is available in 5 gallon pails or 55 gallon drums.

All technical information, recommendations and statements contained herein are based on tests we believe to be reliable. It is offered in good faith but with out guarantee. We make no warranty expressed or implied as to the suitability of our product for any particular use in operations not under our direct control. Liability is limited to the net purchase price of the product.



Power Flo Hydraulic Fluid

Mobile Equipment Design Considerations

Introduction

The following guidelines are offered as general recommendations for mobile hydraulic systems employing **Power Flo** "Fire-Resistant", Environmentally Approved, Biodegradable, Water Soluble hydraulic fluid. In all cases equipment manufacturer's recommendations should be followed if they differ from those listed below.

Pumps

Hydraulic pumps should not be operated above their recommended speed or pressure. **Power Flo** has been designed specifically for use in systems operating at pressures in the 2000 – 5000 psi range and is capable of operating at up to 7000 psi in specific applications. Enhanced lubrication and anti wear characteristics of **Power Flo** allow it to be used in most systems without downgrading the operational parameters of any of the individual components

Pump inlet lines should be in accordance with pump manufacturer recommendations. Pump inlet line diameters must not be reduced, should be kept as short as possible, and be free of any restrictions which may cause a pressure drop. Strainers **should not** be installed in pump inlet lines, since these will significantly reduce system efficiency levels when running at cold temperatures. Wherever possible, pumps should be placed below the level of the fluid in the reservoir to create a positive pressure at the pump inlet port. This will reduce the possibility of pump cavitation where systems are operated in a cold weather environment. In specific applications where the pump is mounted on top of the reservoir it is recommended that the pump inlet port be no more than 12 inches above the fluid level. Cavitation results in excessive pump noise, vibration, erratic response, and reduced pump service life. Cavitation is also accompanied by metal removal, reduced flow, and loss in efficiency.

Fluid Reservoir

Fluid reservoirs should be sized and designed in accordance with industry standards and should include baffles, clean out doors, and inspection covers. Design should be such that there is good fluid circulation within the reservoir, and baffles to prevent "slopping" caused by vehicle motion.

Contamination of fluid reservoirs can be minimized by installing filters in the return line and by ensuring that reservoir filler- breathers incorporate a filter in them to prevent airborne contamination from entering the reservoir during operation. Fluid return lines must terminate below the minimum operating fluid level.

Filters

Cellulose paper filters must not be used with **Power Flo** hydraulic fluid. Filter media specifically approved for water glycol type fluids should be used. (Contact the filter manufacturer) In most standard mobile systems, 10 micron filters are adequate. In some specialized systems using precision servo valves, there may be a requirement for improved filtration. For additional information, contact your servo valve manufacturer. The table below lists filters recommendations for various types of systems and suggested acceptable contamination levels.

In all cases your equipment suppliers should be consulted to determine the appropriate degree of filtration for your various system components.

Target ISO Code for Particles		Maximum Particle Count		System Sensitivity	Type of Hydraulic System	Suggested Filter Size (mm)
5 mm	15 mm	5 mm	15 mm			
13	9	4,000	250	Critical	Silt sensitive control system with very high reliability. Laboratory or aerospace.	3
15	11	16,000	1,000	Semi-Critical	High performance servo & high pressure long life systems, i.e. aircraft, machine tool, etc.	5
16	13	32,000	4,000	Important	High quality reliable systems. General machine requirement.	10
17	14	130,000	8,000	Average	General machinery & mobile systems.	10
19	15	250,000	16,000	Crude	Low pressure heavy industrial systems; or applications where long life is not critical.	15-25

Seals

Power Flo hydraulic fluid is compatible with many common seal materials which are normally used with petroleum based fluids. The table below lists general compatibility guidelines; however, compatibility should be verified with your seal manufacturer.

Recommended Elastomers

- H-Poly 7695 or Equivalent
- Fluorocarbon (Viton, Teflon)
- Silicone (Silastic)
- Fluorosilicone
- PNF (phosphonitrilic fluoroelastomer)
- Ethylene-Propylene
- EPDM (ethylene-propylene diene terpolymer)
- Natural Rubber (polyisoprene)
- Butyl Rubber (isobutylene/isoprene)
- Buna N (acrylonitrile-butadiene rubber, Nitrile, NBR)
- Neoprene Rubber (Chloroprene)

Operating Temperature

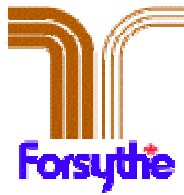
It is recommended that the hydraulic system operating temperature for Power Flo, be maintained below 71°C (160°F) Cooler temperatures will result in better fluid lubricity and longer fluid life.



PUMP WEAR PERFORMANCE For POWER FLO HYDRAULIC FLUID

TEST STAND	DATA AND EVALUATION
<p>ASTM D-2882 Vickers Vane 104-C pump 28.4 L/min Flow @ 1200 rpm Duration 100 hrs Pass Criteria: Physical Wear < 1.0 mg/hr</p>	<p>COMPARATIVE WEAR RATE IN Mg/hr Power Flo AW Mineral Oil <0.1 <0.1 Power Flo exhibits a wear rate that is equivalent to mineral based hydraulic fluids.</p>
<p>High Pressure Water Tolerance - Sundstrand 22-2132 (Var. Disp) Axial Piston Pump - Input speed 3100 rpm - Pressure Load 5000 psi - Duration: 225 hrs. - Pass Criteria: < 10% Flow rate decrease.</p>	<p>Flow Rate Gal/Min Time (hrs) 1 75 125 225 Flow Rate 24.9 24.9 24.9 24.7 Power Flo exhibits a flow rate decrease of less than 1% indicating minimal wear – this supported by visual inspection of pump parts.</p>
<p>High Pressure Hydrostatic Drive Simulation - Sundstrand Series 20 Motor and Pump - Case Drain Flow 5 gal/min - 600 sec. pressure cycle 1300 psi to 4500 psi - Duration: 500 hrs (5 days/week, 16 hrs/day) - Test stand was subjected to operating temperature variations from +14°C to -21°C - Pass Criteria: <5% Flow rate decrease. Visual inspection of pump parts. Fluid integrity remains constant.</p>	<p>Observations: Sundrand pump and motor performed well during test and visual inspection (before/after comparison) confirmed no unusual wear or stress. Hourly date log confirmed – no significant change in flow rate over test period. Power Flo showed excellent resistance to shear – chemical and physical properties remained virtually unchanged.</p> <p>Conclusions: Power Flo is a very stable fluid with excellent lubrication properties. The fluid performed well under high pressure loading and is suitable for winter operating conditions.</p>

All technical information, recommendations and statements contained herein are based on tests we believe to be reliable. It is offered in good faith but with out guarantee. We make no warranty expressed or implied as to the suitability of our product for any particular use in operations not under our direct control. Liability is limited to the net purchase price of the product.



Power Flo Conversion Procedure

Converting from Mineral Oil or Vegetable Oil Fluids To “Eco Logo Approved” Power Flo Hydraulic Fluid

1. While the current hydraulic fluid is at operating temperature, drain all system components including reservoir, pipelines, cylinders, pump, filter housing and coolers.

Where feasible:

- Blow all lines with dry, pressure regulated, and compressed air to remove any fluid trapped in inaccessible places.
 - Clean all valves thoroughly.
2. Clean the system reservoir of residual sludge and deposits; steam or high pressure water cleaning is recommended, if possible. Cleaning should be as complete as existing conditions will permit.
 3. Remove and dispose of existing filters. Clean and inspect all strainers.
 4. Reconnect all system lines.
 5. Install a fresh charge of Power Flo Flush into the system. Flush the system by operating all cylinders without a load or at minimum pressure. Bring the fluid up to a normal operating temperature range, but maintain pressure appropriate for the flush being used. Continue to flush as long as practical to ensure complete circulation, and to fully exploit the cleaning characteristics of Power Flo Flush.
 6. Immediately drain the flush fluid completely.
 7. Remove the existing filter and install a new synthetic media filter.
 8. Fill the system reservoir with Power Flo – then operate all cylinders for 2 - 3 minutes.
 9. Shut the system off...wait 10 minutes – then remove reservoir cap and skim off any residual fluid from the surface and obtain a fluid sample – to be sent to Forsythe Lubrication for analysis.



Contact:

Eco-Safe Solutions

T: (905) 725-6918

E: dlee@ecosafesolutions.ca

W: www.ecosafesolutions.ca



“No Fire” WG 200R Water Glycol Fire Resistant Hydraulic Fluid

“No Fire” WG 200R is a, premium, general purpose water glycol fire resistant hydraulic fluid, which provides a safer working environment than conventional mineral oil based hydraulic fluids. In applications where hydraulic piping may rupture and spray hydraulic fluid onto hot surfaces, mineral oil based fluids can ignite causing a severe hazard to plant personnel and equipment.

RECOMMENDED USES

“No Fire” WG 200R is recommended for use in precision industrial and mobile hydraulic systems operating at system pressures up to 2000 psi at 50°C (**Note:** higher operating pressures [3000 psi] and temperatures may be possible).

“No Fire” WG 200R water glycol fire resistant hydraulic fluid is a Group 1 Factory Mutual approved fluid and is approved by the Canadian Centre for Mineral and Energy Technology (CANMET - CAN3-M423-M84) for use in underground mining applications.

For additional information, please refer to the Forsythe technical bulletins titled “Hydraulic System Design Considerations When Using Water Glycol Fluids”, “Hydraulic Fluid Conversion Procedure” and “Care and Maintenance of Water glycol Fluid Systems”.

FEATURES

- Excellent fire resistance.
- Good anti-wear characteristics.
- Liquid and vapour phase corrosion inhibited.
- Inherently low pour point and excellent viscosity temperature characteristics.
- Non-WHMIS controlled, low toxicity.
- Readily biodegradable, low ecotoxicity.

BENEFITS

- Reduced risk of injury to plant personnel and damage to equipment caused by hydraulic fluid fires. Lower insurance costs.
- Increased protection against premature pump and component wear. Reduced downtime and lower maintenance costs.
- Protects system reservoir and components (ferrous and non-ferrous) against rust and corrosion. Extended equipment life, reduced downtime and maintenance costs.
- Excellent cold temperature properties. Wide operating temperature range.
- Greater workplace acceptance. Reduced health and safety concerns. No special handling or disposal requirements.
- Reduced environmental liability in case of spills or leaks.

All technical information, recommendations and statements contained herein are based on tests we believe to be reliable. It is offered in good faith but with out guarantee. We make no warranty expressed or implied as to the suitability of our product for any particular use in operations not under our direct control. Liability is limited to the net purchase price of the product.

TYPICAL PROPERTIES

Property	Method	Typical
Colour & Appearance	Visual	Clear, Red
Viscosity, cSt @ 40 °C	ASTM D-445	43
Water by Karl Fischer Titration, %	ASTM D-1744	41
Pour Point, °C	ASTM D-97	-50
pH	FLA 003	9.6
Reserve Alkalinity, (mL 0.1N HCl to neutralize 100mL of fluid to pH 5.5)	FLA 011	210
100 Hour Pump Stand Test, mg wear / hour	ASTM D-2882	0.60
100 Hour Vickers Pump Stand Test, mg wear /hour	20-VQ-5	0.93

NOTES

20-VQ-5 Pump Stand Test Conditions:

Pump Pressure	3000 psi
Pump Speed	1200 rpm
Flow Rate	5 GPM
Temperature	65°C

The Vickers 20-VQ-5 Pump Stand Test has been developed to provide hydraulic fluid performance data in combination with ASTM D-2882.

PACKAGING

“No Fire” WG 200R is available in 20 litre pails, 205 litre drums, totes and bulk shipments as required

**Contact:**

Eco-Safe Solutions

T: (905) 725-6918

E: dlee@ecosafesolutions.ca

W: www.ecosafesolutions.ca

“No Fire” HPWG 46B

High Pressure Water Glycol Fire Resistant Hydraulic Fluid

“No Fire” HPWG 46B is a premium, high pressure, water glycol fire resistant hydraulic fluid, which provides a safer working environment than conventional mineral oil based hydraulic fluids. In applications where hydraulic piping may rupture and spray hydraulic fluid onto hot surfaces, mineral oil based fluids can ignite causing a severe hazard to plant personnel and equipment.

RECOMMENDED USES

“No Fire” HPWG 46B is recommended for use in precision industrial and mobile hydraulic systems operating at system pressures up to 7000 psi at 50°C (**Note:** higher operating pressures and temperatures may be possible).

“No Fire” HPWG 46B high pressure water glycol fire resistant hydraulic fluid is a Group 1 Factory Mutual approved fluid and is approved by the Canadian Centre for Mineral and Energy Technology (CANMET - CAN3-M423-M84) for use in underground mining applications.

For additional information, please refer to the Forsythe technical bulletins titled “Hydraulic System Design Considerations When Using Water Glycol Fluids”, “Hydraulic Fluid Conversion Procedure”, and “Care and Maintenance of Water Glycol Fluid Systems.”

FEATURES

- Excellent fire resistance.
- High pressure capability.
- Excellent anti-wear characteristics.
- Non-WHMIS controlled, low toxicity.
- Readily biodegradable, low ecotoxicity.

BENEFITS

- Reduced risk of injury to plant personnel and damage to equipment caused by hydraulic fluid fires. Lower insurance costs.
- Benefits of water glycol fluids can now be applied to high pressure applications (up to 7,000 psi).
- Increased protection against premature pump and component wear. Reduced downtime and lower maintenance costs.
- Greater workplace acceptance. Reduced health and safety concerns. No special handling or disposal requirements.
- Reduced environmental liability in case of

spills or leaks.

- Compatible with conventional water glycol fire resistant hydraulic fluids.
- Multi-use capability and reduced inventory requirements.

TYPICAL PROPERTIES

Property	Method	Typical
Colour & Appearance	Visual	Clear, Blue
Viscosity, cSt @ 40 °C	ASTM D-445	46
Water by Karl Fischer Titration, %	ASTM D-1744	39
Pour Point, °C	ASTM D-97	-63
pH	FLA 003	9.0
Reserve Alkalinity, (mL 0.1N HCl to neutralize 100mL of fluid to pH 5.5)	FLA 011	180
100 Hour Pump Stand Test, mg wear / hour	ASTM D-2882	0.10
100 Hour Vickers Pump Stand Test, mg wear /hour	20-VQ-5	0.13

NOTES

20-VQ-5 Pump Stand Test Conditions:

Pump Pressure	3000 psi
Pump Speed	1200 rpm
Flow Rate	5 GPM
Temperature	65°C

The Vickers 20-VQ-5 Pump Stand Test has been developed to provide hydraulic fluid performance data in combination with ASTM D-2882.

PACKAGING

“No Fire” HPWG 46B water glycol fire resistant hydraulic fluid is available in 20 litre pails, 205 litre drums, totes and bulk shipments as required.



Contact:

Eco-Safe Solutions
T: (905) 725-6918
E: dlee@ecosafesolutions.ca
W: www.ecosafesolutions.ca

All technical information, recommendations and statements contained herein are based on tests we believe to be reliable. It is offered in good faith but with out guarantee. We make no warranty expressed or implied as to the suitability of our product for any particular use in operations not under our direct control. Liability is limited to the net purchase price of the product.

INTRODUCTION TO FIRE RESISTANT HYDRAULIC FLUIDS

Industrial hydraulic equipment operating conditions are more rigorous than ever before. The use of precision machinery, functioning at extreme temperatures with high pump speeds and system pressures is prevalent in all industrial sectors. In areas close to potential ignition sources, safe work practices demand the use of hydraulic fluids that provide greater protection against fire than can be afforded by traditional mineral oil based hydraulic fluids.

Even a small leak in a hydraulic system can allow fluid to escape as a fine spray or mist that can travel uncontrollably over great distances. If mineral oil spray comes in contact with an open flame, molten metal or hot manifold, spontaneous ignition will occur and burn with a fierce, severe flame. The flame can quickly move back to the source of the spray and rapidly spread to other parts of the facility causing severe injury to personnel and extensive damage to equipment and buildings. The use of fire resistant hydraulic fluids in applications where there is a potential for such an occurrence can provide a significant safety factor and greatly reduce the risk of fire damage. Therefore, insurance premiums can be reduced when fire resistant hydraulic fluids are used in situations of fire risk.

The use of a fire resistant hydraulic fluid is firmly entrenched in industry and is ever expanding as companies try to improve safety conditions and reduce costly financial losses caused by equipment fires. A properly functioning fire resistant hydraulic fluid will not immediately ignite or burn when in contact with sparks, open flames, hot surfaces or molten metal. Consequently, fire resistant fluids provide reduced flammability to allow time for equipment shut down and personnel escape. It will also perform the fundamental roles of a hydraulic fluid, ie. transmit power, lubricate moving parts and provide corrosion protection. Advancements in fire resistant hydraulic fluid technology have produced high quality fluids that combine safety and performance to provide innocuous, low maintenance operation of precision industrial equipment.

Types of Fire Resistant Hydraulic Fluids

The ultimate fire resistant hydraulic fluid is of course the oldest type of hydraulic fluid used by mankind: water. However, water cannot provide the lubricity or corrosion protection required in even the simplest piece of modern hydraulic equipment. In order to provide the lubricity and corrosion protection required, other fluids had to be developed in order to produce a usable fire resistant hydraulic fluid. The following fluids are used as fire resistant hydraulic fluids:

- 1) Water Glycol - True solutions based on glycol compounds in water with a combination of anti-wear additives, lubricity improvers and corrosion inhibitors. Containing 37 - 50% water, these fluids provide excellent resistance to fire, stable viscosity/temperature profiles and superb low temperature performance.
- 2) Oil in Water (95 / 5) Emulsion - Traditional emulsions of mineral oil in water. Containing 85 - 95% water, these fluids offer excellent resistance to fire, but temperature limitations, limited lubricity, corrosion concerns and emulsion stability restrict the number of suitable applications.
- 3) Water in Oil (Invert) Emulsion - Similar to water glycol fluids in water content, water in oil emulsions provide limited fire resistance and present problems with regards to lubricity and temperature limitations. Also, stability of this type of fluid during storage is rather poor causing the two phases to split easily.
- 4) Polyol Ester - Fully synthetic blends of oleic acid based esters and performance enhancing additives. Fire resistance is more predicated on passing older industry tests through a high flash point and the use of a non-shear stable anti-mist additive, than a history of successful fire resistance. Excellent lubricity characteristics enable polyol esters to be used in place of mineral oil based hydraulic fluid to provide a small margin of fire safety.

Like mineral oils, polyol ester fluids will burn easily and do not provide adequate fire safety without the use of additional fire safety equipment. This characteristic has caused Factory Mutual to review its classification system for grading fire resistant hydraulic fluids. Revisions to the Factory Mutual Test Protocol and other industry standards will greatly reduce the incentive to use polyol ester fluids as fire resistant hydraulic fluids.

- 5) Other Fluids - Other fluids such as silicones and halogenated aromatics have been used as fire resistant hydraulic fluids in the past, however, due to ecological and price concerns, their use has been reduced to almost nil.

Forsythe Lubrication offers several selections in terms of fire resistant hydraulic fluid. The flagship product is the “No Fire” line of water glycol fire resistant hydraulic fluid, other offerings include phosphate ester and oil and water emulsion type fluids. The following fluids are among the highest quality fire resistant hydraulic fluids available on the market today:

- 1) “No Fire” WG 200R - Premium water glycol hydraulic fluid designed to offer excellent fire resistance and pump performance in industrial equipment running at system pressures up to 2000 psi. This product is a Factory Mutual Group 1 approved fluid and is sanctioned by CANMET for use in underground mining equipment.
- 2) “No Fire” HPWG 46-B - High pressure water glycol hydraulic fluid designed to offer excellent fire resistance and great pump performance in high pressure applications. Able to withstand system pressures of 7000 psi, this product was Canada’s first high pressure water glycol and is designed for use in applications not usually associated with water glycol fluids. “No Fire” HPWG 46-B is a Factory Mutual Group 1 approved fluid and is sanctioned by CANMET for use in underground mining equipment.
- 4) FR - 46-PE - High performance, phosphate ester hydraulic fluid designed for use in precision industrial equipment requiring the combination of lubricity and fire protection provided by a phosphate ester fluid. Able to withstand system pressures over 10000 psi, FR - 46-PE is the fluid of choice in very high pressure situations located in areas susceptible to fires.
- 5) HWC 215 - C - High water containing fire resistant hydraulic fluid is designed for use in applications requiring an economical solution to fire risks. Sold as a concentrate and diluted with 95% water, HWC 215 - C provides good corrosion protection and anti-wear performance in low pressure applications not exceeding 1000 psi.

In addition to these fluids, Forsythe Lubrication offers complete technical support services with regards to choosing the proper fire resistant fluids, proper conversion procedures from existing hydraulic fluids and correct fluid maintenance procedures. Forsythe Lubrication also offers hydraulic consultation services to ensure all changeovers are successful and trouble free. For additional information, please refer to the Forsythe Lubrication technical publications titled “Design Considerations For Hydraulic Systems Using Water Glycol Fluids”, “Hydraulic Fluid Conversion Procedure” and “Care and Maintenance of Water Glycol Systems” or consult your Forsythe Representative.



Contact:

Eco-Safe Solutions

T: (905) 725-6918

E: dlee@ecosafesolutions.ca

W: www.ecosafesolutions.ca