

### Product Description

Anglomoil Hydraulic BIO-FR was designed to replace anti-wear, mineral oil based hydraulic fluids used in applications where fire hazards exist.

### Product Features & Benefits

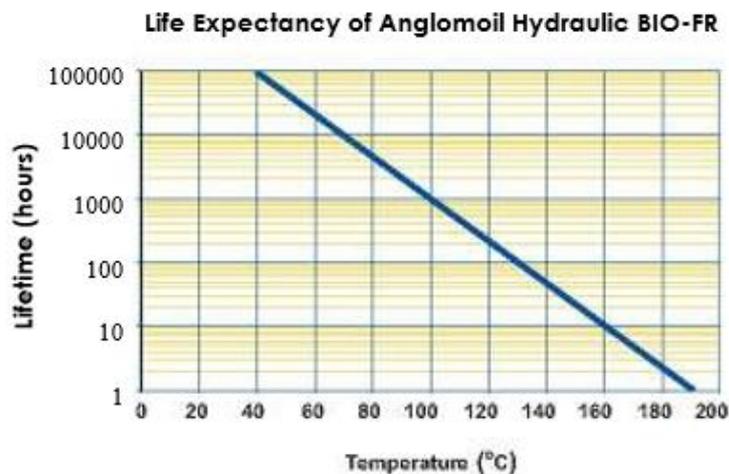
- Fire-resistant
  - High Ignition temperature and low heat release
  - Properties that limit the spread of fire
  - Excellent shear stability
  - Approved by Factory Mutual Approvals
- Non-toxic / non-toxic to aquatic life
- Non-irritating
- Fully biodegradable
- Simple waste treatment

### Additional Information

Anglomoil Hydraulic BIO-FR can also be used in environmentally sensitive hydraulic applications without compromising the overall hydraulic system operations. This fluid does not contain water, mineral oil, or phosphate ester, and is based on high-quality, synthetic, organic esters and carefully selected additives to achieve excellent hydraulic fluid performance. Anglomoil Hydraulic BIO-FR offers the lubrication level of premium, anti-wear hydraulic oils, and can be used with hydraulic components from all major manufacturers.

### Performance

Properly maintained Anglomoil Hydraulic BIO-FR has a useful life comparable to that of mineral oil fluids. Specific fluid lifetime depends primarily on temperature as shown in the graph.



## Properties

Properties	Method	Anglomoil Hydraulic BIO-FR 46	Anglomoil Hydraulic BIO-FR 68
Appearance		Yellow to amber fluid	Yellow to amber fluid
Kinematic Viscosity @ 0 °C @ 20 °C @ 40 °C @ 100 °C	ASTM D445	349 mm <sup>2</sup> /s or cSt 116 mm <sup>2</sup> /s or cSt 49.7 mm <sup>2</sup> /s or cSt 9.7mm <sup>2</sup> /s or cSt	485mm <sup>2</sup> /s or cSt 150 mm <sup>2</sup> /s or cSt 68 mm <sup>2</sup> /s or cSt 14 mm <sup>2</sup> /s or cSt
Viscosity Index	ASTM D2270	185	215
Density @ 15 °C	ASTM D1298	0.92 g/cm <sup>3</sup>	0.92 g/cm <sup>3</sup>
Acid Number	ASTM D974	2.0 mg KOH/g	1.5 mg KOH/g
Pour Point	ASTM D97	< -20°C (<-4°F)	< -20°C (<-4°F)
Flash Point	ASTM D92	300 °C (572 °F)	304 °C (579 °F)
Fire Point	ASTM D92	350 °C (662 °F)	360 °C (680 °F)
Auto Ignition Temperature	DIN 51794	>400 °C (>752 °F)	>400 °C (>752 °F)
Air Release	ASTM D3427	7 min	7 min
Fire Resistance	FM Approvals	Approved	Approved
Pump Test	ASTM D2882	<5 mg wear	<5 mg wear
Gear Lubrication	DIN 51354-2	>12 FZG load stage	>12 FZG load stage
Water Separability	ASTM D1401	41-39-0 (30) ml-ml-ml (min)	42-38-0 (30) ml-ml-ml (min)

## Compatibility

The following chart contains our recommendations regarding the use of Anglomoil Hydraulic BIO-FR with commonly used elastomers. The elastomer applications listed are: "Static," which refers to trapped non-moving seals such as O-rings in valve sub-plates and rigid, low pressure hose connections; "Mild-Dynamic," whose applications include accumulator bladders and hose linings where the hoses are exposed to high pressure and light flexing; and "Dynamic," which refers to cylinder rod seals, pump shaft seals and constantly flexing hydraulic hose.

## Elastomers

ISO 1629	Description	STATIC	MILD DYNAMIC	DYNAMIC
NBR	Medium to high nitrile rubber (Buna N, >30% acrylonitrile)	C	C	C
NBR	Low nitrile rubber (Buna N, <30% acrylonitrile)	S	N	N
FPM	Fluorelastomer (Viton®)	C	C	C
CR	Neoprene	S	S	S
IIR	Butyl Rubber	S	N	N
EPDM	Ethylene propylene rubber	N	N	N
AU	Polyurethane	C	C	C
PTFE	Teflon®	C	C	C

*C = Compatible*

*S = Satisfactory for short use, but replacement with a completely compatible elastomer is recommended at the earliest convenience*

*N = Not compatible*

## Metals

Anglomoil Hydraulic BIO-FR is compatible with iron and steel alloys and most nonferrous metals and their alloys. It is not compatible with lead, cadmium, zinc, and alloys containing high levels of these metals. Suitable substitutes for these materials are available and should be used.

## Paints and Coatings

Anglomoil Hydraulic BIO-FR is compatible with multi-component epoxy coatings. It is not compatible with zinc-based coatings. Specific coating and application recommendations can be obtained from coating manufacturers and directly from Anglomoil.

Properties	Method	Anglomoil Hydraulic BIO- FR
Specific Heat @ 20 °C	ASTM D2766	2.06 kJ/kg °C .49 Btu/lb °F
Coefficient of Thermal Expansion @ 20°C	ASTM D1903	6 x 10 <sup>-4</sup> per °C
Vapour Pressure @ 20°C @ 66°C	ASTM 02551	3.2 x 10.6 mmHg 7.5 x 10.6 mmHg
Bulk Modulus @ 20 °C @ 210 bar @ 3,000 psi		1.87 x 10 <sup>5</sup> N/cm <sup>2</sup> 266,900 psi
Thermal Conductivity @ 19°C	ASTM D2717	0.167 J/sec/m°C
Dielectric Breakdown Voltage	ASTM D877	30 kV

## ANGLOMOIL HYDRAULIC BIO-FR in Service Management

### 1. GENERAL

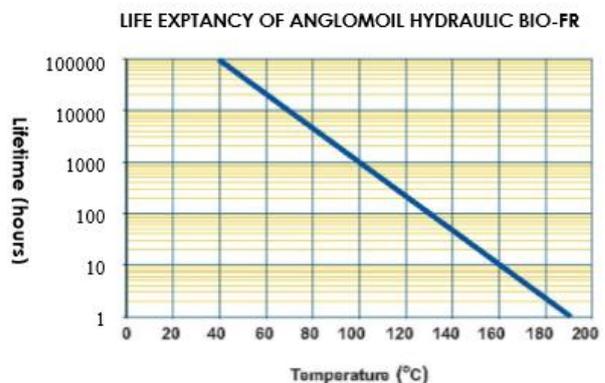
Temperature, water and particulate contamination are the key factors affecting the lifetime of ANGLOMOIL HYDRAULIC BIO-FR. The suitability of ANGLOMOIL HYDRAULIC BIO-FR for continued use is based on the measurement of various physical and chemical parameters listed on the rear page. It is recommended that such a monitoring program be used to plan fluid drain times.

Where monitoring is not feasible, fluid drain periods should be scheduled on an annual basis to ensure the fluid remains in a suitable condition. For high leakage systems or those running low cycle, low temperature and low pressure, this may be increased to two years.

### 2. TEMPERATURE

Systems should be fitted with adequate cooling and heating to maintain acceptable working temperatures. The minimum operating temperature will depend on pump capabilities but generally ANGLOMOIL HYDRAULIC BIO-FR-46 (ISO VG46) should be selected if start up temperatures are below 15°C and no heating is available. Start up temperatures above 15°C allow the use of any ANGLOMOIL HYDRAULIC BIO-FR fluid.

The maximum operating temperatures for ANGLOMOIL HYDRAULIC BIO-FR are 55°C for the tank and 80 to 85°C in the system. While the system may continue to operate successfully at temperatures up to 100°C, the lifetime of the fluid will be significantly reduced as temperature increases above 55°C. The graph below approximates the relationship of fluid lifetime to temperature.



### 3. APPEARANCE

**Fresh fluid** The colour of the fresh fluid is amber. The fluid can have a clear or a very slight hazy appearance.

**Dark appearance** ANGLOMOIL HYDRAULIC BIO-FR contain antioxidants that slow down the oxidation processes of the overall fluid. The antioxidants will sacrificially deplete during use of the fluid until a certain critical level is reached at which the fluid will start to rapidly degrade. The sacrificial antioxidant process leads to a darkening of the fluid in use, a process which will be accelerated at higher temperatures (>80°C), high aeration, and high contamination levels.

A dark colour does not necessarily mean that the overall fluid is in a bad condition. The suitability for continued use is determined by the chemical and physical tests outlined in the table on the final page.

Hazy appearance Hazy appearance generally points to water (or water glycol) contamination, however contamination with incompatible fluids may also be the cause.

#### **4. FLUID LEVEL**

Maintaining adequate fluid levels in the reservoir are important to ensure sufficient opportunity to allow contaminants such as dirt, water and air to release from the fluid.

#### **5. WATER CONTENT**

ANGLOMOIL HYDRAULIC BIO-FR fluids are manufactured to a water specification of 0-500 ppm for product leaving the factory. Water contamination will not always be visually evident as ANGLOMOIL HYDRAULIC BIO-FR fluids can absorb up to 2000ppm of water without appearing hazy. Higher levels of water will split out of the fluid to be base of the reservoir or other areas of low fluid flow.

Water in a hydraulic system will have an immediate reduction in lubrication, especially of roller bearings. Water will also increase the risk of corrosion, filter blockage, valve malfunction, and fluid degradation by hydrolysis. For reliable operation and to ensure system longevity, it is recommended to maintain the hydraulic system with water content as low as possible but 2,000 ppm max.

Where higher levels of water are measured and remaining parameters are within the operating range, the water should be removed by insitu techniques (Dialysis, centrifuge, vacuum drying etc) to allow the fluid to return to normal operation.

#### **6. TOTAL ACID NUMBER (TAN)**

The TAN is a measure of the free organic fatty acids present in the fluid. It is measured by the quantity of base required to neutralise one gram of fluid.

Anglomoil Hydraulic BIO-FR fluids in use produce free fatty acids as they degrade resulting in a rise in the TAN. Fatty acids are weak organic acids and are not as corrosive as mineral acids such as phosphoric acid liberated by degraded phosphate esters. For this reason, it is possible to allow the TAN to rise up to a level of 8.0 before the fluid needs to be drained.

#### **7. VISCOSITY**

Fluid viscosity is a measure of the strength of the lubrication film. Low viscosity indicates shear or the presence of a lower viscosity fluid, (e.g. mineral oil or a phosphate ester) while high viscosity indicates the presence of a higher viscosity fluid or polymerisation. Rising viscosity due to polymerisation is an indication that the fluid requires changing.

Currently two viscosity grades are available:

ANGLOMOIL HYDRAULIC BIO-FR-46 : ISO VG46 ANGLOMOIL HYDRAULIC BIO-FR-68 : ISO VG68

## 8. FURTHER INFORMATION

For further details on the use and management of ANGLOMOIL HYDRAULIC BIO-FR fluids in service please contact ANGLOMOIL on 02 9457 8566

Parameter	Test Method	New Fluid	In Service Operating Range	Parameter Changes Due to	System Effects	
					Too High	Too Low
Viscosity	ASTM D445	Hydraulic BIO-FR 46 & 68	37.5 – 51.6 54.8 – 75.8	<ul style="list-style-type: none"> <li>- Thermal degradation</li> <li>- Shear degradation</li> <li>- Equipment malfunction</li> <li>- Alien fluid contamination</li> <li>- Water contamination</li> </ul>	<ul style="list-style-type: none"> <li>- Cavitation</li> <li>- Decreased flow rate</li> <li>- Increased power consumption</li> <li>- Over Heating</li> <li>- Decreased response time</li> </ul>	<ul style="list-style-type: none"> <li>- Increased wear</li> <li>- Increased flow rate</li> <li>- Decreased efficiency</li> <li>- Relief valve overload</li> </ul>
Water Content, %	OL 1020	0 – 0.05	0 – 0.20	<ul style="list-style-type: none"> <li>- Poor sealing</li> <li>- Heat exchanger failure</li> <li>- Humid air</li> <li>- Improper storage of fluid</li> </ul>	<ul style="list-style-type: none"> <li>- High wear</li> <li>- Corrosion</li> <li>- Sludge</li> <li>- Filter &amp; valve blockage</li> </ul>	Not Applicable
Retained Solids, ppm	OL 100	<50	<75	<ul style="list-style-type: none"> <li>- Wear particles</li> <li>- corrosion</li> <li>- Oil degradation</li> <li>- Poor sealing</li> </ul>	<ul style="list-style-type: none"> <li>- Excessive wear</li> <li>- High filter usage</li> <li>- Valve jamming</li> <li>- Varnishing</li> <li>- Sludge blockages</li> </ul>	Not Applicable
Pentane Insoluble, ppm	ASTM D2065	<50	<150	<ul style="list-style-type: none"> <li>- Wear particles</li> <li>- Oil degradation</li> <li>- External ingress through poor sealing</li> </ul>	<ul style="list-style-type: none"> <li>- Excessive wear</li> <li>- High filter usage</li> <li>- Valve jamming</li> <li>- Varnishing</li> <li>- Sludge blockages</li> </ul>	Not Applicable
Total Acid Number (TAN), mhKOH/mg	ASTM D974	<2.0	0 – 0.8	<ul style="list-style-type: none"> <li>- Thermal degradation</li> <li>- Oxidative degradation</li> <li>- Hydrolytic (water) degradation</li> </ul>	<ul style="list-style-type: none"> <li>- Corrosion (lead &amp; zinc)</li> <li>- Seal Softening</li> <li>- Reduced fire resistance</li> </ul>	Not Applicable

Particl Quantifier	OL1028	<5	<50	- Iron wear particles - Iron corrosion	- High wear rates	Not Applicable
Antioxidant Index	To be advised	1.0	>0.5	- Thermal degradation - Oxidative degradation	- High filter usage - Valve jamming - Varnishing - Sludge blockages	Not Applicable
Metals, ppm Iron Chronium Copper Lead Aluminium Tin Silicon Sodium Zinc Calcium Phosphorus Molybdenum Magnesium	OL1011	<5 <5 <5 <5 <5 50 – 150 <5 <5 <5 <5 400 – 600 <5 <5	Operating parameters on wear metal analysis depend on system component design and tolerances. Minimum levels are always desirable.	- Wear particles - Corrosion	- Excessive wear - Filter blockage	Not Applicable
Particle Size Analysis	NAS	7 max	Dependant on system requirements	- Wear particles - Oil degradation - External ingress through poor sealing - Moisture contamination	- Excessive wear - Poor Filterability - High filter usage - Value jamming - Varnishing - Sludge blockages	Not Applicable

**Master Item# 1737 & 1738**  
**Pack Size Availability: 20L, 205L**

**Last Updated: 8<sup>th</sup> March 2021**