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Bio-Hydra™ FR Fluids
(ISO 32, 46, 68)

STABILIZED™ by Renewable Lubricants

"Biobased Lubricants that Perform Like Synthetics"

Bio-Hydra™ FR Fluids are ultimately biodegradable[1] biobased formulas that meet and exceed Vickers M-2950-S, Vickers 1-286-5, U.S. Steel 126, and U.S. Steel 127. These are high performance hydraulic fluids, **specially formulated with natural and synthetic esters to offer the lowest toxicity in aquatic conditions.** The products meet and exceed the requirements of International Ecolabels and US Environmental Protection Agency (EPA) Vessel General Permit (VGP) guidelines for EALs. In addition, the products exceed the USDA Biobased new carbon, (@ 90%) biobased.

Bio-Hydra™ FR Fluids are formulated to perform in hydraulic systems that require Anti-Wear (AW), anti-rust, anti-oxidation, anti-foam, and demulsibility properties. There anti-wear performance exceeds the requirements for Vickers 35VQ-25 and V-104C (ASTM D-2882) vane pump stand tests, and DIN 51524 Part 2 and 3 (HLP/HVLP), load stage 10. They also meet the requirements for ashless GL-3 gear oils in reduction units and gear sets where they meet the viscosity ranges.

Bio-Hydra™ FR Fluids are highly inhibited against moisture and rusting in both fresh and sea water and pass both A and B Sequences of the ASTM D-665 Turbine Oil Rust Test. Incorporating the super high viscosity index (VI) of the Stabilized* High Oleic Base Stocks (HOBS) into the formula, increases the VI past synthetic levels (Energy Conserving Formulas). These biobased fluids are designed to provide seal conditioning for longer seal life and to reduce oil leakage from the system. An environmentally friendly, zinc-free additive system has also been developed that meets or exceeds high pressure pump requirements.

Fire Resistant Performance: The super high viscosity index of the HOBS naturally improves the thermal shear stability of the formulas and their load capacity. The HOBS's extremely low volatility (NOACK <1) and excellent oxidation stability improves the flash and fire safety features in these formulas. In ASTM D-92, Flash Points range from 518°F (274°C) to 525°F (310°C) and Fire Points range from 610°F (321°C) to 662°F (350°C). Based on previous test results, Bio-Hydra™ FR Fluids ISO 32 (FR), ISO 46 (FR), and ISO 68 (FR) can be Factory Mutual approved as less hazardous fluid "Specification Tested" ISO/CD 15029-3 rating (HFDU), and ISO/TS 15029-2 Spray Ignition-Ignitability (Class H). Previous studies have supported the expected temperature ranges of Autoignition (ASTM D-2155) @ 752 - 815°F (400 - 435°C) and Manifold Ignition (ISO 20823) @ 824 - 896°F (440 - 480°C).

Bio-Hydra™ FR Fluids meet the Environmental Protection Agency (EPA) 2013 Vessel General Permit (VGP) guidelines for Environmentally Acceptable Lubricants (EALs), and should be used in hydraulic systems where **LOW TOXICITY**, **BIODEGRADABILITY** and **NON-BIOACCUMULATION** properties are required. They exceed the acute toxicity (LC-50 / EC-50 >1000 ppm) criteria adopted by the US Fish and Wildlife Service and the US EPA. Because they meet the environmental requirements they can also be used where ISO 15380 (HEES unsaturated /HETG) Hydraulic Fluids are specified. Bio-Hydra™ FR Fluids are ENVIRONMENTALLY RESPONSIBLE lubricants that are formulated from renewable biobased resources. We believe Earth's environmental future rests in the use of renewable materials.

[1]Ultimate Biodegradation (Pw1) within 28 days in ASTM D-5864 Aerobic Aquatic Biodegradation of Lubricants

STABILIZED by Renewable Lubricants™* is RLI™'s trademark on their proprietary and patented anti-oxidant, anti-wear, and cold flow technology. High Oleic Base Stock (HOBS) are agricultural biobased oils. This Stabilized technology allows the HOBS to perform as a high performance formula in high and low temperature applications, reducing oil thickening and deposits. Patented Product: US Patent 6,383,992, US Patent 6,534,454 with additional Pending and Foreign Patents

Availability **F.O.B. :Hartville, Ohio, USA** **1 Gallon** **5 Gallon Pail** **Drum** **Totes** **Bulk**

Bio-Hydra™ FR Fluids ISO 32, 46, 68

The test data below shows that the Bio-Hydra™ Fluids provide high performance in a wide variety of stationary and transportation equipment that operate in broad ranges of environmental conditions. In equipment operating outside, wear from poor cold temperature pumpability, surge loads, moisture, and dusty environments are more prominent. Bio-Hydra™ Fluids are formulated to improve performance in equipment that requires excellent anti-wear, rapid water separation and cold temperature pumpability as low as -25^{0}C. They are compatible with the same seals, filters, materials and components that are designed to operate on petroleum oil based formulations.sewas

TYPICAL SPECIFICATIONS Page 2	METHOD	**ISO 32**	**ISO 46**	**ISO 68**	Spec. Requirements
Viscosity @ 40°C	ASTM D-445	**31.8**	**44.3**	**64.2**	Note 1
Viscosity @ 100°C	ASTM D-445	**7.2**	**8.5**	**13.1**	Note 1
Viscosity @ -25°C, Brookfield	ASTM D-2983	**1,400 cP**	**3,000 cP**	**3500cP**	Note 1
Viscosity Index	ASTM D-2270	**201**	**206**	**210**	90 (min)
Pour Point	ASTM D-97	**-40°C**	**-36°C**	**-35°C**	Note 1
Flash Point (COC)	ASTM D-92	**274°C**	**300°C**	**310°C**	198°C (min)
Fire Point (COC)	ASTM D-92	**320°C**	**340°C**	**350°C**	218°C (min)
Foam Sequence I, II, III (10 min)	ASTM D-892	**0 Foam**	**0 Foam**	**0 Foam**	0 Foam
Rust Prevention	ASTM D-665				
Distilled Water		**Pass**	**Pass**	**Pass**	Pass
Syn. Sea Water		**Pass**	**Pass**	**Pass**	Pass
Copper Corrosion Strip 3hr @ 100°C	ASTM D-130	**1B**	**1B**	**1B**	DIN 51524 2(max)
Rotary Bomb Oxidation, (minutes)	ASTM D-2272	**260**	**260**	**260**	USS 120 (min)
Neutralization Number mg KOH/g	ASTM D-974	**0.4**	**0.4**	**0.4**	1.5 (max)
Swell of Synthetic NBR-L Rubber, % (Avg.)	DIN 53538, Part 1				
Volume Change (%)		**8.0**	**7.0**	**6.0**	0 to 12
Shore A Hardness Change (%)		**-6**	**-4**	**-4**	0 to -7
Demulsibility, ML Oil/Water/Emulsion	ASTM D-1401	**40/ 40/0**	**40/40/0**	**40/40/0**	40-37-3 (max) (30 minutes)
4-Ball Wear, 1h, 167°F, 1200 RPM, 40 kg	ASTM D-4172	**0.4**	**0.4**	**0.4**	USS 127 0.5 (max)
FZG Test	DIN 51354	**11**	**11**	**11**	US Steel 10 (min)
Biodegradation Classification	ASTM D-5864	Ultimate Pw1	Ultimate Pw1	Ultimate Pw1	Ultimate Pw1
Environmentally Friendly	ISO 15380	yes	yes	yes	yes
USDA Biobased	New Carbon	yes	yes	yes	meets/exceeds over 50%
Note 1 Viscosity Sufficient for Application					
Note 2 Not Required					
RLI Product Item #		**80940**	**80950**	**80960**	