



Renewable Lubricants™, Inc.

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Bio-HVO™ Hydraulic Fluid (ISO 46 & 68 FR Fluids)

STABILIZED™
by Renewable Lubricants

"Biobased Lubricants that Perform Like Synthetics"

Bio-HVO™ Hydraulic Fluids are ultimately biodegradable¹ vegetable based formulas that have been USDA Biobased tested to show new carbon (vegetable oil) at >96% and they are **Specially formulated to offer the lowest toxicity in aquatic conditions.** They are an excellent choice for inner plant applications (ie. Steel Mills) as fire resistant (FR) hydraulic fluids, with exceptional oxidation stability (RBOT 350-400 minutes) and exceeding US Steel minimum requirement of 120 minutes. **Although they have a pour point of -25°C, care must be taken if used in hydraulic systems setting static below 0°C for extended periods.**

Bio-HVO™ Hydraulic Fluids are formulated to perform in stationary and mobile hydraulic systems that require Anti-Wear, Anti-Rust and Anti-Oxidation properties. These patented super high VI fluids have a long history of successfully being used in hydraulic systems designed with vane, piston, and gear-type pumps, that require DIN 51524 Part 2 and 3, Parker-Denison HF-O, HF-1, HF-2, Eaton-Vickers, Rexroth, and Sauer-Sundstrand. They also meet the requirements for ashless GL-1, GL-2, GL-3 and AGMA Non-EP gear oils in reduction units and gear sets where they meet the viscosity ranges. They have shown to have exceptional anti-wear performance in ASTM D-4172 Four Ball Wear Tests. **Very little wear was encountered in accelerated pump tests using biobased formulations in Denison T-5D, Vickers 20VQ, 35VQ-25 (M-2950-S), and V-104C (ASTM D-2882), Vickers I-286-S pump stand tests at pressures and temperatures ranging from 2000 to 3000 psi and from 150⁰ to 210⁰ F.** Their anti-wear performance exceeds the requirements for GM (LS-2), US Steel 126, 136 and 127, and DIN 51524 Part 2 and 3 load stage 10 in the FZG (DIN 51354). They are highly inhibited against moisture and rusting in both fresh and sea water and pass A and B Sequences of the ASTM D-665 Turbine Oil Rust Test. Incorporating the super high viscosity index of the Stabilized* High Oleic Base Stocks (HOBS) into the formulas, gives multi-grade synthetic base oils performance by boosting the viscosity index to synthetic levels (Energy Conserving Formulas). 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 532°F (278°C) to 536°F (280°C) and Fire Points range from 635°F (335°C) to 644°F (340°C). Based on previous test results, HVO Hydraulic Fluids 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). The tests 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-HVO™ Hydraulic 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) or HETG Hydraulic Fluids are specified. Bio-HVO™ Hydraulic Fluids are **ENVIRONMENTALLY ACCEPTED LUBRICANTS (EALs)** that are formulated from renewable agricultural biobased resources. We believe Earth's environmental future rests in the use of renewable materials.

¹Ultimate 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 vegetable 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

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

Bio-HVO™ Hydraulic Fluid

TYPICAL SPECIFICATIONS TEST	Page 2	METHOD	<u>Bio-HVO</u> 46	<u>Bio HVO</u> 68
Specific Gravity @ 15.6°C Viscosity @ 40°C Viscosity @ 100°C Viscosity @ -15°C, Brookfield Viscosity Index		ASTM D-287 ASTM D-445 ASTM D-445 ASTM D-2983 ASTM D-2270	0.92 47.5 10 1100 cP 200	0.92 66.5 13.5 1500 cP 210
Pour Point Flash Point (COC) Fire Point (COC) Volatility 1 hour @ 250°C Hydrolytic Stability, Copper Wt. Loss (mg) Copper Appearance Water Layer Foam Sequence I, II, III (10 min) Rust Prevention Distilled Water Syn. Sea Water		ASTM D-97 ASTM D-92 ASTM D-92 NOACK ASTM D-2619 ASTM D-892 ASTM D-665	-25°C 532°F/278°C 635°F/335°C 1% 0.01 1B 0.17 0 Foam Pass/Clean Pass/Clean	-23°C 536°F/ 280°C 644°F/340°C 1% 0.01 1B 0.17 0 Foam Pass/Clean Pass/Clean
Cincinnati Machine Thermal Stability Procedure A Precipitate or sludge, mg/100ml Steel Rod Deposit, mg Metal Removed, mg/200 ml Copper Rod Deposit, mg			0.6 3 Nil 7	0.6 3 Nil 7
Accelerated Storage Stability Copper Corrosion Strip 3hr @ 100°C Copper Corrosion Strip 3 Days @ 100°C			Pass 1A 1B	Pass 1A 1B
RPVOT, (min) Dielectric Strength, KV (Avg) Acid Number Elastomer Testing BUNA-N Rubber Volume Change, % Shore A Hardness Change Demulsibility, ML Oil/Water/Emulsion 4-Ball Wear, 1h, 167°F, 1200 RPM, 40 kg FZG Test A/8,3/90		ASTM D-2272 ASTM D-877 ASTM D-974 D-471 D-2240 ASTM D-1401 ASTM D-4172 DIN 51354 Part2	350-400 47 0.4 1.6 0.0 40/ 40/ 0 0.3-0.4 12	350-400 46 0.4 1.6 0.0 40/ 40/ 0 0.3-0.4 12
Biodegradability Ecotoxicity Fathead minnow, 96h LC50, ppm Daphnis magna, 48 h, EC50, ppm Sludge respiration inhibition, EC50, ppm Meets EPA requirements 560/6-82-002, 560/6-82-003		CEC-L33-T-82 OECD 301B Mod. Sturm ASTM D-5864	>80% >60% >60% >10,000 ppm >10,000 WAF >10,000 ppm Yes	>80% >60% >60% >10,000 ppm >10,000 WAF >10,000 ppm Yes
<u>Biodegradation Classification</u>		ASTM D-5864	Ultimate PW1	Ultimate PW1
<u>Environmentally Friendly</u>		ISO 15380	Yes	Yes
<u>USDA Biobased Tested</u>		New Carbon	Yes	Yes
<u>Environmental Management System</u>		ISO 14001:1996	Yes	Yes
RLI Product Item #			81500	81510