Renewable Lubricants, Inc.

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Bio-Ultimax™
Hydraulic Fluids
(ISO 5, 10, 15, 22, 32, 46)

STABILIZED™T by Renewable Lubricants

ISOGREEN CERTIFIED LUBRICANTS

"Biobased Lubricants that Perform Like Synthetics"

Bio-Ultimax™ 1200LT (Low Temperature) Hydraulic Fluids are ultimately biodegradable[1], biosynthetic formulas that were designed specifically to replace and outperform mineral oil based hydraulic fluids for environmentally sensitive and/or cold temperature areas. These patented biobased hydraulic fluids are formulated to perform in high and low-pressure hydraulic systems that require Anti-Wear (AW), anti-rust, anti-oxidation, anti-foam, and demulsibility properties. They 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 of the Stabilized* HOBS into the formula, gives multi-grade synthetic base oil performance by boosting the viscosity index (VI) past synthetic levels (energy conserving formulas). This super high viscosity index naturally improves the thermal shear stability of the formula and increases load capacity. They provide additional fluid value at the higher temperatures, which is a performance benefit over lower VI products of the same ISO viscosity. The HOBS's extremely low volatility increases the flash and fire safety features in the formula compared to petroleum formulations with the same viscosity ranges. They are formulated to provide seal conditioning for longer seal life and to reduce oil leakage from the system. They are compatible with the same seals, filters, materials and components that are designed to operate on petroleum oil-based formulations. An environmentally friendly, zinc-free additive system has also been developed that meets or exceeds high pressure pump requirements.

Bio-Ultimax™ Hydraulic Fluids have a long-term history of proven performance with over 15 years of successfully being used in a wide variety of stationary and mobile hydraulic equipment. These patented super high VI fluids have performed successfully in hydraulic systems up to 10,000 psi and in systems with ultra-fine filtration. They are designed for use in hydraulic vane, piston, and gear-type pumps that require DIN 51524 Part 2 and 3 (HLP/HVLP), Parker-Denison HF-O/T6H20C, HF-1, HF-2, Eaton-Vickers M-2950-S (35VQ-25) and I-286-S (V-104C), Rexroth, Sauer-Sundstrand, GM (LS-2), US Steel 126, 136, and 127. 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 the field studies and 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 150^0 to 210^0 F.** Their anti-wear performance **exceeds the requirements** for GM (LS-2), US Steel 126, 136 and 127, load stage 10 in the FZG (DIN 51354), and DIN 51524 Part 2 and 3 requirements for low viscosity hydraulic and turbine oils. They may be used in reduction gears for cold temperature applications, where the OEM recommends a lighter viscosity or SAE 0W for proper channeling.

Bio-Ultimax™ 1200 LT Hydraulic Fluids are **recommended** for use with Viton fluorocarbon (FKM 2), fluorosilicone, Teflon (PTFE), Polyurethane (AU), polysulfide, Medium to high nitrile rubber (Buna N, >30% acrylonitrile) and Hydrogenated Nitrile Buna Rubber (HNBR). They are **not recommended** for use where neoprene, natural rubber, and styrene-butadiene rubber (SBR, Buna S) seals are used, and ISO grades 5, and 10 provide high seal swell on Low nitrile rubber NBR-L, NBR1 (Buna N, <30% acrylonitrile).

Bio-Ultimax™ 1200 LT 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/HETG) Hydraulic Fluids are specified. Bio-Ultimax™ Hydraulic Fluids are **ENVIRONMENTALLY ACCEPTED LUBRICANTS (EALs)** that are formulated from renewable biobased resources. We believe Earth's environmental future rests in the use of renewable materials.

[1]Ultimate/Readily Biodegradation Pw1 >60% within 28 days in ASTM D-5864 Aerobic Aquatic Biodegradation of Lubricants

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

Bio-Ultimax™ 1200LT Hydraulic Fluids ISO 15, 22, 32, 46

The test data below shows that the Bio-Ultimax™ 1200LT Hydraulic 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-Ultimax™ 1200LT Hydraulic Fluids are formulated to improve performance in equipment that requires excellent anti-wear, rapid water separation, filterability, and cold temperature pumpability as low as -40^{0}C for 0W formulations. ISO grades 15 and 22 meet and exceed SAE 0W, ISO 32 meets and exceeds 0W20, and ISO 46 meets and exceeds SAE 0W30 viscosity requirements.

TYPICAL SPECIFICATIONS	METHOD	**ISO 5**	**ISO 10**	**ISO 15**	**ISO 22**	**ISO 32**	**ISO 46**	Spec. Require
Viscosity @ 40°C, **cSt**	ASTM D-445	**4.48**	**10.65**	**14.0**	**21.3**	**30.9**	**44.9**	Note 1
Viscosity @ 100°C, **cSt**	ASTM D-445	**1.35**	**3.08**	**3.9**	**5.3**	**7.1**	**9.8**	Note 1
Viscosity @ -20°C, **cSt**	ASTM D-445	**86.68**	**154.8**	**225**	**425**	**775**	**1030**	Note 1
Viscosity @ -30°C Brookfield	ASTM D-2983	**500**	**900**	**900**	**1300**	**1750**	**2250**	Note 1
Viscosity @ -40°C MRV TP1	ASTM D-4684	**2200 cP**	**2200 cP**	**2200 cP**	**3050 cP**	**6500 cP**	**17500 cP**	0W= <60,000 cP
Viscosity Index	ASTM D-2270	**151**	**160**	**189**	**199**	**204**	**212**	90 (min)
Pour Point	ASTM D-97	**-60°C**	**-60°C**	**-60°C**	**-54°C**	**-50°C**	**-48°C**	Note 1
Flash Point (COC)	ASTM D-92	**320°F/160°C**	**338°F/170°C**	**365°F/185°C**	**428°F/220°C**	**451°F/233°C**	**462°F/239°C**	175-195°C (min)
Hydrolytic Stability,	ASTM D-2619							(DIN EN ISO 2592)
Copper Wt. Loss (mg)		**0.0139**	**0.0139**	**0.0139**	**0.0208**	**0.0208**	**0.0208**	0.2
Copper Appearance		**1B**	**1B**	**1B**	**1B**	**1B**	**1B**	Report
Water Layer		**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	4
Foam Sequence I, II, III (10 min)	ASTM D-892	**<40/0 Foam**	**<40/0 Foam**	**<30/0 Foam**	**<30/0 Foam**	**<30/0 Foam**	**<30/0 Foam**	150/0, 80/0, 150/0
Rust Prevention	ASTM D-665							(DIN EN ISO 6247)
Distilled Water		**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	Pass
Syn. Sea Water		**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	Pass
Copper Corrosion Strip 3hr @ 100°C	ASTM D-130	**1A**	**1A**	**1A**	**1A**	**1A**	**1A**	DIN 51524 2(max)
Rotary Bomb Oxidation, (minutes)	ASTM D-2272	**450**	**450**	**450**	**450**	**450**	**450**	USS 120 (min)
Dielectric Strength (KV) (Avg)	ASTM D-877	**49**	**49**	**49**	**49**	**50**	**45**	>35
Oxidation Stability (Pressure Differential Scanning Calorimeter) min	ASTM D-5483 Modified	**90 (165°C)**	**90 (165°C)**	**90 (165°C)**	**90 (165°C)**	**90 (165°C)**	**90 (165°C)**	Note 2
Neutralization Number mg KOH/g	ASTM D-974	**<0.4**	**<0.4**	**<0.4**	**<0.4**	**<0.4**	**<0.4**	1.5 (max)
Swell of Synthetic NBR1 Rubber, % (Avg.)	DIN 53538, Part 1							
Volume Change (%)		**12.0**	**12.0**	**11.0**	**11.0**	**10.0**	**8.0**	0 to 12
Shore A Hardness Change (%)		**-7**	**-7**	**-7**	**-6**	**-6**	**-5**	0 to -7
Filterability	Denison TP							
A-No Water (s) (Avg)	02100	**72**	**72**	**72**	**85**	**111**	**260**	600 (max)
B-2% Water (s) (Avg)	HF-0	**98**	**98**	**98**	**105**	**124**	**271**	2xA (max)
Demulsibility, ML	Requirement	**40/ 40/ 0**	**40/ 40/ 0**	**40/ 40/ 0**	**40/ 40/ 0**	**40/ 40/ 0**	**40/ 40/ 0**	40/37/3 (max)
Oil/Water/Emulsion	ASTM D-1401	**(<10 min)**	**(<10 min)**	**(<10 min)**	**(<10 min)**	**(<10 min)**	**(<10 Min)**	(30 minutes)
4-Ball Wear, 1h, 167°F, 1200 RPM, 40 kg	ASTM D-4172	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	USS 127 0.5 (max)
FZG Test A/8,3/90	DIN 51354 Part 2	**10**	**10**	**11**	**11**	**12**	**12+**	10 (min)
Biodegradation Classification	ASTM D-5864 OECD 301B	Ultimate PW1 Readily	Ultimate PW1 Readily	Ultimate PW1 Readily	Ultimate PW1 Readily	Ultimate PW1 Readily	Ultimate PW1 Readily	Ultimate PW1 Readily
Environmentally Friendly	ISO 15380	yes	yes	yes	yes	yes	yes	meets/exceeds
USDA Biobased	New Carbon	>60%	>60%	>60%	>60%	>60%	>60%	meets/exceeds
Environmental Management System	ISO 14001:1996	yes	yes	yes	yes	yes	yes	meets/exceeds
Ecotoxicity LC-50 / EC-50	**EPA 560/6-82-002, 003**	meets/exceeds	meets/exceeds	meets/exceeds	meets/exceeds	meets/exceeds	meets/exceeds	meets/exceeds
Note 1 Viscosity Sufficient for Application								
Note 2 Not Required								
Product Item #		**81460**	**81470**	**81310**	**81320**	**81330**	**81340**	