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Bio-AW/AL™ Hydraulic Press Oils

ISO 32, 46, 68

"Biobased Lubricants that Perform Like Synthetics"

Bio-AW/AL™ Hydraulic Press Oils are ultimately biodegradable[1] vegetable based formulas that replace mineral oil based hydraulic fluids in demanding press hydraulic systems. Bio-AW/AL™ Hydraulic Press Oils are formulated to perform in hydraulic systems that require Anti-Wear (AW), Anti-Leak (AL), anti-rust, anti-oxidation, anti-foam, and demulsibility properties. Bio-AW/AL™ Hydraulic Press Oils contain the same performance benefits and additive technology as the Bio-Ultimax™ 1000 Hydraulic Fluids with the addition of the anti-leak and/or non-drip performance. 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 formula, increases the viscosity index past synthetic levels (Energy Conserving Formulas). A zinc-free (ashless) additive system has also been developed that is environmentally friendly and meets or exceeds pump requirements.

Bio-AW/AL™ Hydraulic Press Oils are designed for use in mobile and stationary hydraulic vane, piston, and gear-type pumps when used in accordance with the equipment manufacturer. **Very little wear was encountered, 0 to 25mg (Pass), in accelerated biobased tests using Denison T-5D, Vickers 20VQ, 35VQ-25 (M-2950-S), and V-104C (ASTM D-2882) pump stand tests at pressures and temperatures ranging from 2000 to 3000 psi and from 150^0 to 210^0 F.** The anti-wear performance exceeds the load stage 10 in the FZG (DIN 51354) requirements for US Steel 136, DIN 51524 Part 2 and 3 (HLP/HVLP), and GM (LS-2). They also meet the requirements for ashless GL-3 gear oils in reduction units and gear sets where they meet the viscosity ranges.

Bio-AW/AL™ 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-AW/AL™ 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 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

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

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The test data below show that the Bio-AW/AL™ Hydraulic Press Oils 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-AW/AL™ Hydraulic Press Oils are formulated to improve performance in equipment that requires excellent anti-wear, anti-leak, demulsibility, and cold temperature pumpability as low as -35^{0}C.

TYPICAL SPECIFICATIONS	METHOD	**ISO 32**	**ISO 46**	**ISO 68**	Spec. Requirements
Viscosity @ 40°C	ASTM D-445	**30.87**	**43.8**	**64.1**	Note 1
Viscosity @ 100°C	ASTM D-445	**6.9**	**9.67**	**12.5**	Note 1
Viscosity @ -15°C, Brookfield	ASTM D-2983	**not complete**	**1100 cP**	-----	Note 1
Viscosity @ -25°C, Brookfield	ASTM D-2983	**1,200 cP**	**3,000 cP**	-----	Note 1
Viscosity @ -30°C MRV TP1	ASTM D-4684	**4,500 cP**	**8,000 cP**	-----	10W= <60,000
Viscosity @ -35°C MRV TP1	ASTM D-4684	**7,500 cP**	-----	-----	5W= <60,000
Viscosity Index	ASTM D-2270	**184**	**216**	**198**	90 (min)
Pour Point	ASTM D-97	**-40°C**	**-36°C**	**-30°C**	Note 1
Flash Point (COC)	ASTM D-92	**236°C**	**243°C**	**251°C**	198°C (min)
Fire Point (COC)	ASTM D-92	**260°C**	**268°C**	**274°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	**360**	**360**	**360**	USS 120 (min)
Oxidation Stability (Pressure Differential Scanning Calorimeter) min	ASTM D-5483 Modified	**70.0 (165°C)**	**70.0 (165°C)**	**70.0 (165°C)**	Note 2
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 (%)		**6.0**	**6.0**	**6.0**	0 to 12
Shore A Hardness Change (%)		**-4**	**-4**	**-4**	0 to -7
Filterability	Denison TP 02100				
A-No Water (s) (Avg)	HF-0 Requirement	**113**	**268**	**335**	600 (max)
B-2% Water (s) (Avg)		**187**	**271**	**449**	2xA (max)
Demulsibility, ML Oil/Water/Emulsion	ASTM D-1401	**40/ 40/ 0**	**40/ 40/ 0**	**40/40/0**	40/37/3 (max)
4-Ball Wear, 1h, 167°F, 1200 RPM, 40 kg	ASTM D-4172	**0.3 – 0.4**	**0.3 – 0.4**	**0.3 – 0.4**	USS 127 0.5 (max)
FZG Test	DIN 51354	**12**	**12**	**12**	US.Steel 10 (min)
Biodegradation Classification	ASTM D-5864	Ultimate PW1	Ultimate PW1	Ultimate PW1	Ultimate PW1
	OECD 301B	Readily	Readily	Readily	Readily
Environmentally Friendly	ISO 15380	yes	yes	yes	yes
USDA Biobased Tested	New Carbon	yes	yes	yes	yes
Environmental Management System	ISO 14001	yes	yes	yes	yes
Ecotoxicity LC-50 / EC-50	**EPA 560/6-82-002, 003**	meets/exceeds	meets/exceeds	meets/exceeds	meets/exceeds
Note 1 Viscosity Sufficient for Application					
Note 2 Not Required					
RLI Product Item #		**81410**	**81420**	**81430**	