SINCE 1839 Schaeffer MANUFACTURING COMPANY

ISO 9001 CERTIFIED

TECHNICAL DATA

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593 ECOSHIELD™ BIODEGRADABLE NON EP GEAR OIL

ISO 68 through 320

EcoShield™ Biodegradable Non EP Gear Oil is a fully formulated rust and oxidation inhibited, anti-wear, readily biodegradable, environmentally friendly, ecologically responsive, non-toxic fluid that is designed for use in lightly to moderately loaded gear drive, circulating oil system and bearing applications and those gear drive applications that contain internal backstops or sprag clutch mechanisms, that are operated in environmentally sensitive areas. EcoShield™ Biodegradable Non EP Gear Oil meets the USDA definition EO 13101 for Biobased products.

EcoShield™ Biodegradable Non EP Gear Oil is blended from a unique combination of high oleic vegetable base oils and biodegradable synthetic polyol ester base fluids. This unique base fluid combination provides the EcoShield™ Biodegradable Non EP Gear Oil with the following performance advantages:

1. Excellent Oxidative and Thermal Stability.
2. Very good low temperature properties.
3. High natural viscosity index.
4. Very good natural lubricity.
5. Low volatility characteristics.
6. Very good hydrolytic stability.
7. Very low foaming tendencies.
8. Excellent demulsibility.

Further blended into this unique combination of high oleic vegetable base fluids and the synthetic polyol ester base fluids is a highly specialized ashless thermally stable, multifunctional additive anti-wear package. This highly specialized additive package provides the EcoShield™ Biodegradable Non EP Gear Oil with the following performance advantages:

1. **Excellent thermal stability.**
2. **Excellent anti-wear protection and load carrying capabilities.**
3. **Enhanced oxidative stability.**
4. **Excellent rust and corrosion protection**
5. **Extended pump and bearing life**
6. **Superior rust and corrosion protection.**
7. **Excellent demulsibility.**
8. **Excellent filterability.**
9. **Enhanced hydrolytic stability.**
10. **Low free Phenol per EPA 420.1.**

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EcoShield™ Biodegradable Hydraulic Fluid meets and exceeds the following specifications and manufacturer's requirements: AGMA 9005 D-94, AGMA 9005-E02, AGMA 250.04/251.02, DIN 51517 Part 2, US Steel 126, 127 and 136 and AF Nor E 48-603.

INSTALLATION

To achieve optimum performance from biodegradable non-EP gear oils, a system should be as free of contamination as possible before charging with the final fill of these fluids. Contamination of biodegradable hydraulic fluids can have an adverse effect on their performance as hydraulic fluids.

To prevent biodegradable problems caused by admixtures of other fluids and contaminants, Schaeffer Mfg. recommends a flushing procedure for systems being converted to biodegradable non-EP gear oils. The degree of flushing depends on the type and condition of the system and the fluid previously used.

New Systems:

Many new systems may have an internal coating of rust preventatives or may have been run on preservative fluids before shipping. Protective coatings on individual components, such as pumps and valves, should be removed and the components cleaned.

To prepare new systems for the biodegradable hydraulic fluids, Schaeffer Mfg. recommends a six-step procedure:

Step 1 – If the system contains oil, drain as much as possible from the system. Wipe the reservoir and other accessible interior spaces with lint-free rags. Look carefully for pipe scale, weld spatter, threading compound, gasket cement, shavings, and other debris left behind after installation.

Step 2 – Replace filters, if necessary.

Step 3 – Charge the system with sufficient EcoShield™ Biodegradable Non-EP Gear Oil to assure full circulation to all components.

Step 4 – Operate the system at normal temperatures and loads for a minimum of four hours. Monitor the differential pressure drop across the filter. A filter change may be necessary during this flush because contaminants in the system are incompatible with the EcoShield™ Biodegradable Non-EP Gear Oil. If this is the case, change the filters and continue to operate the system at normal temperatures, but at reduced loads, until the four hours of flushing are completed.

Step 5 – Drain the system while hot and repeat Step 1. Replace filters if there are any.

Step 6 – Add the final charge of EcoShield™ Biodegradable Non-EP Gear Oil and begin normal operation.

Conversion from R& O Type Gear Oils:

Step 1 – Before draining systems containing R & O type gear oils, add five-percent volume of 131 Neutra Fuel Stabilizer or 287 Food Grade Flushing Agent. Circulate under normal operating conditions for at least six hours. If the system is unusually dirty, add a ten-percent volume of 131 Neutra Fuel Stabilizer or 287 Food Grade Flushing Agent to increase the thoroughness of cleaning and to reduce cleaning time. This much solvent, however, will drastically reduce the viscosity of the oil. Operating the machine under normal load may cause rapid wear, therefore, operate under light load or no load, and monitor temperature and pressures.

Step 2 – Drain the system, including all cylinders, accumulators, and lines, while hot.

Step 3 – Install new filters and clean the filter housings.

Step 4 – Fill the system with sufficient EcoShield™ Biodegradable Non-EP Gear Oil to assure full circulation to all components. If the system was severely contaminated, substitute 112 HTC in the appropriate ISO viscosity grade for this phase of flushing.

Step 5 – Operate the system for not less than two hours under normal operating conditions.

(If the flushing fluid shows any sign of contamination, repeat Steps 2, 3, 4 and 5)

Step 6 – If the previous flushing charge in the system was not EcoShield™ Non-EP Gear Oil, fill the system with just enough EcoShield™ Biodegradable Non-EP Gear Oil for good circulation. Operate the system under normal conditions for 30 minutes. Repeat Steps 2 and 3, and then proceed to Step 7. If the previous charge was EcoShield™ Biodegradable Non-EP Gear Oil, skip to Step 7.

Step 7 – After repeating Steps 2 and 3, fill the system with the final charge of EcoShield™ Biodegradable Non-EP Gear Oil. Assume normal operation and monitor filters daily.

Conversion from Industrial Hydraulic and Circulating Oils:

Most dry industrial hydraulic and circulating oils are compatible with EcoShield™ Non-EP Gear Oil. However, the moisture level in systems previously charge with industrial hydraulic and circulating oils must be reached to as low a level as possible.

To flush these systems, operate them under normal conditions for at least four hours prior to draining. Proceed with Steps 2 through 7 described earlier under “Conversion from R&O Type Gear Oils”.

Conversion from Synthetic Oils:

Systems using synthetic oils require special consideration. Contact Schaeffer Mfg. Company for guidance.

SPILLAGE AND DISPOSAL

Depending on the contamination and/or degradation levels, small amounts of spilled or leaked EcoShield™ Biodegradable Non-EP Gear Oil will not adversely affect ground water or the environment. For small spills on the ground uncontaminated product will be readily biodegraded by naturally occurring soil organisms when exposed to air. Nonetheless, spillage of EcoShield™ Biodegradable Non-EP Gear Oil should be handled similarly to currently accepted methods for conventional mineral oil spills.

EcoShield™ Biodegradable Non-EP Gear Oil does not contain hazardous substances reportable under CERCLA. Since all oil spills are reportable, even a spill of this vegetable oil-based product must be reported to the National Response Center (the US Coast Guard). Local environmental agencies should also be consulted to clarify local requirements.

Acceptable methods of disposal include use as a fuel supplement, recycling and reclamation (that is, the same disposal practices available for conventional mineral oils). Since EcoShield™ Biodegradable Non-EP Gear Oil typically will not be a hazardous waste, additional disposal options may be available, including land farming or processing through sewage treatment facilities. If necessary, approvals are obtained from appropriate regulatory authorities.

The flushing solution may not be biodegradable therefore; it should be disposed of in an environmentally safe manner. Follow procedures used for disposing of conventional mineral oils.

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TYPICAL PROPERTIES

ISO Grade	68	100	150	220	320
Specific Gravity @ 60°F/15°C	0.9048	0.9175	0.9193	0.9209	0.9402
Viscosity @ 40°C, Cst (ASTM D-445)	68	100	150	220	320
Viscosity @ 100°, Cst (ASTM D-445)	14.15	15.93	21.06	27.14	35.5
Viscosity Index (ASTM D-2270)	218	171	165	159	157
Flash Point °F/°C (ASTM D-92)	397°/203°	444°/229°	442°/228°	441°/227°	421°/216°
Pour Point °F/°C(ASTM D-92)	-22°/-30°	-13°/-25°	-4°/-20°	-4°/-20°	0°/-18°
Foam Test (ASTM D-892)					
Tendency					
Stability, ml					
Sequence I	0/0	0/0	0/0	0/0	0/0
Sequence II	0/0	0/0	0/0	0/0	0/0
Sequence III	0/0	0/0	0/0	0/0	0/0
Total Acid Number (ASTM xD-664)	0.54	0.54	0.54	0.54	0.54
Demulsibility (ASTM D-1401)					
@ 130°F/54.4°C; Oil-Water-Emulsion (min)	40/40/0 (15 min)	40/40/0 (15 min)	40/40/0 (15 min)	40/40/0 (15 min)	40/40/0 (15 min)
Rust Test (ASTM D-665)					
Procedure A (Distilled Water)	Pass	Pass	Pass	Pass	Pass
Procedure B (Salt Water)	Pass	Pass	Pass	Pass	Pass
Hydrolytic Stability (ASTM D-2619)					
Copper Wt. Loss (mg/cm^2)	0.01	0.01	0.01	0.01	0.01
Acidity of Water, mg/KOH	0.21	0.21	0.21	0.21	0.21
Copper Strip Corrosion Test (ASTM D-130)	1a	1a	1a	1a	1a
RVPOT. Oxidative Stability (ASTM D-2272)					
Minutes to fail	210	210	210	210	210

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Typical Properties Continued

ISO Grade	68	100	150	220	320
Oxidation Solubility Test (ASTM D-943)					
Hours to TAN of 2	4000	4000	4000	4000	4000
Four Ball Wear (ASTM D-4172)					
1hr/40kg/167°, Scar Diameter, mm	0.36	0.36	0.36	0.35	0.35
FZG (DIN) (5182)					
Load Stage	12	12	12	12	12
Thermal Stability Test (Cincinnati Milicron Method) (ASTM D-2070)					
Sludge mg/100 ml	0.5	0.5	0.5	0.5	0.5
Condition of Copper Rod	3	3	3	3	3
Condition of Iron Rod	2	2	2	2	2
Sludging Tendencies (ASTM D-4310)					
Total Sludge, mg	78.1	78.1	78.1	78.1	78.1
Copper Wt. Loss, mg	20.00	20.00	20.00	20.00	20.00
Iron Wt. Loss, mg	1.10	1.10	1.10	1.10	1.10
Air Release Properties					
Time @ 50°C/122°F	0.5	0.5	0.5	0.5	0.5
Biodegradability					
% Biodegradability CEC-L-33-T-93	95%	95%	95%	95%	95%
% Biodegradability Modified Stürm OECD 301B ASTM D-5864	61%	61%	61%	61%	61%
Environmental Persistence Classification US Military	PW-1	PW-1	Pw-1	Pw-1	Pw-1
Ecotoxicity					
Fathead Minnow, 96 hours LC50, ppm	>10,000	>10,000	>10,000	>10,000	>10,000
Daphina Magna 48 hours, EC50, ppm	>10,000 WAF	>10,000 WAF	>10,000 WAF	>10,000 WAF	>10,000 WAF
Sludge Respiration Inhibition, EC50, ppm	>10,000	>10,000	>10,000	>10,000	>10,000

Packaging: 593 EcoShield™ Biodegradable Non-EP Gear Oil is available in 5 gallon pails, 30 and 55 gallon drums.