PRODUCT INFORMATION

A PRODUCT OF AMERICAN CHEMICAL TECHNOLOGIES, INC.

EcoSafe® FR-46, FR-68 and FR-100

Fire Resistant & Readily Biodegradable Hydraulic Fluids

DESCRIPTION:

EcoSafe® FR fluids are fully synthetic, non-aqueous hydraulic fluids that have been approved by Factory Mutual Research as Group II (HF-D) "less flammable hydraulic fluids". They can be used in industrial, marine, and mobile equipment, including high-pressure systems, systems with servo valves and all robotics. **EcoSafe® FR** fluids are formulated from a very high VI, fully synthetic basestock, coupled with a patented, non-metallic additive package which provide the properties demanded by today's high performance hydraulic systems, while at the same time, satisfying the stringent criteria for biodegradability and toxicity. All three viscosity grades achieved a 12-stage rating in the FZG Gear Test demonstrating a high level of protection against wear and scuffing. **EcoSafe® FR** fluids also have excellent low temperature properties; good shear stability, and are resistant to oxidative and thermal degradation. **EcoSafe® FR** fluids meet or surpass Bosch-Rexroth, Sauer-Danfoss, Denison, Parker and Eaton (formerly Vickers) specifications.

Typical physical properties are listed in Table 1. Seal compatibility data is listed in Tables 3 & 4. The increased performance which **EcoSafe® FR** fluids provide results in extended pump service life and reduced downtime along with lower maintenance costs. These fluids meet, or exceed, the pump performance of premium, anti-wear mineral oils, even at the 5,000 psi (380 bar) operating pressure. ***Additional bonus features include:*** non-sludge/varnish forming, high viscosity index, low pour point, excellent heat transfer, low foaming and complete compatibility with commonly used seals, hoses and metals.

If you want to add **EcoSafe® FR** fluid to a hydraulic system, call us and we will advise you regarding compatibility/solubility. Most "oil soluble" additives are not soluble in **EcoSafe® FR** fluids requiring a thorough and detailed plan prior to conversion. A separate information sheet *'Converting Hydraulic Systems to EcoSafe® FR Fluids'* is available upon request. Your ACT representative is also trained and experienced in all aspects of conversion assistance.

TABLE 1
TYPICAL PHYSICAL PROPERTIES

Test	*FR-46*	*FR-68*	*FR-100*
Viscosity @ 100 °F, SUS	230	320	480
@ 210 °F, SUS	53.3	65.3	86.0
Viscosity Index	185	189	196
Pour Point, °F	- 55	- 50	- 40
Density (lbs./gal) @ 60 °C	8.19	8.21	8.25
Flash Point, °F, COC	525	535	550

TABLE 2
TYPICAL PERFORMANCE PROPERTIES

Vickers 104C Vane Pump (ASTM D-2882) (2,000 psi, 100 hours, 150 °F, 7.5 gpm, 1,200 rpm, 3.5 gal. Sample)	< 10 mg Total Wear *
Four Ball Wear (ASTM D-2266) (1,800 rpm, 1 hour, 167 °F, 40 kg load)	0.35 mm
Four Square Gear Test (FZG) (194 °F, 1,760 rpm, 1,600 ml sample, 12 stages	Pass, all 12 stages
Turbine Oil Stability Test (ASTM D 943) (95 °C, iron and copper catalysts, 60 mls water) Time to 2.0 Acid Number increase	>2,000 hours

* Results of 1.2 and 1.7 mg's Total Wear were obtained by UEC (USX Engineers & Consultants, Inc.)

TABLE 3
SEAL COMPATIBILITY WITH EcoSafe® FLUIDS

Original Physical Properties	V747-75 2-214	L1120-70 2-214	V1006-75 2-214	N674-70 2-214	C873-70 2-214	E540-80 2-214	S604-70 2-214
Hardness, Shore A., pts.	78	68	79	71	73	80	70
Tensile Strength, psi	1,733	908	1,716	2,459	1,914	1,584	825
Elongation, %	195	211	228	399	244	205	185
EcoSafe® FR Fluids 158 Hrs. @ 158 °F							
Hardness Change, pts.	- 2	+ 2	+ 1	- 2	- 5	0	- 2
Tensile Change, %	- 2.9	- 23.7	+ 1.0	+ 4.7	+ 6.9	0	- 45.9
Elongation Change, %	- 1.5	- 29.3	0	- 4.8	+ 14.3	- 6.3	- 38.4
Volume Change, %	- 0.1	+ 0.3	- 0.01	+ 1.7	+ 7.2	- 1.4	- 1.0

KEY:

V747	Fluorocarbon (Viton)	C873	Neoprene
L1120	Fluorosilicone	E540	Ethylene-Propylene
V1006	Fluoroelastomer	S604	Silicone
N674	Nitrile (Buna N)		

(Data furnished courtesy of Parker Seals)

TABLE 4
SEAL COMPATIBILITY WITH EcoSafe® FLUIDS (Continued)
Test Method - DIN 53 521

Material	NBR-1 (Buna-n)	FKM-2 (Viton)	Polyurethane P 5000
Temperature, °C	100	100	60
Time, hours	1,000	1,000	1,000
Hardness Change, Pts.	-5	-3	-2
Modulus Change, %	+29.5	+4.7	-8.6
Tensile Change, %	-11.9	-5.8	+13.2
Elongation Change, %	-31.5	+6.8	+15.7
Weight Change, %	+9.0	+0.7	+3.9
Volume Change, %	+10.8	+1.5	+4.7

Performed by: *Parker Hanniffin GmbH*
Prädifa – Packing Division

TABLE 5
ENVIRONMENTAL DATA

OECD Ready Biodegradability Test Method 301B, 28 days	70.9
OECD Ready Biodegradability Test Method 301F, 28 days	88.0
OECD Method 203, Fish Acute Toxicity Test 96 hour LC50 for rainbow trout, Oncorhynchus mykiss	"practically non-toxic"

Note: 60% biodegradation within 28 days is required to be classified as a "readily biodegradable" hydraulic fluid.

STORAGE AND HANDLING:

We believe **EcoSafe® FR** fluids have a low degree of hazard when used as intended. They are stable, non-corrosive; high flash point materials that are compatible with nearly all commonly used materials in standard hydraulic systems. As with all products of this type, we recommend that good hygiene practices be observed, including: (1) avoid prolonged skin contact, (2) provide adequate ventilation, (3) do not ingest; and that all OSHA Standards pertaining to products of this type be observed. Refer to American Chemical Technologies' Material Safety Data Sheet for personnel protection, spill and leak procedures, handling and first aid information.

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