

Environmentally Acceptable Hydraulic Oil

MILLUBE™ EM-Series

1. Description

MILLUBE™ EM-Series are hydraulic oil which have many great functions such as, excellent lubricity, rust prevention and oxidation stability. And they are Environmentally Acceptable Lubricant (EAL) according to the definitions and requirements of the US EPA 2013 Vessel General Permit (VGP).

2. Feature

✓ High Safety

Meets the 2013 VGP requirements of 'biodegradability', 'toxicity' and 'bioaccumulation'.

✓ Excellent Lubricity, Rust Prevention and Oxidation Stability

Shows excellent lubricity, rust prevention and oxidation stability required for hydraulic oil.

3. Typical Characteristics and Safety

<Typical Characteristics >

Test Items		Test Method	MILLUBE™		
			EM-32A	EM-46A	EM-68A
Appearance(25℃)		—	Clear liquid	Clear liquid	Clear liquid
Density (15℃, g/cm ³)		ASTM D 1298	0.912	0.922	0.924
Color (ASTM)		ASTM D 1500	L2.5	L2.5	L2.0
Flash Point(℃)		ASTM D 92	231	239	249
Acid Value (mgKOH/g)		ASTM D 974	1.04	0.93	1.29
Kinetic Viscosity (mm ² /s)	40℃	ASTM D 445	33.16	49.33	66.86
	100℃		7.36	9.85	13.31
Viscosity Index		ASTM D 2270	197	191	205
Pour Point (℃)		ASTM D 97	-37.5	-37.5	-37.5
Foaming Test (ml)		ASTM D 892	10/0	10/0	0/0
Water Separability 54℃ (ml-ml-ml (min))		ASTM D 1401	40-40-0 (25)	40-37-3 (30)	40-37-3 (40)
Thermal Stability		JIS K 2540	Pass	Pass	Pass

The above figures are typical of those obtained with normal production tolerance and do not constitute a specification.

<Safety>

Test Items		Test Method	Requirement	MILLUBE™		
				EM-32A	EM-46A	EM-68A
Biodegradability (%)		OECD 301C	>60	>60		
Toxicity (EC50,LC50) (mg/L)	Algae	OECD 201	>100	>100		
	Daphnia	OECD 202	>100	>100		
	Fish	OECD 203	>100	>100		
Bioaccumulation (log Kow)		OECD 117	<3 or >7	Pass		

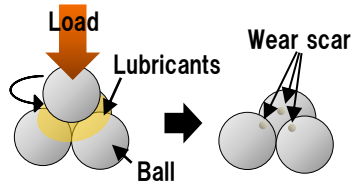
These data are the result of evaluating MILLUBE™ EM-32A, EM-46A, EM-68A or their components.

4. Results

<Lubricity>

【Wear Resistance Test】
(Four-Ball Method)

Test Method:ASTM D 4172



MILLUBE™			EAL commercial oil	Mineral oil
EM-32A	EM-46A	EM-68A		
340 μm	310 μm	300 μm	435 μm	560 μm
(Examples) EM-46A				

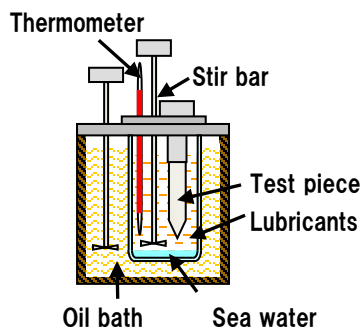
Show excellent wear resistant.

< Rust Prevention >

【Rust Prevention Test】

Test Method:JIS K 2510

(Artificial seawater)



MILLUBE™			EAL commercial oil	Mineral oil
EM-32A	EM-46A	EM-68A		
1 day later			1 day later	1 day later
Not rusted			Rusted	Not rusted
(Examples) EM-46A				

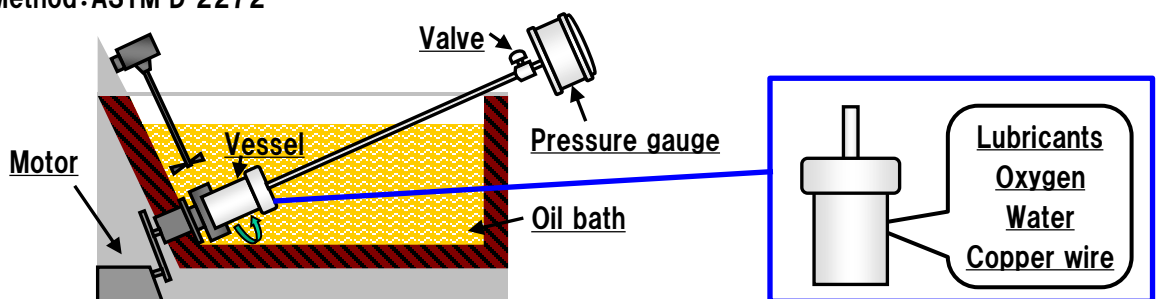
●JIS K 2510 requirement:Not rusted after 1 day

Show excellent rust prevention far exceeding the requirements set by the JIS test method.

<Oxidation Stability>

【Oxidation Stability Test (Rotating Pressure Vessel)】

Test Method:ASTM D 2272



	MILLUBE™			EAL commercial oil	Mineral oil
	EM-32A	EM-46A	EM-68A		
Oxidation Stability (min)	260	250	240	90	140

Show higher oxidation stability than EAL commercial oil.

MILLUBE is a registered trademark in Japan, China and South Korea, and a trademark in other countries of NOF CORPORATION.



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