Page (1) (outside front cover)

illus - large turbine

quote - 500 & 1000

~~MONSANTO INDUSTRIAL TURBINE FLUIDS~~

Title: New Facts About Fire-Resistant Turbine Fluids

7 top left

Turbinol - black

red (turbine lubricant by Monsanto)

logo

O/FF-23

pix

Introduction,

P(2)

~~inside~~ (inside cover)

Monsanto's ~~MOS 153~~ Turbinol 153 ~~gas~~ turbine lubricant has performed satisfactorily for ten years in commercial pipeline gas turbines. ~~Pydraul 135 is a new, lower cost~~ fire resistant synthetic fluid ~~which has~~ performed satisfactorily for over three years in regulator systems of steam turbines and steel mill equipment. Pydraul 135 is also in service as a bearing lubricant in several small steam turbines. Properties of these two fluids and a premium 95VI turbine oil are compared in this bulletin. On the basis of these test results and field experiences, Pydraul 135 is proposed as a gas turbine lubricant, steam turbine lubricant, and hydraulic fluid for steam turbine control systems.

It is a that offers

No

Back Page.

Monsanto (logo)

0407304

page 8

MONSANTO COMPANY • 800 NORTH LINDBERGH BLVD. • ST. LOUIS, MO. 63166

TO ASSIST YOU IN THE EVALUATION OF THE ABOVE PRODUCT, WE HAVE OBTAINED THE INFORMATION CONTAINED IN THIS BULLETIN FROM LITERATURE SOURCES AND PRELIMINARY INVESTIGATION IN OUR OWN LABORATORIES. WHILE WE BELIEVE THE INFORMATION IS ACCURATE, WE ASSUME NO RESPONSIBILITY AND DISCLAIM ANY LIABILITY INCURRED IN USING THESE DATA OR SUGGESTIONS. ONLY QUALIFIED TECHNICAL PERSONNEL SHOULD WORK WITH THIS PRODUCT UNTIL SUBSEQUENT STUDIES JUSTIFY ITS USE IN YOUR PRODUCTS OR PROCESSES. OBVIOUSLY NOTHING IN THIS BULLETIN SHOULD BE CONSTRUED AS A RECOMMENDATION TO USE ANY PRODUCT IN CONFLICT WITH EXISTING PATENTS COVERING ANY MATERIAL OR ITS USE

& district offices

TYPICAL PROPERTIES OF ~~TURBINE FLUIDS~~ Turbinol

PHYSICAL PROPERTIES

	~~MCS 153~~ Turbinol 153	Pydraul 135	Typical Premium R&O Turbine Oil
Appearance			
Viscosity, SSU: (curves ~~attached~~ below)			
@ 210°F	37.1	40.8	43.0
@ 175°F	42.1	49.0	52.0
@ 100°F	108	136.9	150
@ 40°F	2,160	1,600	2,000
@ 20°F	17,000	7,800	---
Pour Point, °F	0	-12	+10
Specific Gravity, 60°/60°F	1.34	1.19	0.87
Moisture Content (MAX) Typical Values	~~0.08% to~~ 0.15%	0.05	---
Neutralization Number (acidity) (mg KOH/gM)	0.02 to 0.1	0.20	0.1 to 0.2
Secant Bulk Modulus, psi			300,000 at room temperature
~~@ 50°F~~ only	450,000	395,000	
@ 100°F	412,000	350,000	
~~@ 150°F~~	~~378,000~~	309,000	
@ 200°F	342,000	275,000	
@ 250°F	315,000	242,000	
@ 300°F	288,000	211,000	

(2) Comparison of some properties with petroleum oil and commercial straight phosphate esters are shown in Appendix I.

bottom section page 3

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Falex load – Jaw load – lbs
– Torque – lb. inches

LUBRICATION PROPERTIES

	Turbinol MCS 153	Pydraul 135	Typical Premium R&O Turbine Oil
Four-Ball Wear Test: (mm scar diameter) 620 rpm, 167°F, 1 hr.			
Steel/steel 10 kg	0.23	0.24	–
40 kg	0.53	0.43	0.6 to 1.0
Steel/bronze 10 kg	0.92	0.48	2.0 to 3.0
Timken Test: Passing Load, lbs.	40	50	15
Ryder Gear Test, lbs./in.	–		2800
Vickers Pump Test: 1,000 hrs., 140°F, 1,000 psi			
Weight Loss, grams			
Ring	0.0220	-0.0220	
Vane	0.0010	-0.0020	
Viscosity Change, %			Similar
@ 100°F	+6	+11	
@ 210°F	+7	+5	
Acidity Change, mg KOH/g			
Initial	–	0.10	Pydraul 135
Final	–	0.27	

The lubrication performance of Turbinol 153 compares quite favorably with premium turbine oil.

Check – will provide later

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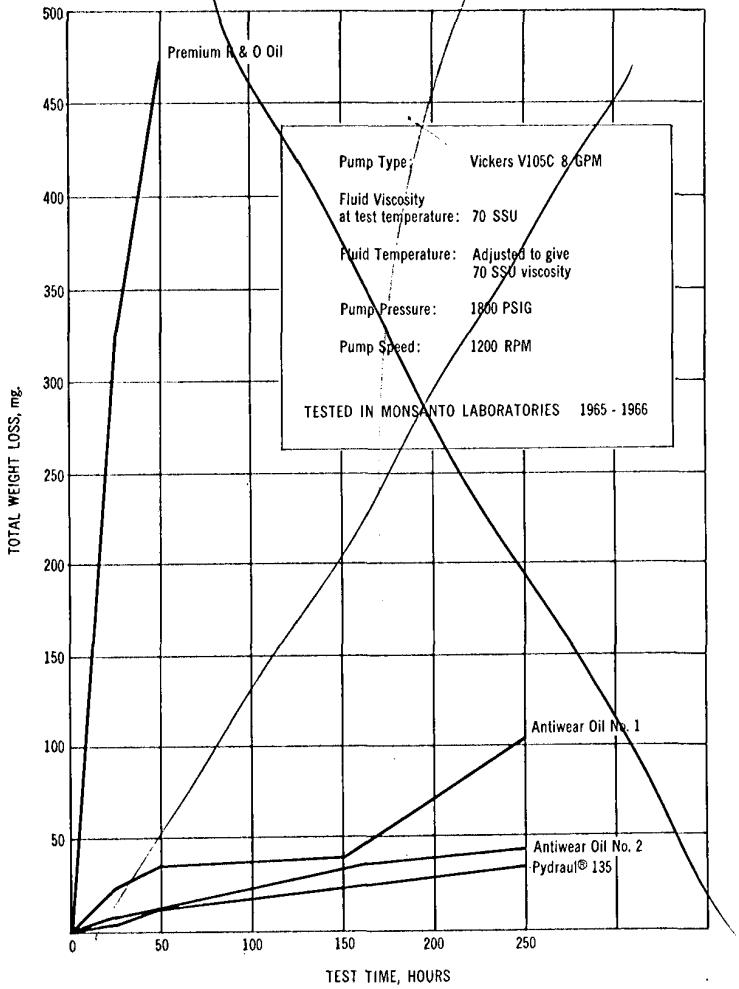
SEVERE VICKERS VANE PUMP TEST RESULTS



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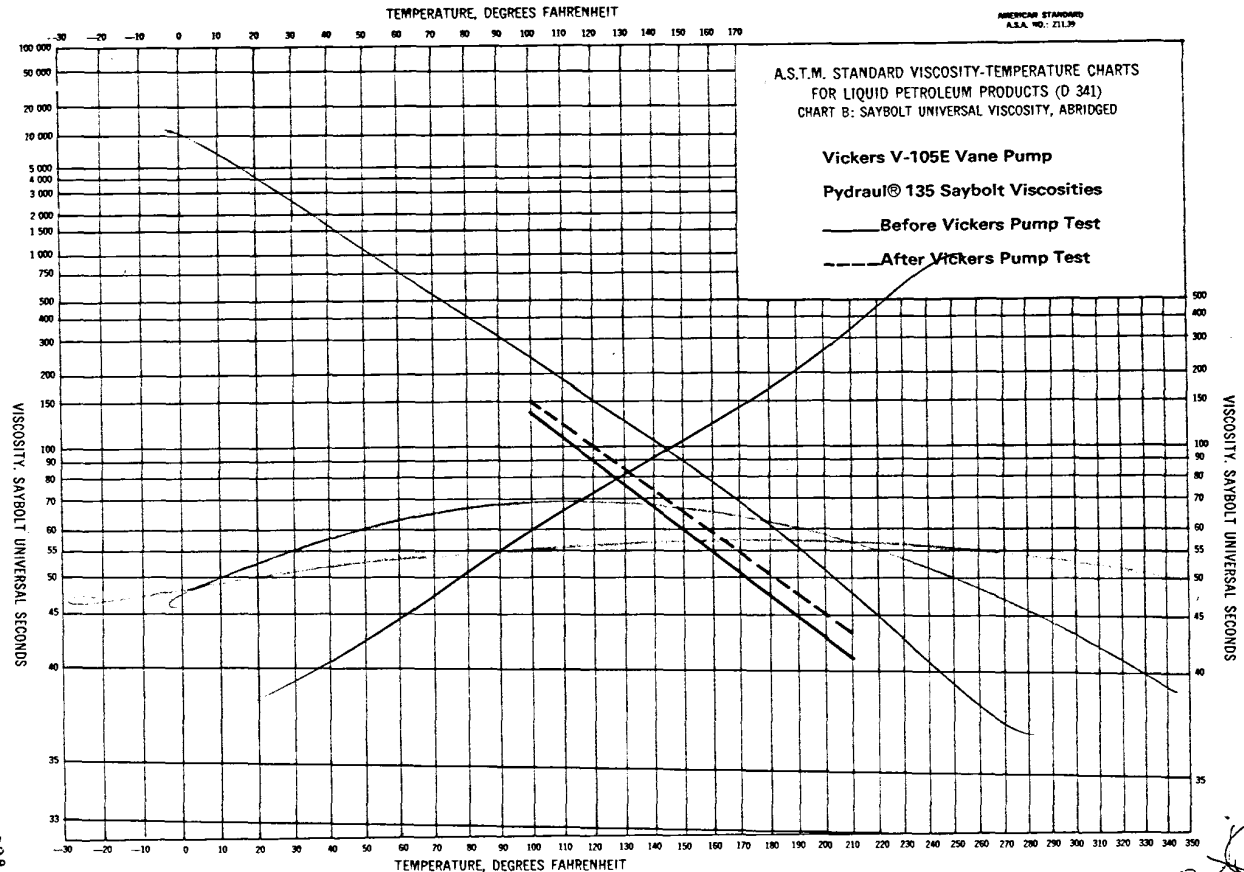

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STABILITY ~~AND CORROSION~~ PROPERTIES

	Turbinol ~~MCS 153~~	~~Pydraul 135~~	Typical Premium R&O Turbine Oil
ASTM Rust Test D-665:	PASS		
140°F Distilled Water	~~Not run~~	Pass	Pass
~~140°F Synthetic Sea Water~~	~~Fail~~	Pass	Pass
ASTM Emulsion Test D-1401:			
ml Emulsion after 30 minutes	0	0	0
ASTM Foam Test D-892:			
Sequence 1	Pass	Pass	Pass
Sequence 2	Pass	Pass	Pass
Sequence 3	Pass	Pass	Pass
ASTM Turbine Oil Stability Test D-943 (Modified[a]): (insert next page)			
Hrs. to reach 2.0 mg KOH/g	>2000	~~1986~~	2000

Test fluid formulated without rust inhibitor

Addition of suitable inhibitor to synthetic FR fluids do provide rust protection for high moisture environments

(a) Because of the higher specific gravity of these fluids, water used in the test would not settle to the bottom of the test cylinder. Hence, oxygen stream was saturated with water before being bubbled through the test fluid.

MICH-19457: * * *

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Hydrolytic Stability Test (Beverage Bottle Test) 200°F water, 48 hrs., Cu strip	Pass		Pass
Fluid Neut. No., mg KOH/g			Not
Initial	0.05	0.10	0.1 (Run)
~~Final~~	~~0.12~~	0.31	0.2 (Run)
Increase	0.07		~~Run~~
Mg NaOH/g to neutralize water layer	nil	0.02	5.0 (Run)
% Viscosity Change,			
SSU @ 100°F	+2.5	+1.0	—
SSU @ 210°F	-	+0.4	
Insolubles	Trace	None	0.5 %
Copper Strip	None - clear ~~No corrosion~~	No corrosion	No visible corrosion

1/4 of page 5

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also page (5)

Mobil Oil Petroleum Oil Ohio

~~STABILITY AND CORROSION PROPERTIES~~
~~-continued-~~

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	Turbinal ~~MCS~~ 153	Pydraul 135	Commercial Phosphate Ester Turbine Fluid ~~Pydraul 312~~	
Oxidation/Corrosion Test: 168 hrs., 250°F, air				
Metal Attack, mg/cm²				
Al	-0.01	0.0	0.0	-0.01
Mg	-0.01	0.0	0.0	-0.01
Cu	-0.04	-0.09	-0.81	-0.04
Fe	0.0	-0.02 (Steel)	0.0	0.0
Cd	-0.01	-0.01	0.0	-0.01
Viscosity, ~~SSU~~				
~~100°F Initial~~	~~108.7~~	134.4	-	45.9
~~100°F Final~~	~~118.0~~	364.9	-	
% Change, 100°F	+ 8.5	+172.0 (a)	+9.0	+9.9
~~210°F Initial~~	~~37.06~~	~~40.3~~	-	4.76
~~210°F Final~~	~~37.28~~	~~50.9~~	-	
% Change, 210°F	+ 0.6	+ 26.0 (a)	-	+4.9
Acidity, TAN				
Initial	0.07	0.20	0.36	0.02
Final	0.05	1.80	1.21	0.48
Change	+0.02		+0.46	

(a) The high viscosity increase of Pydraul 135 is attributed mainly to volatilization of one blending component with Initial Boiling Point about 400°F. The large volume ratio of air to fluid (5 one/hour through 100 ml fluid) strips lower boiling component.

Alcor Deposition Test (DEPOSITION)

48 hrs, 250°F fluid, 1000 ml/min air flow @ 400°-475°F tube temperature

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Total Deposit Rating	10.5		10.5
Filter, mg	10		13
Acidity, TAN Change	+ 0.03	(Copy (B))	+0.02

Copy (B)

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