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HYDRAULIC SYSTEM - ORONITE 8515
PRESERVATIVE FLUIDS - EVALUATION OF

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HYDRAULIC SYSTEM - ORONITE 8515 PRESERVATIVE

FLUIDS - EVALUATION OF

PURPOSE:

The present MIL-H-8446 B-58 hydraulic fluid does not have a high enough level of corrosion inhibitor to warrant its usage as a preservative oil, nor will it pass any applicable military specification. Therefore, a special preservative oil suitable for protection and storage of B-58 hydraulic units and compatible with the hydraulic fluid now in use would be most desirable.

This test was a continuation of F-7164 under the same title as above. Its purpose was to conduct further testing of three Oronite preservative fluids to determine their oxidation and corrosion stability and their effect on certain seal materials.

SUMMARY:

At Convair's request Oronite Chemical Company prepared three formulations of preservative fluids for "screening" to determine their suitability for protection and storage of B-58 hydraulic units.

These fluids, identified by number, contained the following amounts of inhibitor (calcium petroleum sulfonate): 53839R(2%), 53839A-R (4%) and 53839B-R (6%). They were blended from base stocks of Oronite 8515 High Temperature Hydraulic Fluid.

Physical and chemical property tests, designed to disclose degree of rust prevention as well as similarities and differences to Oronite 8515 were performed on the fluids under TR-7164 and results are reported in FGT-2228. Results obtained during the initial testing indicated that Fluid 53839A-R offers the best all around protection. However, it was deemed advisable to determine their oxidation/corrosion stabilities before a decision was made on their use.

Therefore, a supplemental test request was initiated to conduct further testing of the fluids. Results of these additional tests indicate that Fluid 53839A-R offers the best combination of rubber compatibility and oxidation/corrosion stability. These findings give added support to the conclusion stated in FGT-2228 that Oronite Rust Preventative Fluid 53839A-R furnishes the best all around protection of the three fluids tested.

HYDRAULIC SYSTEM - ORONITE 8515 PRESERVATIVE

FLUIDS - EVALUATION OF

OBJECT:

To determine (1) The oxidation and corrosion stability of Oronite 8515 Preservative Fluids 53839R, 53839 A-R, and 53839 B-R, and (2) their effects on certain "O"ring seal material after aging for 72 hours at 350°F.

DESCRIPTION OF MATERIALS:

<u>Test Fluids</u>	<u>Vendor</u>
1. Oronite 8515 High Temperature Hydraulic Fluid No. 53685R (as control sample)	Oronite Chemical Co. 200 Bush Street San Francisco, Calif.
2. Oronite Rust Preventative Hydraulic Fluid 8515 No. 53839R (containing 2% Inhibitor, by wt.)	"
3. Oronite Rust Preventative Hydraulic Fluid 8515 No. 53839 A-R (containing 4% Inhibitor, by wt.)	"
4. Oronite Rust Preventative Hydraulic Fluid 8515 No. 53839 B-R (containing 6% Inhibitor, by wt.)	"

Support Materials:

Source:

Q2825*214 "O"Rings
Cure Date (2Q59) Batch #1

Convair Stock
(Manfgr. Plastics and Rubber
Products Co., Los Angeles,
California)

LS-53 "O" Rings
Compound 6071R

Furnished by Dept. 6-4
(Manfgr. Dow Corning Corp.)

NOTE: Following receipt of the test request the originator, J. B. Ray, requested that Dow Corning LS-53 "O"rings be substituted for Q2774**"O"rings. Also, after this test was written, all Q-2795 "O"rings were replaced with Q-2825 "O"rings. Therefore, the latter were used in this test.

* Identical to MS 28775-214, except compound is PRP 3046-70.

** Identical to AN 6290, except for compound.

PROCEDURE:

Procedures used were as called out in the test request.

The following is a list of the tests conducted and methods employed.

<u>Test</u>	<u>Accuracy</u>	<u>Method</u>
1. Viscosity; @100° and 210°F	± 0.1%	ASTM D 445-53T
2. Neutralization No.	± 0.02 (No.)	ASTM D 664-54
3. Oxidation and Corrosion Stability (72 hours @ 400°F)	--	Military Specification MIL-H-8446A Para. 4.4.1

4. Effect of oil aging on properties of seal materials.

(a.) The "O" rings were aged for 72 hours @ 350°F in each type fluid. The fluid and "O" rings were aged in an air tight container having an air-to-fluid ratio of 10:1 by volume at room temperature. The fluid-to-seal ratio was 20 ml. of fluid to 1 gram of seal material. The "O" rings were placed flat on steel wire mesh having wire no larger than 0.016" dia. and no more than ten wires per inch. The wire was placed 1/2" from the container bottom.

(b.) After the aging cycle the "O" rings were removed and allowed to cool. Then their physical properties were compared with those of non-aged "O" rings by the following tests:

- | | |
|--------------------------------------|--|
| 1. Tensile Strength | Federal Test Method Standard No. 601, Method 4111. |
| 2. Swell | Federal Test Method Standard No. 791, Method 3603.2. |
| 3. Temperature of Retraction (TR-10) | ASTM D-1329-54T |
| 4. Hardness - Shore "A" Durometer | |

RESULTS:

● Test results and the relative protection afforded by the preservative fluids are recorded in the following tables and figures:

TABLE I "Oxidation and Corrosion Stability Characteristics of Oronite 8515 Preservative Fluids"

TABLE II "Effects of Oronite 8515 Preservative Fluids on Q2825-214 Type "O" Rings."

FIGURE 1 is a bar graph of the tensile strength of Q2825-214 "O" rings after oil aging (72 hours @ 350°F) in the test fluids.

DISCUSSION:

At Convair's request Oronite Chemical Co. prepared three formulations of preservative fluids for screening, using Oronite 8515 High Temperature Hydraulic Fluid as the base stock. Each of these experimental fluids contained a specific amount of inhibitor. Identification of the test fluids and percentages of inhibitor (calcium petroleum sulfonate) in each is as follows:

<u>Fluid</u>	<u>% Inhibitor</u>
1. Oronite 8515 High Temperature Hydraulic Fluid No. 53685R (Control Sample)	None
2. Oronite Preservative Fluid No. 53839R	2% by wgt.
3. " " " No. 53839A-R	4% " "
4. " " " No. 53839B-R	6% " "

Initial testing of these fluids was conducted under TR-7164 and the test results are reported in FGT-2228. These tests showed that of the three formulations tested Oronite Rust Preventative Fluid 53839A-R (containing 4% inhibitor) offers the best all around protection. However, none of the fluids possess the qualities and characteristics desired of a preservative fluid for the B-58 hydraulic system since some of their physical and chemical properties differ widely from those of the control sample. Nevertheless, it seemed advisable to evaluate their oxidation and corrosion stability characteristics.

Therefore, a supplemental test request was initiated to conduct further testing of the three Oronite preservative fluids. Original test requirements called for determination of their effects on Q2795 and Q2774 type "O" rings. However, the originator requested that LS-53 type "O" rings be substituted for the Q2774 type. In the course of procuring the Q2795 type it was found that their designation had been changed to Q2825.

During the "O" ring aging cycle the LS-53 "O" ring containers developed leaks and the specimens had to be discarded. Reruns could not be made because of insufficient samples; consequently no data is being reported on the LS-53 type "O" rings.

Physical and chemical properties, as called out in the test request, were conducted on each of the test fluids. The data from these tests are contained in Tables I and II and in Figure 1.

A detailed look at these data discloses that all three of the test fluids meet the oxidation and corrosion stability requirements of Military Specification MIL-H-8446B (Amendment 1) which permits a neutralization number change of 1.0 after O/C. However, Oronite Preservative Fluid 53839A-R is the only one that satisfies the less lenient (0.5 neut. no. change) requirements of MIL-H-8446A. Therefore, it may be concluded that fluid 53839A-R is the most stable of the three fluids tested.

The tensile strength, percent swell, and temperature of retraction (TR-10) properties of the aged "O" rings appear to be influenced directly by the concentration of the inhibitor. Rubber compatibility characteristics of the fluid containing 2% inhibitor come closer to matching those of the control sample than either of the other fluids. However, Fluid 53839A-R does not differ excessively. Therefore, this fluid because of its excellent oxidation corrosion stability appears to offer the best all around protection.

CONCLUSIONS:

Based on tests conducted by the Engineering Chemistry Laboratory the following conclusions may be drawn:

1. The oxidation and corrosion stability of Oronite Rust Preventative Fluid 53839A-R (containing 4% Inhibitor) is superior to those of Fluids 53839R and 53839B-R.
2. Fluid 53839R (containing 2% Inhibitor) has the least deleterious effects on Q2825-214 type "O" rings. However, the effects of fluid 53839A-R on this type seal material do not differ significantly from those of 53839R.
3. From the standpoint of rubber compatibility and oxidation/corrosion stability, Fluid 53839A-R appears to be the most suitable of the three formulations for B-58 hydraulic system use. These findings further support the same conclusion drawn under FGT-2228.

Note: Original Data may be found in Project Record Book # 9509.

REFERENCES

1. Convair Report FGT-2228
2. American Society for Testing Materials, Vol. V, 1955 Ed.
3. Convair Procurement Specification FMS-0018B.
4. Federal Test Method Standard No. 601, 12 April 1955.
5. Military Specification MIL-H-8446A.
6. Military Specification MIL-H-8446B.

TABLE I
OXIDATION AND CORROSION STABILITY CHARACTERISTICS OF OROMITE 8515 PRESERVATIVE FLUIDS

TESTS	OROMITE 8515 HIGH TEMPERATURE HYDRAULIC FLUID 53685R (Control Sample)	OROMITE PRESERVATIVE FLUID 5839R CONTAINING 2% INHIBITOR	OROMITE PRESERVATIVE FLUID 5839A-R CONTAINING 4% INHIBITOR	OROMITE PRESERVATIVE FLUID 5839 B-R CONTAINING 6% INHIBITOR	MILITARY SPEC. MIL-H-8446A REQUIREMENTS	MILITARY SPEC. MIL-H-8446A REQUIREMENTS
Viscosity: ASTM D445-50T						
Centistokes @ 100°F	21.82	21.62	23.14	24.18	Detachable	Same
" @ 210°F	6.94	7.10	7.46	7.58	"	"
Neutralization Number: ASTM D-664-54	0.03	0.78	1.33	1.91	0.2 Max.	"
Oxidation and Corrosion Stability (72 Hrs. @ 400°F) MIL Spec. MIL-H-8446A Para. 4.4.1						
Viscosity: Centistokes @ 100°F After 0.2.	17.48	22.80	20.37	22.93	None	Same
" @ 210°F	5.26	7.04	6.29	6.64	Detachable	"
% Viscosity Change @ 210°F	28.21	0.10	15.68	12.40	35.0%	"
Neutralization Number	0.96	1.31	1.72	2.82	Detachable	1.0 Max.
Neutralization Number Change	0.93	0.53	0.39	0.98	0.50 Max.	"
Wt. Change of Metal Specimens Mg/cm ²						
Copper	0.07	0.18	0.09	0.09	0.4	Same
Steel	0.02	0.02	0.02	0.02	0.2	"
Aluminum	0.02	0.01	0.02	0.02	0.2	"
Silver Plated Steel	0.04	0.03	0.04	0.01	0.2	"
Appearance of Metal Specimens						
Copper	Pass	Pass	Pass	Pass	5	↑
Steel	Pass	Pass	Pass	Pass	5	↑
Aluminum	Pass	Pass	Pass	Pass	5	↑
Silver Plated Steel	Pass	Pass	Pass	Pass	5	↑
Sediment	Nil	Nil	Nil	Nil	No insoluble or gumming	Same
Evaporation %	2.0	2.5	3.5	3.0	8.0 (Max.)	"
Fluid Appearance	Good	Good	Good	Good	No Requirement	"
NOTE: The initial viscosities and neutralization numbers recorded above differ slightly from those reported in RPT-2288. These property changes have occurred since the fluids were tested under P-7164.						

ANALYSIS
 PREPARED BY _____
 CHECKED BY _____
 REVISED BY _____

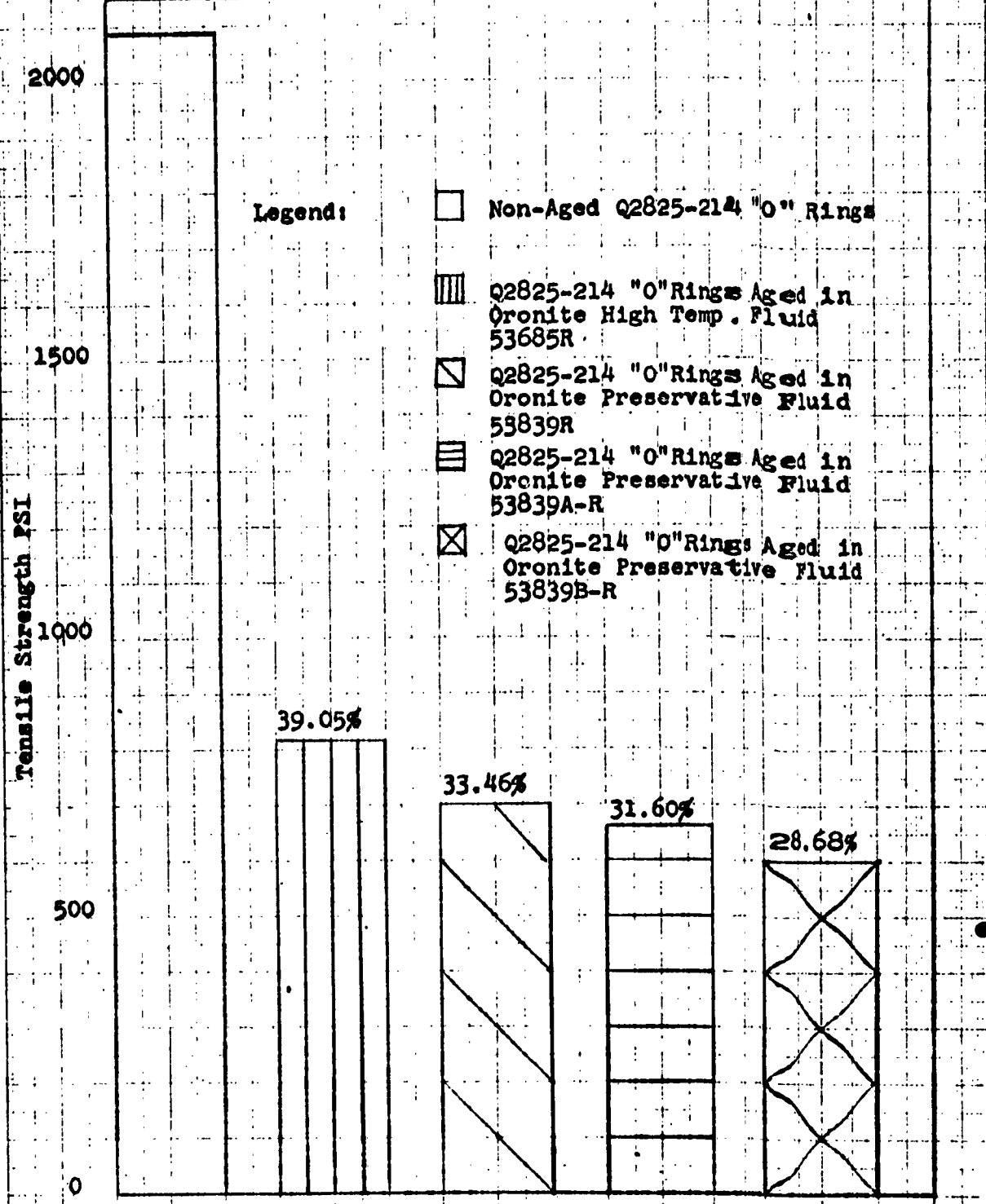
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TABLE II
 EFFECTS OF ORONITE 8515 PRESERVATIVE FLUIDS ON THE PROPERTIES OF Q2825-214
 TYPE "O" RINGS

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 ORDER NO. 5-38
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TESTS	ORONITE 8515 HIGH TEMPERATURE HYDRAULIC FLUID 51685R (Control Sample)	ORONITE PRESERVATIVE FLUID 53839R CONTAINING 2% INHIBITOR	ORONITE PRESERVATIVE FLUID 53839A-R CONTAINING 4% INHIBITOR	ORONITE PRESERVATIVE FLUID 53839B-R CONTAINING 6% INHIBITOR
RUBBER COMPATIBILITY				
Q2825-214 "O" rings aged 72 hours @ 3500P in each type fluid				
Tensile Strength (psi)				
"O" rings non-aged	2092	2092	2092	2092
"O" rings aged	817	700	661	600
Hardness (Shore "A" Durometer)				
"O" rings non-aged	70	70	70	70
"O" rings aged	70	71	70	70
Temperature of Retraction (TR-10)				
"O" rings non-aged	-55°F	-55°F	-55°F	-55°F
"O" rings aged	-56°F	-61°F	-59°F	-67°F
"O" rings Swell %	15.31	17.65	18.75	20.79

FIGURE 1
EFFECTS OF AGING (72 HOURS @ 350°F) Q2825-214 TYPE "O" RINGS IN
ORONITE 8515 PRESERVATIVE FLUIDS ON TENSILE STRENGTH



(% Figures = % of Tensile Strength of Non-Aged "O" Rings)