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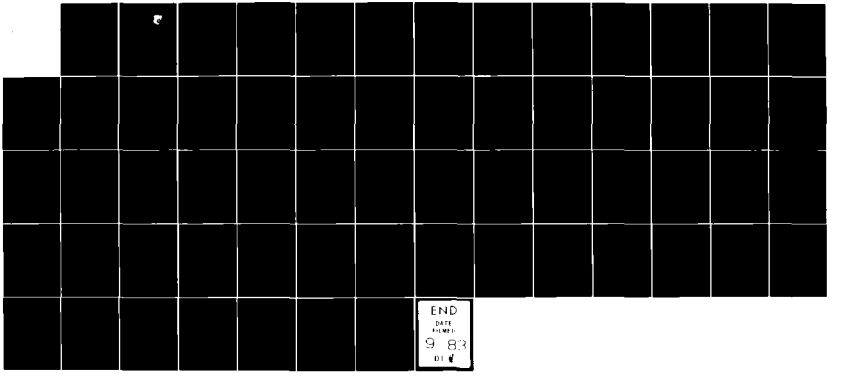

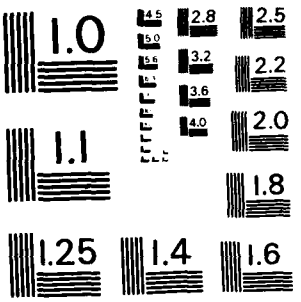

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STORAGE OF SYNTHETIC TURBINE LUBRICANTS UNDER ADVERSE CONDITIONS

H. A. Smith
M. A. Schumacher

Lubrication Branch
Fuels and Lubrication Division

April 1983

Final Report for Period June 1979 - October 1980

Approved for public release; distribution unlimited.

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The stability of six turbine lubricants consisting of four MIL-L-7808 fluids, one MIL-L-23699 fluid, and one MIL-L-7808 fluid containing a corrosion inhibitor with all being stored under adverse conditions were investigated. Conditions of storage consisted of both sealed containers and open containers exposed to free water or high humidity for periods up to 16 months. Effects of microorganisms were also investigated. Lubricant was periodically examined for changes in appearance, odor, total acid number values, Complete Oil

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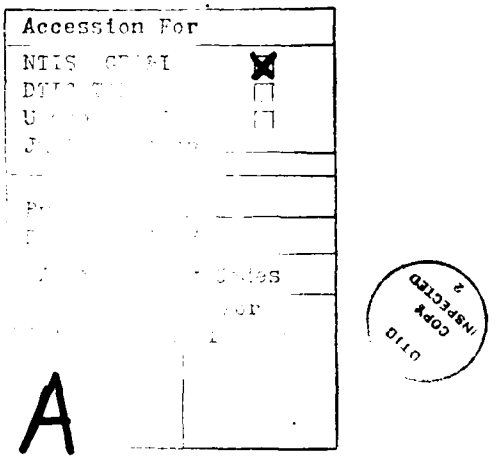
20. ABSTRACT (Cont'd)

Breakdown Rate Analyzer (COBRA) values and microscopic examination for microbiological activity.

This study has shown that the two parameters most effecting long-term storage of turbine lubricants are temperature and free water or high humidity. As the storage temperature increases, the rate of lubricant hydrolysis rapidly increases with hydrolysis being the major mechanism for lubricant degradation under these conditions. One MIL-L-7808 fluid showed superior stability in comparison to the other fluids but not of sufficient degree to provide 16 months storage under high moisture conditions at 100°F. Microbiological activity did not effect the rate of lubricant degradation significantly.

PREFACE

This technical report was prepared by the Lubrication Branch, Fuels and Lubrication Division, Aero Propulsion Laboratory (APL), Air Force Wright Aeronautical Laboratories (AFWAL), Air Force Systems Command, Wright-Patterson Air Force Base, Ohio. The work herein was accomplished under Project 3048, Task 304806, Work Unit 30480626, "Turbine Engine Lubricant Research," during the period of June 1979 to November 1980 with Mr H. A. Smith as Project Engineer. Special acknowledgement is given to Mr M. A. Schumacher, AFWAL/POFF, for his outstanding contribution to this effort.



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SECTION I

INTRODUCTION

The storage of turbine lubricants in normally used containers such as hermetically sealed quart cans or drum stock utilized through use of servicing carts is satisfactory with respect to long-term lubricant stability. Current lubricants possess good low temperature oxidative, thermal and hydrolytic stability under these conditions of storage which is of relatively low temperatures and limited oxygen availability. Water content of new lubricant is also low and usually below 500 ppm.

For turbine lubricants (ester base) to be stored under these conditions, lubricant storage stability can be predicted using the SOD lead corrosion test. Specification MIL-L-7808 requires lubricant stored in hermetically sealed containers to conform to all specification requirements after three years of storage. Specification MIL-L-23699 requires hermetically sealed containers of the lubricants to conform to specification requirements after one year of storage.

In normal turbine engine lubricant systems, lubricant storage stability is not a problem due to frequent usage, oil consumption and replenishment, and a very low water or humidity environment.

The use of ester type lubricants under conditions which are not typically associated with turbine engines is increasing due to new applications and new lubricant system requirements. Some advanced systems employing ester base lubricants require storage capability under adverse conditions such as non-hermetically sealed dormant systems for time periods of two years or more.

A lubricant sample obtained from such a system after 18 months storage showed severe degradation and contained large quantities of both motile and non-motile microorganisms. Although the lubricant contained no free water or suspended water, the presence of bacteria suggested free water may have been present somewhere in the lubricant system. The question which remained unanswered after the completion of the analyses

was what caused the severe lubricant degradation. Possibilities include low temperature oxidation, hydrolysis, microbiological activity, or a combination of these possibilities. Since no information existed relative to lubricant storage characteristics under adverse conditions, a program was initiated for investigation of the storage capability of current turbine lubricants under these conditions.

The objectives of this study was to investigate differences long-term storage characteristics of current lubricants under va s storage conditions and the effect of microorganisms on lubricant degradation causing increased acidity of the lubricant.

SECTION II

TEST EQUIPMENT AND PROCEDURES

1. GENERAL

The test program was designed to investigate six lubricants at two temperatures using different types of containers under various environments. This resulted in five major test systems as shown below.

Test System A. Closed system with free water.

Test System B. Open system with 100% relative humidity.

Test System C. Control systems with closed and open containers.

Test System D. Open and closed systems with free water and innoculated.

Test System E. Open and closed systems with 100% relative humidity and innoculated.

Table 1 shows a diagram of the test program.

2. TEST EQUIPMENT

The storage containers used for the test program included the following.

a. Sixteen ounce capacity flint glass bottles with Poly-Seal screw caps.

b. Four ounce capacity flint glass bottles with Poly-Seal screw caps.

c. One hundred fifty milliliter capacity Pyrex beakers.

d. Sixteen ounce plain tin F style oblong cans with one inch screw caps.

Sealed desiccators were used for obtaining 100% relative humidity test chambers. A horizontal air-flow mechanical connection oven was used for the tests conducted at 100°F (37.8°).

3. TEST PROCEDURES

The test samples were prepared and coded as shown in Tables 1 and 2. Closed system samples were sealed with caps while open system samples were stored uncapped. Samples containing free water were prepared by adding the test lubricant to containers having the free water without mixing. Sample containers were stored in desiccators containing free water below the desiccator plate for the 100% relative humidity testing. All of the 108 lubricant test samples were stored in the dark except for the brief periods of sampling or visual observations. Forty-eight of the samples were stored at room temperature in a steel cabinet. The remaining 60 samples were stored at 100 °F in the mechanical connection oven. No sterilization of any containers or fluids was done prior to testing.

4. TESTING AND EVALUATION CRITERIA

The stored samples were periodically analyzed using the following test procedures and evaluation criteria.

a. Total Acid Number Measurements

The total acid number of lubricants is the quantity of base, expressed in milligrams of potassium hydroxide required to neutralize all acidic constituents present in one gram of the oil. These determinations were conducted using ASTM Method D664, "Neutralization Number by Potentiometric Titration."

b. Complete Oil Breakdown Rate Analyzer (COBRA) Measurements

The COBRA is an electronic instrument that measures the electrochemical characteristics of the lubricant. Lubricant degradation increases the electrochemical characteristics which are measured by

TABLE 1

TURBINE LUBRICANT STABILITY TEST SYSTEMS

TEST SYSTEM A - CLOSED SYSTEM
(FREE WATER - 16 OZ. GLASS BOTTLES)
300ml OIL PLUS 100ml H_2O

70°F (21°C) A-1	100°F (37.8°C) A-2
A-1-1 (1M-1)	A-2-1 (1M-1)
A-1-2 (1N-1)	A-2-2 (1N-1)
A-1-3 (15E-1)	A-2-3 (15E-1)
A-1-4 (11E-1)	A-2-4 (11E-1)
A-1-5 (0-9A-4)	A-2-5 (0-9A-4)
A-1-6 (1M-1+ Corrosion Inhibitor)	A-2-6 (1M-1+ Corrosion Inhibitor)

TEST SYSTEM B - OPEN SYSTEM
(100% RELATIVE HUMIDITY - 150ml GLASS BEAKERS)
100ml OIL

70°F (21°C) B-1	100°F (37.8°C) B-2
B-1-1 (1M-1)	B-2-1 (1M-1)
B-1-2 (1N-1)	B-2-2 (1N-1)
B-1-3 (15E-1)	B-2-3 (15E-1)
B-1-4 (11E-1)	B-2-4 (11E-1)
B-1-5 (0-9A-4)	B-2-5 (0-9A-4)
B-1-6 (1M-1+ Corrosion Inhibitor)	B-2-6 (1M-1+ Corrosion Inhibitor)

TEST SYSTEM C - CONTROL SYSTEMS C-1 THRU C-4
CLOSED SYSTEM - 300ml OIL

70°F (21°C) GLASS BOTTLES C-1	70°F (21°C) METAL CANS C-2	100°F (37.8°C) GLASS BOTTLES C-3	100°F (37.8°C) METAL CANS C-4
C-1-1 (1M-1)	C-2-1 (1M-1)	C-3-1 (1M-1)	C-4-1 (1M-1)
C-1-2 (1N-1)	C-2-2 (1N-1)	C-3-2 (1N-1)	C-4-2 (1N-1)
C-1-3 (15E-1)	C-2-3 (15E-1)	C-3-3 (15E-1)	C-4-3 (15E-1)
C-1-4 (11E-1)	C-2-4 (11E-1)	C-3-4 (11E-1)	C-4-4 (11E-1)
C-1-5 (0-9A-4)	C-2-5 (0-9A-4)	C-3-5 (0-9A-4)	C-4-5 (0-9A-4)
C-1-6 (1M-1+ Corrosion Inhibitor)	C-2-6 (1M-1+ Corrosion Inhibitor)	C-3-6 (1M-1+ Corrosion Inhibitor)	C-4-6 (1M-1+ Corrosion Inhibitor)

TEST SYSTEM C - CONTROL SYSTEMS C-5 THRU C-8
OPEN SYSTEM - 300ml OIL

70°F (21°C) GLASS BOTTLES C-5	70°F (21°C) METAL CANS C-6	100°F (37.8°C) GLASS BOTTLES C-7	100°F (37.8°C) METAL CANS C-8
C-5-1 (1M-1)	C-6-1 (1M-1)	C-7-1 (1M-1)	C-8-1 (1M-1)
C-5-2 (1N-1)	C-6-2 (1N-1)	C-7-2 (1N-1)	C-8-2 (1N-1)
C-5-3 (15E-1)	C-6-3 (15E-1)	C-7-3 (15E-1)	C-8-3 (15E-1)
C-5-4 (11E-1)	C-6-4 (11E-1)	C-7-4 (11E-1)	C-8-4 (11E-1)
C-5-5 (0-9A-4)	C-6-5 (0-9A-4)	C-7-5 (0-9A-4)	C-8-5 (0-9A-4)
C-5-6 (1M-1+ Corrosion Inhibitor)	C-6-6 (1M-1+ Corrosion Inhibitor)	C-7-6 (1M-1+ Corrosion Inhibitor)	C-8-6 (1M-1+ Corrosion Inhibitor)

TABLE 1 (Cont.)

TURBINE LUBRICANT STABILITY TEST SYSTEMS

TEST SYSTEM D

CLOSED SYSTEM - FREE WATER - 16 OZ. BOTTLES
100ml H_2O 300ml OIL
1/2ml OF OP-172-1 INNOCULATE

70°F (21°C) D-1	100°F (37.8°C) D-2
D-1-1 (1M-1)	D-2-1 (1M-1)
D-1-2 (1N-1)	D-2-2 (1N-1)
D-1-3 (15E-1)	D-2-3 (15E-1)
D-1-4 (11E-1)	D-2-4 (11E-1)
D-1-5 (0-9A-4)	D-2-5 (0-9A-4)
D-1-6 (1M-1 + Corrosion Inhibitor)	D-2-6 (1M-1 + Corrosion Inhibitor)

TEST SYSTEM F

OPEN SYSTEM - 100% RELATIVE HUMIDITY - 150ml GLASS BEAKERS
100ml OIL
1/4ml OF OP-172-1 INNOCULATE

70°F (21°C) E-1	100°F (37.8°C) E-2
E-1-1 (1M-1)	E-2-1 (1M-1)
E-1-2 (1N-1)	E-2-2 (1N-1)
E-1-3 (15E-1)	E-2-3 (15E-1)
E-1-4 (11E-1)	E-2-4 (11E-1)
E-1-5 (0-9A-4)	E-2-5 (0-9A-4)
E-1-6 (1M-1 + Corrosion Inhibitor)	E-2-6 (1M-1 + Corrosion Inhibitor)

OPEN SYSTEM - FREE WATER - 16 OZ. BOTTLES
100ml H_2O 300ml OIL
1/2ml OF OP-172-1 INNOCULATE

100°F (37.8°C)
D-3

D-3-1 (1M-1)
D-3-2 (1N-1)
D-3-3 (15E-1)
D-3-4 (11E-1)
D-3-5 (0-9A-4)
D-3-6 (1M-1 + Corrosion Inhibitor)

CLOSED SYSTEM - 4 OZ. BOTTLES
100ml OIL
1/4ml OF OP-172-1 INNOCULATE

100°F (37.8°C)
E-3

E-3-1 (1M-1)
E-3-2 (1N-1)
E-3-3 (15E-1)
E-3-4 (11E-1)
E-3-5 (0-9A-4)
E-3-6 (1M-1 + Corrosion Inhibitor)

changes in the COBRA readings. New lubricants have COBRA values below 10 while highly degraded lubricants have values of 150 or above.

c. Visual Appearance and Odor

The visual appearance and odor of a lubricant can provide information relative to its condition. Visual appearance can give information relative to free water content, degradation and sedimentation, and microbiological activity. Odor characteristics can also indicate lubricant condition. Synthetic turbine lubricants having strong rancid odors usually exhibit high levels of degradation.

Terms used in describing the visual appearance of the lubricants are as follows:

Clear and Bright - The lubricant is transparent, has a bright appearance and no visible suspended sediment.

Transparent - Darkening of the lubricant but still capable of transmitting light so objects or images can be viewed through the lubricant.

Slightly Cloudy - Slight haze but not completely translucent.

Cloudy - Completely translucent.

Opague - Very dark in color. No light transmittance.

Sediment - Visible material that settles to the bottom of the sample or visible particles suspended in the sample.

Scum - A film layer of materials that forms on or rises to the surface of the sample or at the interface of the oil-free water samples.

Terms used in describing the odor of the lubricants are as follows:

Sweet - Normal new oil odor.

Semi-Sour - Slight offensive odor.

Sour - Strong offensive odor.

Rancid - Very disagreeable offensive odor. Containers containing this type of degraded lubricant cannot be left open in the laboratory due to its strong rancid odor.

d. Microscopic Examination for Microorganisms

Phase contrast microscopy was used for the microscopic examination of the various samples. Small quantities of the lubricant, scum or water were withdrawn from the storage containers by means of a disposable pipet and placed on microscope slides. Cover slides were used for all examinations which were made at 200X, 400X, and 800X magnification. No attempt was made to identify or classify the types of microorganisms observed.

SECTION III

TEST LUBRICANTS

Six lubricants were evaluated in the program with all being ester base lubricants. Table 2 presents a description of these unused lubricants.

TABLE 2

DESCRIPTION OF TEST LUBRICANTS

TEST OIL NUMBER	QUALIFICATION NUMBER	DESCRIPTION
1	1M-1	MIL-L-7808 J Lubricant
2	1N-1	MIL-J-7808 Lubricant
3	15E-1	MIL-L-7808 J Lubricant
4	11E-1	MIL-L-7808 J Lubricant
5	O-9A-4	MIL-L-2369 C Lubricant
6	1M-1 Plus Corrosion Inhibitor	MIL-L-7808 J Plus Barium Dinonylnaphthalene Sulfonate

Lubricant coded OP-172-1 was also used to innoculate the above lubricants for specific phases of this program. Prior analysis of this lubricant was as follows:

Total Acid Number:	24
Viscosity @100^{o}F	13.57 cs
Gas Chromatography:	MIL-L-7808, Qualification Number 1M-1 Chromatogram showed indications of oil degradation.
Phase Contrast Microscopy:	No dispersed silicone or suspended water. Large number of motile and non-motile microorganisms present.

SECTION IV

TEST RESULTS AND DISCUSSION

Evaluation of the test lubricants were made at various intervals during the storage program. Visual appearance and odor evaluations were made initially and at 1, 2, 3, 6, 11, and 16 month storage periods. COBRA readings were conducted on the same schedule as that for appearance and odor. Total acid number measurements were made initially and at 6 and 16 month storage periods. Microbiological evaluations were conducted only at the end of 11 months storage. The evaluation data is presented in Tables 3 through 56.

The effect of test conditions at 100°F was consistent for all the MIL-L-7808 lubricants and the MIL-L-23699 lubricant. The various test systems are listed below in order of decreasing severity.

1. Open glass beaker, 100% humidity innoculated with OP-172-1 (only slight more severe than 2 below).

2. Open glass beaker, 100% humidity (significantly more severe than 3 below).

3. Closed glass bottle, free water, innoculated with OP-172-1 (only slightly more severe than 4 below).

4. Closed glass bottle, free water (significantly more severe than 5 below).

5. Open glass bottle, free water innoculated with OP-172-1 (extremely more severe than 6 below).

6. Open metal container (6 through 10 exhibited only very slight differences).

7. Closed glass bottle, innoculated with OP-172-1.

8. Open glass bottle

9. Closed metal container.

10. Closed glass container.

The obtained storage stability data shows the two most significant variables effecting lubricant storage is temperature and water. At $70^{o}F$, all conditions of storage were satisfactory for 16 months of storage. At $100^{o}F$, all storage conditions involving free water or 100% relative humidity caused excessive lubricant degradation prior to six month storage except for MIL-L-7808 lubricant, Qualification Number 11E. This lubricant demonstrated superior hydrolytic stability but still was not satisfactory for 16 months storage under these conditions. Very little difference was found among the various storage conditions not involving free water or high relative humidity. Changes in total acid number values and COBRA values showed very similar trends for all test fluids.

The various storage conditions at $100^{o}F$ are listed below in order of decreasing severity for the MIL-L-7808 fluid containing the corrosion inhibitor.

1. Closed glass bottle, free water, innoculated with OP-172-1 (only slightly more severe than 2 below).

2. Closed glass bottle, free water (only slightly more severe than 3 below).

3. Open glass beaker 100% relative humidity, innoculated with OP-172-1 (only slightly more severe than 4 below).

4. Open glass beaker, 100% relative humidity (significantly more severe than 5 below).

5. Open glass bottle, free water, innoculated with OP-172-1 (extremely more severe than 6 below).

6. Open metal container (6 through 10 exhibited only very slight differences).

7. Closed metal container.

8. Closed glass bottle innoculated with OP-172-1.

9. Open glass bottle.

10. Closed glass bottle.

This specific fluid is very similar to the other MIL-L-7808 and MIL-L-23699 fluids in that temperature and the presence of free water or high humidity are the most significant variables effecting storage. The major storage stability difference in the fluid containing the corrosion inhibitor is the free water showing a greater effect than the 100% relative humidity. This was reversed for the MIL-L-7808 and MIL-L-23699 fluids.

The presence of microorganisms did not significantly effect storage stability. As would be expected, only those systems having free water or high humidity exhibited microbiological activity. No significant difference in microbiological activity was observed for testing conducted at $70^{o}F$ and $100^{o}F$. All fluids appeared similar in support of microbiological growth except the MIL-L-23699 lubricant. This specific formulation may possess some microbiological inhibitor characteristics. Although this fluid exhibited low hydrolytic stability and no microscopic examinations were made on storage tests conducted at $100^{o}F$, the microscopic examinations on all $70^{o}F$ storage samples of this lubricant showed no microbiological activity while all the other fluids showed some support for microbiological activity at this temperature.

All fluids formed a scum or emulsion at the oil-water interface for those systems containing free water. Formation of these scums or emulsions did not require microbiological activity for all lubricants investigated.

SECTION V

CONCLUSIONS AND RECOMMENDATIONS

This study has shown that the two parameters most effecting long-term storage of turbine lubricants in non-sealed systems are temperature and free water or high humidity. As the storage temperature increases, the rate of lubricant hydrolysis rapidly increases and is the major mechanism for lubricant degradation under these conditions. One MIL-L-7808 lubricant showed superior hydrolytic stability in comparison to the other test lubricants but not of sufficient degree to provide 16 months storage under high moisture conditions at a temperature of 100°F.

Microbiological activity did not significantly effect the rate of lubricant degradation. The presence of microbiological activity did, in some cases, contribute to the scum, sludge and emulsions forming at lubricant-water interfaces. This type of material has the capability of plugging small oil orifices or filters.

The corrosion inhibited fluid consisting of a MIL-L-7808 fluid plus barium dinonylnaphthalene sulfonate showed less storage stability than the other lubricants and did not display any microbiological inhibiting characteristics.

Future development of ester type lubricants for use under conditions of high humidity and long-term storage should include studies for improving the hydrolytic stability of current turbine engine lubricants.

REFERENCES

1. E. N. Cart, Jr., "Accelerated Storage Stability Tests," ASD-TR-61-144, Sept 1961.

TABLE 3

TOTAL ACID NUMBER DATA FOR TEST SYSTEM A-1

Storage Conditions - Closed Glass Bottles, Free Water, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	.61	.13
-2	MIL-L-7808	1N-1	.11	.25	.14
-3	MIL-L-7808	15E-1	.11	.21	.24
-4	MIL-L-7808	11E-1	.13	.05	.03
-5	MIL-L-23699	O-9A-4	.44	1.18	5.41
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	.50	.62

TABLE 4

TOTAL ACID NUMBER DATA FOR TEST SYSTEM A-2

Storage Conditions - Closed Glass Bottles, Free Water, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	5.48	98.78
-2	MIL-L-7808	1N-1	.11	.66	117.42
-3	MIL-L-7808	15E-1	.11	.23	29.36
-4	MIL-L-7808	11E-1	.13	.52	2.72
-5	MIL-L-23699	O-9A-4	.44	101.50	*
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	32.29	*

*Test terminated after six months due to extreme offensive odor.

TABLE 5

TOTAL ACID NUMBER DATA FOR TEST SYSTEM B-1

Storage Conditions - Open Glass Beakers, 100% Relative Humidity, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	.69	.22
-2	MIL-L-7808	1N-1	.11	.05	.24
-3	MIL-L-7808	15E-1	.11	.03	.04
-4	MIL-L-7808	11E-1	.13	.05	.18
-5	MIL-L-23699	O-9A-4	.44	2.57	22.89
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	.31	.42

TABLE 6

TOTAL ACID NUMBER DATA FOR TEST SYSTEM B-2

Storage Conditions - Open Glass Beakers, 100% Relative Humidity, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	69.26	*
-2	MIL-L-7808	1N-1	.11	34.31	*
-3	MIL-L-7808	15E-1	.11	4.52	116.77
-4	MIL-L-7808	11E-1	.13	3.76	46.34
-5	MIL-L-23699	O-9A-4	.44	145.47	*
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	30.18	*

*Test terminated after six months due to extreme offensive odor.

TABLE 5

TOTAL ACID NUMBER DATA FOR TEST SYSTEM B-1

Storage Conditions - Open Glass Beakers, 100% Relative Humidity, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	.69	.22
-2	MIL-L-7808	1N-1	.11	.05	.24
-3	MIL-L-7808	15E-1	.11	.03	.04
-4	MIL-L-7808	11E-1	.13	.05	.18
-5	MIL-L-23699	O-9A-4	.44	2.57	22.89
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	.31	.42

TABLE 6

TOTAL ACID NUMBER DATA FOR TEST SYSTEM B-2

Storage Conditions - Open Glass Beakers, 100% Relative Humidity, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	69.26	*
-2	MIL-L-7808	1N-1	.11	34.31	*
-3	MIL-L-7808	15E-1	.11	4.52	116.77
-4	MIL-L-7808	11E-1	.13	3.76	46.34
-5	MIL-L-23699	O-9A-4	.44	145.47	*
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	30.18	*

*Test terminated after six months due to extreme offensive odor.

TABLE 7

TOTAL ACID NUMBER DATA FOR CONTROL SYSTEM C-1

Storage Conditions - Closed Glass Bottles, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	.03	.11
-2	MIL-L-7808	1N-1	.11	.05	.12
-3	MIL-L-7808	15E-1	.11	0.00	0.00
-4	MIL-L-7808	11E-1	.13	.05	.13
-5	MIL-L-23699	0-9A-4	.44	.45	.54
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	.30	.35

TABLE 8

TOTAL ACID NUMBER DATA FOR CONTROL SYSTEM C-2

Storage Conditions - Closed Metal Cans, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	.51	.16
-2	MIL-L-7808	1N-1	.11	.05	.13
-3	MIL-L-7808	15E-1	.11	.22	.02
-4	MIL-L-7808	11E-1	.13	.14	.11
-5	MIL-L-23699	0-9A-4	.44	.87	2.55
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	.66	.32

TABLE 9

TOTAL ACID NUMBER DATA FOR CONTROL SYSTEM C-3

Storage Conditions - Closed Glass Bottles, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	.46	.25
-2	MIL-L-7808	1N-1	.11	.08	.14
-3	MIL-L-78C8	15E-1	.11	.03	.04
-4	MIL-L-7808	11E-1	.13	.16	.14
-5	MIL-L-23699	O-9A-4	.44	.52	.82
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	.92	.46

TABLE 10

TOTAL ACID NUMBER DATA FOR CONTROL SYSTEM C-4

Storage Conditons - Closed Metal Cans, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	.24	.52
-2	MIL-L-7808	1N-1	.11	.29	.21
-3	MIL-L-7808	15E-1	.11	.11	.18
-4	MIL-L-7808	11E-1	.13	.16	.13
-5	MIL-L-23699	O-9A-4	.44	2.00	3.83
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	.86	.60

TABLE 11

TOTAL ACID NUMBER DATA FOR CONTROL SYSTEM C-5

Storage Conditions- Open Glass Bottles, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	.37	.13
-2	MIL-L-7808	1N-1	.11	.08	.14
-3	MIL-L-7808	15E-1	.11	0.00	.02
-4	MIL-L-7808	11E-1	.13	.27	.08
-5	MIL-L-23699	O-9A-4	.44	.66	.85
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	.72	.33

TABLE 12

TOTAL ACID NUMBER DATA FOR CONTROL SYSTEM C-6

Storage Conditions - Open Metal Cans, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	.36	.14
-2	MIL-L-7808	1N-1	.11	.11	.13
-3	MIL-L-7808	15E-1	.11	.03	.02
-4	MIL-L-7808	11E-1	.13	.24	.09
-5	MIL-L-23699	O-9A-4	.44	1.52	2.76
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	.66	.22

TABLE 13

TOTAL ACID NUMBER DATA FOR CONTROL SYSTEM C-7

Storage Conditions - Open Glass Bottles, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	.19	.45
-2	MIL-L-7808	1N-1	.11	.11	.17
-3	MIL-L-7808	15E-1	.11	0.00	.14
-4	MIL-L-7808	11E-1	.13	.11	.16
-5	MIL-L-23699	0-9A-4	.44	2.15	15.22
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	.25	.34

TABLE 14

TOTAL ACID NUMBER DATA FOR CONTROL SYSTEM C-8

Storage Conditions - Open Metal Cans, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	.14	1.56
-2	MIL-L-7808	1N-1	.11	.05	.15
-3	MIL-L-7808	15E-1	.11	0.00	.01
-4	MIL-L-7808	11E-1	.13	.25	.16
-5	MIL-L-23699	0-9A-4	.44	4.81	14.67
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	.22	.60

TABLE 15

TOTAL ACID NUMBER FOR TEST SYSTEM D-1

Storage Conditions - Closed Glass Bottles, Free Water, 70°F (21°C), Innoculated with OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	.14	.35
-2	MIL-L-7808	1N-1	.11	0.00	.14
-3	MIL-L-7808	15E-1	.11	0.00	.23
-4	MIL-L-7808	11E-1	.13	0.00	.06
-5	MIL-L-23699	O-9A-4	.44	1.23	5.66
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	.25	.53

TABLE 16

TOTAL ACID NUMBER FOR TEST SYSTEM D-2

Storage Conditions - Closed Glass Bottles, Free Water, 100°F (37.8°C), Innoculated with OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	12.15	114.57
-2	MIL-L-7808	1N-1	.11	1.10	122.15
-3	MIL-L-7808	15E-1	.11	.43	55.44
-4	MIL-L-7808	11E-1	.13	.52	4.76
-5	MIL-L-23699	O-9A-4	.44	154.16	*
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	44.58	*

*Test terminated after six months due to extreme offensive odor.

TABLE 17

TOTAL ACID NUMBER DATA FOR TEST SYSTEM D-3

Storage Conditions - Open Glass Bottles, Free Water, 100°F (37.8°C) Innoculated with OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	2.27	29.28
-2	MIL-L-7808	1N-1	.11	.41	28.89
-3	MIL-L-7808	15E-1	.11	.14	1.07
-4	MIL-L-7808	11E-1	.13	.11	1.11
-5	MIL-L-23699	O-9A-4	.44	123.07	*
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	3.81	37.87

*Test terminated after six months due to extreme offensive odor.

TABLE 18

TOTAL ACID NUMBER DATA FOR TEST SYSTEM E-1

Storage Conditions - Open Glass Beakers, 100% Relative Humidity, 70°F (21°C), Innoculated With OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	.11	.25
-2	MIL-L-7808	1N-1	.11	.11	.30
-3	MIL-L-7808	15E-1	.11	.08	.14
-4	MIL-L-7808	11E-1	.13	.17	.28
-5	MIL-L-23699	O-9A-4	.44	3.32	24.40
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	.30	.48

TABLE 19

TOTAL ACID NUMBER DATA FOR TEST SYSTEM E-2

Storage Conditions - Open Glass Beakers, 100% Relative Humidity
100°F (37.8°C), Innoculated With OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	76.88	*
-2	MIL-L-7808	1N-1	.11	54.70	*
-3	MIL-L-7808	15E-1	.11	8.33	116.46
-4	MIL-L-7808	11E-1	.13	5.26	55.93
-5	MIL-L-23699	O-9A-4	.44	147.82	*
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	30.24	*

*Test terminated after six months due to extreme offensive odor.

TABLE 20

TOTAL ACID NUMBER DATA FOR TEST SYSTEM E-3

Storage Conditions - Closed Glass Bottles, No Free Water, 100°F (37.8°C), Innoculated With OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	6 MONTHS	END OF TEST 16 MONTHS
-1	MIL-L-7808	1M-1	.08	.17	.37
-2	MIL-L-7808	1N-1	.11	.11	.31
-3	MIL-L-7808	15E-1	.11	0.00	.20
-4	MIL-L-7808	11E-1	.13	.14	.34
-5	MIL-L-23699	O-9A-4	.44	.52	.99
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	.33	.31	.51

TABLE 21

COBRA DATA FOR TEST SYSTEM A-1

Storage Conditions - Closed Glass Bottles, Free Water, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	4	7	6	5	7	6
-2	MIL-L-7808	1N-1	4	4	5	5	5	4	5
-3	MIL-L-7808	15E-1	4	4	6	5	5	4	4
-4	MIL-L-7808	11E-1	4	5	5	5	4	4	4
-5	MIL-L-23699	0-9A-4	4	5	5	5	5	4	4
-6	MIL-C-8188	1M-1 plus corrosion inhibitor	11	20	24	24	19	40	39

TABLE 22

COBRA DATA FOR TEST SYSTEM A-2

Storage Conditions - Closed Glass Bottles, Free Water, 100°F (378°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	4	6	5	8	200+	200+
-2	MIL-L-7808	1N-1	4	4	4	6	5	200+	200+
-3	MIL-L-7808	15E-1	4	5	4	4	4	59	200+
-4	MIL-L-7808	11E-1	4	4	5	4	4	4	4
-5	MIL-L-23699	0-9A-4	4	6	27	200+	200+	*	*
-6	MIL-C-8188	1M-1 plus corrosion inhibitor	11	15	31	39	193	*	*

*Test terminated after six months due to extreme offensive odor.

TABLE 23

COBRA DATA FOR TEST SYSTEM B-1

Storage Conditions - Open Glass Beakers, 100% Relative Humidity, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	4	5	5	5	5	5
-2	MIL-L-7808	1N-1	4	4	5	5	5	5	5
-3	MIL-L-7808	15E-1	4	4	5	5	5	4	5
-4	MIL-L-7808	11E-1	4	4	6	5	5	4	5
-5	MIL-L-23699	0-9A-4	4	5	6	5	5	200+	200+
-6	MIL-C-8188	1M-1 plus corrosion inhibitor	11	21	25	24	16	16	22

TABLE 24

COBRA DATA FOR TEST SYSTEM B-2

Storage Conditions - Open Glass Beakers, 100% Relative Humidity, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	4	4	9	200+	*	*
-2	MIL-L-7808	1N-1	4	4	5	5	154	*	*
-3	MIL-L-7808	15E-1	4	6	4	5	5	200+	200+
-4	MIL-L-7808	11E-1	4	4	4	4	5	60	71
-5	MIL-L-23699	0-9A-4	4	10	173	200+	200+	*	*
-6	MIL-C-8188	1M-1 plus corrosion inhibitor	11	23	25	24	179	*	*

*Test terminated after six months due to extreme offensive odor.

TABLE 25

COBRA DATA FOR CONTROL SYSTEM C-1

Storage Conditions - Closed Glass Bottles, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	4	5	5	5	4	4
-2	MIL-L-7808	1N-1	4	4	5	5	5	4	4
-3	MIL-L-7808	15E-1	4	4	5	5	4	4	4
-4	MIL-L-7808	11E-1	4	14	5	4	4	4	4
-5	MIL-L-23699	O-9A-4	4	4	5	5	4	4	4
-6	MIL-C-8188	1M-1 plus corro-sion inhibi-tor	11	15	18	16	15	15	15

TABLE 26

COBRA DATA FOR CONTROL SYSTEM C-2

Storage Conditions - Closed Metal Cans, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	4	5	6	6	4	4
-2	MIL-L-7808	1N-1	4	4	5	5	4	4	4
-3	MIL-L-7808	15E-1	4	4	5	5	5	4	4
-4	MIL-L-7808	11E-1	4	4	5	4	5	4	4
-5	MIL-L-23699	O-9A-4	4	4	5	5	4	4	4
-6	MIL-C-8188	1M-1 plus corro-sion inhibi-tor	11	15	16	16	16	16	16

TABLE 27

COBRA DATA FOR CONTROL SYSTEM C-3

Storage Conditions - Closed Glass Bottles, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M1	4	4	5	5	4	5	4
-2	MIL-L-7808	1NL	4	4	4	5	4	4	4
-3	MIL-L-7808	15E-1	4	4	4	4	4	4	4
-4	MIL-L-7808	11E-1	4	4	4	4	4	4	4
-5	MIL-L-23699	0-9A-4	4	4	4	4	4	4	4
-6	MIL-C-8188	1M-1 plus corrosion inhibitor	11	12	16	16	14	13	16

TABLE 28

COBRA DATA FOR CONTROL SYSTEM C-4

Storage Conditions - Closed Metal Cans, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	4	5	5	4	4	4
-2	MIL-L-7808	1N-1	4	4	5	6	5	8	6
-3	MIL-L-7808	15E-1	4	4	4	4	4	4	4
-4	MIL-L-7808	11E-1	4	4	4	4	4	4	4
-5	MIL-L-23699	0-9A-4	4	4	4	5	4	7	9
-6	MIL-C-8188	1M-1 plus corrosion inhibitor	11	12	15	16	15	13	16

TABLE 29

COBRA DATA FOR CONTROL SYSTEM C-5

Storage Conditions - Open Glass Bottles, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	4	5	6	5	4	4
-2	MIL-L-7808	1N-1	4	4	5	5	4	4	4
-3	MIL-L-7808	15E-1	4	4	5	5	4	4	4
-4	MIL-L-7808	11E-1	4	4	5	5	5	4	4
-5	MIL-L-23699	0-9A-4	4	4	5	5	4	4	4
-6	MIL-C-8188	1M-1 plus corrosion inhibitor	11	15	18	15	16	14	15

TABLE 30

COBRA DATA FOR CONTROL SYSTEM C-6

Storage Conditions - Open Metal Cans, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	4	6	6	6	5	5
-2	MIL-L-7808	1N-1	4	4	5	5	4	4	4
-3	MIL-L-7808	15E-1	4	4	5	5	5	4	4
-4	MIL-L-7808	11E-1	4	4	5	5	5	4	4
-5	MIL-L-23699	0-9A-4	4	4	5	5	5	7	7
-6	MIL-C-8188	1M-1 plus corrosion inhibitor	11	14	17	16	15	16	16

TABLE 31

COBRA DATA FOR CONTROL SYSTEM C-7

Storage Conditions - Open Glass Bottles, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	4	5	5	4	4	4
-2	MIL-L-7808	1N-1	4	4	5	5	4	4	4
-3	MIL-L-7808	15E-1	4	4	4	4	4	4	4
-4	MIL-L-7808	11E-1	4	4	4	4	4	4	4
-5	MIL-L-23699	O-9A-4	4	4	4	4	5	24	28
-6	MIL-C-8188	1M-1 plus corrosion inhibitors	11	12	14	16	13	12	15

TABLE 32

COBRA DATA FOR CONTROL SYSTEM C-8

Storage Conditions - Open Metal Cans, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	4	5	5	4	4	6
-2	MIL-L-7808	1N-1	4	4	5	5	5	4	4
-3	MIL-L-7808	15E-1	4	4	4	5	5	4	14
-4	MIL-L-7808	11E-1	4	4	4	4	4	4	4
-5	MIL-L-23699	O-9A-4	4	4	4	5	8	31	39
-6	MIL-C-8188	1M-1 plus corrosion inhibitor	11	11	15	16	19	12	15

TABLE 33

COBRA DATA FOR TEST SYSTEM D-1

Storage Conditions - Closed Glass Bottles,
Free Water, 70°F (21°C) Innoculated with OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	4	6	5	5	4	4
-2	MIL-L-7808	1N-1	4	4	6	5	5	4	4
-3	MIL-L-7808	15E-1	4	5	6	5	5	4	4
-4	MIL-L-7808	11E-1	4	5	5	5	5	4	4
-5	MIL-L-23699	O-9A-4	4	5	7	6	5	37	42
-6	MIL-C-8188	1M-1 plus corro-sion inhibi-tor	11	25	24	24	19	25	26

TABLE 34

COBRA DATA FOR TEST SYSTEM D-2

Storage Conditions - Closed Glass Bottles,
Free Water, 100°F (37.8°C) Innoculated with OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	5	5	5	11	200+	200+
-2	MIL-L-7808	1N-1	4	4	4	5	6	200+	200+
-3	MIL-L-7808	15E-1	4	5	4	4	4	200+	200+
-4	MIL-L-7808	11E-1	4	4	4	4	4	4	200+
-5	MIL-L-23699	O-9A-4	4	7	42	200+	200+	*	*
-6	MIL-C-8188	1M-1 plus corro-sion inhibi-tor	11	20	23	39	200+	*	*

*Test terminated after six months due to extreme offensive odor.

TABLE 35

COBRA DATA FOR TEST SYSTEM D-3

Storage Conditions - Open Glass Bottles, Free Water, 100°F (37.8°C) Innoculated with OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	5	5	6	5	96	82
-2	MIL-L-7808	1N-1	4	4	4	4	4	82	95
-3	MIL-L-7808	15E-1	4	4	4	5	4	4	5
-4	MIL-L-7808	11E-1	4	4	4	4	4	4	5
-5	MIL-L-23699	O-9A-4	4	5	9	54	200 +	*	*
-6	MIL-C-8188	1M-1 plus corrosion inhibitor	11	13	16	17	33	200 +	200 +

TABLE 36

COBRA DATA FOR TEST SYSTEM E-1

Storage Conditions - Open Glass Beakers, 100% Relative Humidity, 70°F (21°C) Innoculated with OP-172-

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	5	5	5	5	4	4
-2	MIL-L-7808	1N-1	4	4	5	5	5	4	4
-3	MIL-L-7808	15E-1	4	5	6	5	5	4	4
-4	MIL-L-7808	11E-1	4	5	6	6	5	4	4
-5	MIL-L-23699	O-9A-4	4	6	6	6	6	200 +	200 +
-6	MIL-C-8188	1M-1 plus corrosion inhibitor	11	23	27	24	16	18	21

*Test terminated after six months due to extreme offensive odor.

TABLE 37

COBRA DATA FOR TEST SYSTEM E-2

Storage Conditions - Open Glass Beakers, 100% Relative Humidity
100°F (37.8°C) Innoculated with OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	4	6	14	200 +	*	*
-2	MIL-L-7808	1N-1	4	4	5	6	200 +	*	*
-3	MIL-L-7808	15E-1	4	5	5	5	8	200 +	200 +
-4	MIL-L-7808	11E-1	4	4	5	4	5	37	40
-5	MIL-L-23699	0-9A-4	4	13	193	200 +	200 +	*	*
-6	MIL-C-8188	1M-1 plus corro-sion inhibi-tor	11	23	23	29	161	*	*

*Test terminated after six months due to extreme offensive odor.

TABLE 38

COBRA DATA FOR TEST SYSTEM E-3

Storage Conditions - Closed Glass Bottles, No Free Water, 100°F (37.8°C) Innoculated with OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	4	4	4	5	4	4	4
-2	MIL-L-7808	1N-1	4	4	5	5	4	4	4
-3	MIL-L-7808	15E-1	4	4	4	5	4	4	4
-4	MIL-L-7808	11E-1	4	4	4	4	4	4	4
-5	MIL-L-23699	0-9A-4	4	4	4	4	5	4	4
-6	MIL-C-8188	1M-1 plus corro-sion inhibi-tor	11	13	15	15	16	12	18

TABLE 39

VISUAL APPEARANCE AND ODOR DATA FOR TEST SYSTEM A-1

STORAGE CONDITIONS - CLOSED GLASS BOTTLES, FREE WATER, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright Sweet Odor	Cloudy Cottony. Material in Water Layer. Sweet	Cloudy Cottony. Material in Water Layer. Sweet	Cloudy Cottony. Material in Water Layer. Sweet	Cloudy Cottony. Scum at Oil/Water Interface Sweet	Cloudy, Cottony. Scum at Oil/Water Interface. Sweet *Several Types of Live Motile Microorganisms. Bacterial or Fungal Filaments present also.	Cloudy, Cottony. Scum at Oil/Water Interface. Sweet
-2	MIL-L-7808	1N-1	Clear & Bright Sweet Odor	Cloudy Small Amt of Scum at Oil/Water Interface. Sweet	Cloudy Small Amt of Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Sweet *No live motile microorganisms noticed but microbiological debris present.	Cloudy Scum at Oil/Water Interface. Sweet
-3	MIL-L-7808	15E-1	Clear & Bright Sweet Odor	Cloudy Scum at Oil/Water Interface. Sediment on Bottom Sweet	Cloudy Scum at Oil/Water Interface. Sediment on Bottom Sweet	Cloudy Scum at Oil/Water Interface. Sediment on Bottom Sweet	Cloudy Scum at Oil/Water Interface. Sediment on Bottom Sweet	Cloudy Scum at Oil/Water Interface. Sweet *No microrganisms noticed.	Cloudy Scum at Oil/Water Interface. Sweet
-4	MIL-L-7808	11E-1	Clear & Bright Sweet Odor	Cloudy Scum at Oil/Water Interface Sweet	Cloudy Scum at Oil/Water Interface Sweet	Cloudy Scum at Oil/Water Interface Sweet	Cloudy Scum at Oil/Water Interface Sweet	Cloudy Scum at Oil/Water Interface. Sweet *Several types of live motile microorganisms. Bacterial or fungal filaments present also.	Cloudy Scum at Oil/Water Interface. Sweet
-5	MIL-L-23699	O-9A-4	Clear & Bright Sweet Odor	Cloudy Dark Spots at Oil/Water Interface. Sweet	Cloudy Dark Spots at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Inface. Sweet	Cloudy Scum at Oil/Water Inface. Sweet	Very Cloudy. Scum at Interface. Semi-Sweet *No microorganisms noticed.	Very Cloudy. Scum at Interface. Semi-Sweet
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	Clear & Bright Sweet Odor	Slightly Cloudy Scum at Oil/Water Interface Approximately 20 Black Fuzzy Colonies of Microbes Present. Sweet	Slightly Cloudy Scum Oil/Water Interface Black Colonies of Microbes Present. Sweet	Slightly Cloudy Scum at Oil/Water Interface Microbe Colonies on Bottom and at Interface. Sweet	Slightly Cloudy Scum at Oil/Water Interface Microbe Colonies Becoming Very Large and Fuzzy. Sweet	Slightly Cloudy. Scum at Interface Microbe Colonies. Sweet *Several motile types of microorganisms and filaments of fungi or bacteria present	Slightly Cloudy. Scum at Interface Microbe Colonies. Sweet

* MICROSCOPIC EXAM DATA (11 MONTHS).

TABLE 40

VISUAL APPEARANCE AND ODOR DATA FOR TEST SYSTEM A-2

STORAGE CONDITIONS - CLOSED GLASS BOTTLES, FREE WATER, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright Sweet Odor	Cloudy Sweet	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy White Scum at Oil/Water Interface. Sweet	Cloudy Sweet	Cloudy, Oil Very Dark. Semi-Sour *Possible fungal or bacterial strands present. Also other microbiological debris. No motile microorganisms present.	Cloudy, Oil Very Dark. Semi-Sour
-2	MIL-L-7808	1N-1	Clear & Bright Sweet Odor	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Sediment Dispersed in Oil Sweet	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Semi-Sour	Opaque, Oil Very Dark Scum in Water Layer. Rancid *Large amount of possible microbiological debris present. No motile microorganisms present.	Opaque, Oil Very Dark Scum in Water Layer. Rancid
-3	MIL-L-7808	15E-1	Clear & Bright Sweet Odor	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Semi-Sour	Slightly Cloudy Scum at Oil/Water Interface. Semi-Sour *No live motile microorganisms but microbiological debris present.	Slightly Cloudy Scum at Oil/Water Interface. Semi-Sour
-4	MIL-L-7808	11E-1	Clear & Bright Sweet Odor	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy. Scum at Oil/Water Interface. Sweet *No microorganisms noticed. Scum seems to be emulsion. Thousands of bubbles visible under scope.	Cloudy. Scum at Oil/Water Interface. Sweet
-5	MIL-L-23699	0-9A-4	Clear & Bright. Sweet Odor	Slightly Hazy. Scum at Oil/Water Interface, Fuzzy Material in Oil. Semi-Sour	Cloudy No Scum at Oil/Water Interface. Sour	Cloudy Very Dark. No Scum at Oil/Water Interface. Rancid	Cloudy Very Dark. No Scum at Oil/Water Interface. Rancid	** *	** **
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	Clear & Bright Sweet Odor	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. White Sediment in Water Layer Sweet	Cloudy Scum at Oil/Water Interface. White Sediment in Water Layer Semi-Sour	Cloudy Scum at Oil/Water Interface. White Sediment in Water Layer Rancid	** *	** **

** TEST TERMINATED AFTER SIX MONTHS DUE TO EXTREME OFFENSIVE ODOR.

* MICROSCOPIC EXAM DATA (11 MONTHS).

TABLE 41

VISUAL APPEARANCE AND ODOR DATA FOR TEST SYSTEM B-1
STORAGE CONDITIONS - OPEN GLASS BEAKERS, 100% RELATIVE HUMIDITY, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright Sweet Odor	Slightly Cloudy Sediment on Bottom Sweet	Slightly Cloudy Sediment on Bottom Sweet	Cloudy Sediment on Bottom Sweet	Slightly Cloudy Sediment on Bottom Sweet	Cloudy, Sediment and Scum on Bottom. Sweet *Few motile microorganisms present. Possible fungi or bacterial strands present.	Slightly Cloudy Sediment and Scum on Bottom. Sweet
-2	MIL-L-7808	1N-1	Clear & Bright Sweet Odor	Slightly Cloudy Sweet	Slightly Cloudy Sediment on Bottom Sweet	Slightly Cloudy Sediment on Bottom Sweet	Slightly Cloudy Sediment on Bottom Sweet	Clear & Bright Sediment on Bottom. Sweet *No live motile microorganisms but possible microbiological debris present.	Clear and Bright Sediment on Bottom. Sweet
-3	MIL-L-7808	15E-1	Clear & Bright Sweet Odor	Cloudy Sediment on Bottom Sweet	Cloudy Sediment on Bottom Sweet	Cloudy Sediment on Bottom Sweet	Slightly Sediment on Bottom Sweet	Slightly Cloudy Sediment/Water Droplets/Microbial Colonies on Bottom Sweet *Live microorganisms and microbiological debris present. Visible black colonies of bacteria or fungi on bottom of beaker.	Slightly Cloudy Sediment/Water Droplets/Microbial Colonies on Bottom Sweet
-4	MIL-L-7808	11E-1	Clear & Bright Sweet Odor	Slightly Cloudy Sediment Scum and Water on Bottom. Sweet	Cloudy Sediment, Scum and Water Droplets on Bottom Sweet	Cloudy Sediment, and Water Droplets on Bottom Sweet	Cloudy Sediment, and Water Droplets on Bottom Sweet	Cloudy, Sediment Scum and Water Droplets on Bottom Sweet *No live motile microorganisms. Presence of other microbes evident.	Slightly Cloudy Scum and Sediment on Bottom. Sweet
-5	MIL-L-23699	O-9A-4	Clear & Bright Sweet Odor	Clear & Bright Semi-Sour	Slightly Cloudy Semi-Sour	Slightly Cloudy Semi-Sour	Slightly Cloudy Sour	Clear & Bright Sour *No Microorganisms noticed.	Clear & Bright Scum on Bottom. Sour
-6	MIL-C-8188	1M-1 plus Corrosion inhibitor	Clear & Bright Sweet Odor	Slightly Cloudy Sediment on Bottom Sweet	Slightly Cloudy Sediment on Bottom Sweet	Slightly Cloudy Sediment on Bottom Sweet	Slightly Cloudy Sediment on Bottom Sweet	Slightly Cloudy Sediment on Bottom. Sweet *Large amounts of clumped material and several types of motile microorganisms present.	Clear and Bright Sediment and Water Droplets on Bottom. Sweet

*MICROSCOPIC EXAM DATA (11 MONTHS).

TABLE 42

VISUAL APPEARANCE AND ODOR DATA FOR TEST SYSTEM B-2

STORAGE CONDITIONS - OPEN GLASS BEAKERS, 100% RELATIVE HUMIDITY, 100°F (37.8°)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright	Slightly Cloudy Water Droplets on Bottom.	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Very Dark In Color. Sediment on Bottom.	**	**
								*	
			Sweet Odor	Sweet	Semi-Sour	Semi-Sour	Rancid	**	
-2	MIL-L-7808	1N-1	Clear & Bright	Cloudy	Cloudy Sediment and Water on Bottom.	Cloudy Sediment and Water on Bottom.	Slightly Cloudy Oil is Light Green In Color	**	**
								*	
			Sweet Odor	Sweet	Sweet	Semi-Sour	Rancid	**	
-3	MIL-L-7808	15E-1	Clear & Bright	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment, Scum and Water on Bottom.	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediemnt on Bottom.	Slightly Cloudy Dark in Color Sediment. Rancid	Slightly Cloudy Dark in Color Sediment. Rancid
			Sweet Odor	Semi-Sour	Semi-Sour	Semi-Sour	Rancid	*No microorganisms noticed.	
-4	MIL-L-7808	11E-1	Clear & Bright	Cloudy	Cloudy Sediment	Cloudy Sediment	Cloudy at Bottom.	Slightly Cloudy Rancid	Slightly Cloudy Rancid
			Sweet Odor	Sweet	Sweet	Semi-Sour	Sour	*No microorganisms noticed.	
-5	MIL-L-23699	O-9A-4	Clear & Bright	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment and Water on Bottom.	Slightly Cloudy Oil Dark In Color Sediment.	Cloudy Oil Dark In Color Sediment Patches Of Crystalized Material Floating On Top Of Oil.	**	**
								*	
			Sweet Odor	Semi-Sour	Sour	Rancid	Rancid	**	
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	Clear & Bright	Cloudy Sediment and Water Droplets On Bottom.	Cloudy Sediment and Water Droplets On Bottom.	Slightly Cloudy Sediment and Water Droplets On Bottom.	Cloudy Oil Dark In Color. Sediment and Water Droplets on Bottom.	**	**
								*	
			Sweet Odor	Sweet	Semi-Sour	Sour	Rancid	**	

** TEST TERMINATED AFTER SIX MONTHS DUE TO EXTREME OFFENSIVE ODOR.

* MICROSCOPIC EXAM DATA (11 MONTHS).

TABLE 43

VISUAL APPEARANCE AND ODOR DATA FOR CONTROL SYSTEM C-1

STORAGE CONDITIONS - CLOSED GLASS BOTTLES, 70°F (21° C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-2	MIL-L-7808	1N-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-3	MIL-L-7808	15E-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-4	MIL-L-7808	11E-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-5	MIL-L-23699	O-9A-4	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Semi-Sour	Clear & Bright Semi-Sour
			Sweet Odor	Semi-Sour	Semi-Sour	Semi-Sour	Semi-Sour	*No microorganisms noticed.	
-6	MIL-C-8188	1M-1 plus Corrosion inhibitor	Clear & Bright	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Clear & Bright Sediment on Bottom. Sweet	Clear & Bright Sediment on Bottom. Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	

* MICROSCOPIC EXAM DATA (1 MONTHS).

TABLE 44

VISUAL APPEARANCE AND ODOR DATA FOR CONTROL SYSTEM C-2

STORAGE CONDITIONS - CLOSED METAL CANS, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-2	MIL-L-7808	1N-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-3	MIL-L-7808	15E-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-4	MIL-L-7808	11E-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-5	MIL-L-23699	O-9A-4	Clear & Bright	Clear & Bright	Slightly Cloudy	Clear & Bright	Clear & Bright	Clear & Bright Semi-Sour	Clear & Bright Semi-Sour
			Sweet Odor	Semi-Sour	Semi-Sour	Semi-Sour	Semi-Sour	*No microorganisms noticed.	
-6	MIL-C-8188	1M-1 plus Corrosion inhibitor	Clear & Bright	Clear & Bright Sediment	Clear & Bright Sediment	Clear & Bright Sediment	Clear & Bright Sediment	Clear & Bright Sediment on Bottom. Sweet	Clear & Bright Sediment on Bottom. Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	

* MICROSCOPIC EXAM DATA (11 MONTHS).

TABLE 45

VISUAL APPEARANCE AND ODOR DATA FOR CONTROL SYSTEM C-3

STORAGE CONDITIONS - CLOSED GLASS BOTTLES, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-2	MIL-L-7808	1N-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-3	MIL-L-7808	15E-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-4	MIL-L-7808	11E-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-5	MIL-L-23699	O-9A-4	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Semi-Sour	Clear & Bright Semi-Sour
			Sweet Odor	Semi-Sour	Semi-Sour	Semi-Sour	Semi-Sour	*No microorganisms noticed.	
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	Clear & Bright	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Clear & Bright Sediment on Bottom. Semi-Sour	Clear & Bright Sediment on Bottom. Semi-Sour
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	

* MICROSCOPIC EXAM DATA (11 MONTHS).

TABLE 46

VISUAL APPEARANCE AND ODOR DATA FOR CONTROL SYSTEM C-4

STORAGE CONDITIONS - CLOSED METAL CANS, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-2	MIL-L-7808	1N-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-3	MIL-L-7808	15E-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-4	MIL-L-7808	11E-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-5	MIL-L-23699	O-9A-4	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Semi-Sour	Clear & Bright Semi-Sour
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	Clear & Bright	Clear & Bright Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Clear & Bright Sediment on Bottom. Semi-Sour	Clear & Bright Sediment on Bottom. Semi-Sour
			Sweet Odor	Sweet	Sweet	Sweet	Semi-Sour	*No microorganisms noticed.	

* MICROSCOPIC EXAM DATA (11 MONTHS).

TABLE 47

VISUAL APPEARANCE AND ODOR DATA FOR CONTROL SYSTEM C-5

STORAGE CONDITIONS - OPEN GLASS BOTTLES, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet
								*No microorganisms noticed.	
-2	MIL-L-7808	1N-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet
								*No microorganisms noticed.	
-3	MIL-L-7808	15E-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet
								*No microorganisms noticed.	
-4	MIL-L-7808	11E-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet
								*No microorganisms noticed.	
-5	MIL-L-23699	O-9A-4	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright
			Sweet Odor	Semi-Sour	Semi-Sour	Semi-Sour	Semi-Sour	Semi-Sour	Semi-Sour
								*No microorganisms noticed.	
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sediment on Bottom. Sweet	Clear & Bright Sediment on Bottom. Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	

* MICROSCOPIC EXAM (11 MONTHS).

TABLE 48
VISUAL APPEARANCE AND ODOR DATA FOR CONTROL SYSTEM C-6

Storage Conditions - Open Metal Cans, 70°F (21°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
1	MIL-L-7808	1M-1	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet * No Microorganisms Noticed	Clear & Bright Sweet
2	MIL-L-7808	1N-1	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet * No Microorganisms Noticed	Clear & Bright Sweet
3	MIL-L-7808	15E-1	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet * No Microorganisms Noticed	Clear & Bright Sweet
4	MIL-L-7808	11E-1	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet * No Microorganisms Noticed	Clear & Bright Sweet
5	MIL-L-23699	O-9A-4	Clear & Bright Sweet Odor	Clear & Bright Semi-sour Odor	Clear & Bright Semi-sour Odor	Clear & Bright Semi-sour Odor	Clear & Bright Semi-sour Odor	Clear & Bright Semi-sour * No Microorganisms Noticed	Clear & Bright Semi-sour
6	MIL-C-8188	1M-1 plus corrosion inhibitor	Clear & Bright Sweet Odor	Slightly Cloudy Sediment on Bottom Sweet Odor	Slightly Cloudy Sediment on Bottom Sweet Odor	Slightly Cloudy Sediment on Bottom Sweet Odor	Slightly Cloudy Sediment on Bottom Sweet Odor	Clear & Bright Sediment on Bottom Sweet * No Microorganisms Noticed	Clear & Bright Sediment on Bottom Sweet

*Microscopic Exam Data (11 Months)

TABLE 49

VISUAL APPEARANCE AND ODOR DATA FOR CONTROL SYSTEM C-7

STORAGE CONDITIONS - OPEN GLASS BOTTLES, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright Sweet Odor	Clear & Bright Sweet	Clear & Bright Sweet	Clear & Bright Sweet	Clear & Bright Sweet	Clear & Bright Sweet *No microorganisms noticed.	Clear & Bright Sweet
-2	MIL-L-7808	1N-1	Clear & Bright Sweet Odor	Clear & Bright Sweet	Clear & Bright Sweet	Clear & Bright Sweet	Clear & Bright Sweet	Clear & Bright Sweet *No microorganisms noticed.	Clear & Bright Sweet
-3	MIL-L-7808	15E-1	Clear & Bright Sweet Odor	Clear & Bright Sweet	Clear & Bright Sweet	Clear & Bright Sweet	Clear & Bright Sweet	Clear & Bright Sweet *No microorganisms noticed.	Clear & Bright Sweet
-4	MIL-L-7808	11E-1	Clear & Bright Sweet Odor	Clear & Bright Sweet	Clear & Bright Sweet	Clear & Bright Sweet	Clear & Bright Sweet	Clear & Bright Sweet *No microorganisms noticed.	Clear & Bright Sweet
-5	MIL-L-23699	O-9A-4	Clear & Bright Sweet Odor	Clear & Bright Semi-Sour	Clear & Bright Semi-Sour	Clear & Bright Semi-Sour	Clear & Bright Semi-Sour	Clear & Bright Semi-Sour *No microorganisms noticed.	Clear & Bright Semi-Sour
-6	MIL-C-6188	1M-1 plus Corrosion Inhibitor	Clear & Bright Sweet Odor	Slightly Cloudy Sediment on Bottom. Sweet	Slightly Cloudy Sediment on Bottom. Sweet	Slightly Cloudy Sediment on Bottom. Semi-Sour	Slightly Cloudy Sediment on Bottom. Semi-Sour	Slightly Cloudy Sediment on Bottom. Semi-Sour *No microorganisms noticed.	Slightly Cloudy Sediment on Bottom. Semi-Sour

* MICROSCOPIC EXAM DATA (11 MONTHS).

TABLE 50

VISUAL APPEARANCE AND ODOR DATA FOR CONTROL SYSTEM C-8

STORAGE CONDITIONS - OPEN METAL CANS, 100°F (37.8°C)

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	Sweet *No microorganisms noticed.	Sweet
-2	MIL-L-7808	1N-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	Sweet *No microorganisms noticed.	Sweet
-3	MIL-L-7808	15E-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	Sweet *No microorganisms noticed.	Sweet
-4	MIL-L-7808	11E-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	Sweet *No microorganisms needed.	Sweet
-5	MIL-L-23699	O-9A-4	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright
			Sweet Odor	Semi-Sour	Semi-Sour	Semi-Sour	Semi-Sour	Semi-Sour *No microorganisms noticed.	Semi-Sour
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	Clear & Bright	Clear & Bright Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Clear & Bright Sediment on Bottom.	Clear & Bright Sediment on Bottom. Semi-Sour	Clear & Bright Sediment on Bottom. Semi-Sour
			Sweet Odor	Sweet	Sweet	Semi-Sour	Semi-Sour	*No microorganisms noticed.	

* MICROSCOPIC EXAM DATA (11 MONTHS).

TABLE 31

VISUAL APPEARANCE AND ODOR DATA FOR TEST SYSTEM D-1

STORAGE CONDITIONS - CLOSED GLASS BOTTLES, FREE WATER, 70°F (21°C), INNOCULATED WITH OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright Sweet Odor	Cloudy Cottony Material in Water Layer. Sweet	Cloudy Cottony Material and Small Dark Colonies of Microorganisms present in Water Layer. Sweet	Cloudy Cottony Material and Dark Colonies of Microorganisms present in Water Layer. Sweet	Cloudy Cottony Material and Dark Colonies of Microorganisms present in Water Layer. Sweet	Cloudy. Cottony Material and Microorganism Colonies. Sweet *Several types of live flagellated organisms present. Dense strands of fungalor bacterial material present also.	Cloudy. Cottony Material and Microorganism Colonies. Sweet
-2	MIL-L-7808	1N-1	Clear & Bright Sweet Odor	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy. Scum at Oil/Water Interface Sweet *No live microorganisms noticed. Possible cellular debris present.	Cloudy. Scum at Oil/Water Interface Sweet
-3	MIL-L-7808	15E-1	Clear & Bright Sweet Odor	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Slight Amount of Sediment. Sweet	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy. Scum at Oil/Water Interface. Sweet *Microorganisms present in scum layer.	Cloudy. Scum at Oil/Water Interface. Sweet
-4	MIL-L-7808	11E-1	Clear & Bright Sweet Odor	Cloudy Scum at Oil/Water Interface. Sweet	Cloudy Scum at Oil/Water Interface. Cottony Material in Water Layer. Sweet	Cloudy Scum at Oil/Water Interface. Cottony Material in Water Layer. Sweet	Cloudy Scum at Oil/Water Interface. Cottony Material in Water Layer. Sweet	Cloudy. Scum at Oil/Water Interface. Cottony Material in Water. Sweet *Several types of motile microorganisms. Worm-like microorganisms present also.	Cloudy. Scum at Oil/Water Interface. Cottony Material in Water. Sweet
-5	MIL-L-23699	0-9A-4	Clear & Bright Sweet Odor	Cloudy Darker Layer at Oil/Water Interface. Semi-Sour	Cloudy Semi-Sour	Cloudy Scum and Dark Spots at Oil/Water Interface. Sour	Cloudy Sour	Cloudy Sour *No microorganism noticed.	Slightly Cloudy Sour
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	Clear & Bright Sweet Odor	Slightly Cloudy Scum and Black Microorganism Colonies Present at Oil/Water Interface. Sweet	Slightly Cloudy Scum and Black Microorganism Colonies Present at Oil/Water Interface. Sweet	Slightly Cloudy Scum and Black Microorganism Colonies Present at Oil/Water Interface. Sweet	Slightly Cloudy Scum and Black Microorganism Colonies Present at Oil/Water Interface. Sweet	Clear and Bright Scum, Dense Microorganism Colonies Present at Interface and in Water Layer. Sweet *Several types of motile microorganisms present. Large amounts of filamentous material present also.	Clear and Bright. Scum, Dense Microorganism Colonies Present at Interface and in Water Layer. Sweet

* MICROSCOPIC EXAM DATA (11 MONTHS).

TABLE 52

VISUAL APPEARANCE AND ODOR DATA FOR TEST SYSTEM D-2

STORAGE CONDITIONS - CLOSED GLASS BOTTLES, FREE WATER, 100°F (37.8°C) INNOCULATED WITH OP-172-1

TLST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright	Cloudy Scum at at Oil/ Water Inter-face.	Cloudy Slight Scum at Oil/Wa-ter In-terface.	Cloudy Slight Scum Oil/Wa-ter In-terface.	Cloudy Slight Scum Oil/Wa-ter In-terface.	Oil Very Dark Almost Opaque. Rancid	Oil Very Dark Almost Opaque. Rancid
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No live microorganisms noticed. Pos sible microbiological debris present	
-2	MIL-L-7808	1N-1	Clear & Bright	Cloudy Scum at Oil/Wa-ter In-terface.	Cloudy Scum at Oil/Wa-ter In-terface.	Cloudy Scum at Oil/Wa-ter In-terface.	Cloudy Scum at Oil/Wa-ter In-terface.	Opaque. Scum at Oil/Water Interface. White Cottony Material in Water Layer.	Opaque. Scum at Oil/Water Interface. White Cottony Material in Water Layer.
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed. Possible microbiological debris present.	
-3	MIL-L-7808	15E-1	Clear & Bright	Cloudy Scum at Oil/Wa-ter In-terface.	Cloudy Scum at Oil/Wa-ter In-terface.	Cloudy Scum at Oil/Wa-ter In-terface.	Cloudy Scum at Oil/Wa-ter In-terface.	Cloudy. Scum at Oil/Water In-terface.	Oil Dark in Col-or. Slightly Cloudy.
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed. Large amounts of debris present.	
-4	MIL-L-7808	11E-1	Clear & Bright	Cloudy Scum at Oil/Wa-ter In-terface.	Cloudy Scum at Oil/Wa-ter In-terface	Cloudy Scum at Oil/Wa-ter In-terface.	Cloudy Scum at Oil/Wa-ter In-terface.	Cloudy. Scum at Oil/Water Interface. Semi-Sour	Cloudy. Scum at Oil/Water Interface. Semi-Sour
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed. Scum may be emulsion.	
-5	MIL-L-23699	O-9A-4	Clear & Bright	Cloudy Slight Scum Layer at Oil/Wa-ter In-terface.	Clear & Bright	Slightly Cloudy Oil Dark-er in Color.	Opaque Oil Very Dark.	**	**
			Sweet Odor	Semi-Sour	Semi-Sour	Rancid	Rancid	* **	
-6	MIL-C-8188	1M-1 plus Corro-sion Inhib-itor	Clear & Bright	Cloudy Scum at Oil/Wa-ter In-terface.	Cloudy Scum at Oil/Wa-ter In-terface.	Cloudy Oil Dark in Color. Scum at Oil/Wa-ter In-terface. Slight Sediment on Bottom.	Opaque Oil is a Very Dark Purple Color.	**	**
			Sweet Odor	Sweet	Sweet	Sour	Rancid	* **	

** TEST TERMINATED AFTER SIX MONTHS DUE TO EXTREME OFFENSIVE ODOR.

* MICROSCOPIC EXAM DATA (11 MONTHS).

TABLE 53

VISUAL APPEARANCE AND ODOR DATA FOR TEST SYSTEM D-3
STORAGE CONDITIONS - OPEN GLASS BOTTLES, FREE WATER, 100°F (37.8°C) INNOCULATED WITH OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright Sweet Odor	Clear & Bright Scum at Oil/Water Interface Sweet Odor	Clear & Bright Scum & Small Microorganism Colonies at Oil/Water Interface Sweet Odor	Clear & Bright Cottony Material Dispersed in Water Layer Sweet Odor	Clear & Bright Cottony Material in Water Layer Sweet Odor	Oil is Very Dark but Clear No Free Water Present Rancid * No Live Microorganisms but Microbiological Debris Present	Oil is Very Dark but Clear No Free Water Present Rancid
-2	MIL-L-7808	1N-1	Clear & Bright Sweet Odor	Slightly Cloudy Scum at Oil/Water Interface Sweet Odor	Slightly Cloudy Scum at Oil/Water Interface Sweet Odor	Clear & Bright Scum at Oil/Water Interface Sweet Odor	Clear & Bright Slight Scum at Oil/Water Interface Water Layer Decreasing Semi-sour Odor	Opaque, Oil Very Dark in Color No Free Water Present Sour * Possible Microbiological Debris and Microorganisms Present	Opaque, Oil Very Dark in Color No Free Water Present Sour
-3	MIL-L-7808	15E-1	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Clear & Bright Sweet Odor	Slightly Cloudy No Free Water Present Semi-sour * No Microorganisms Noticed	Clear & Bright No Free Water Present Semi-sour
-4	MIL-L-7808	11E-1	Clear & Bright Sweet Odor	Slightly Cloudy Scum at Oil/Water Interface Sweet Odor	Clear & Bright Scum at Oil/Water Interface Sweet Odor	Clear & Bright Slight Scum at Oil/Water Interface Sweet Odor	Slightly Cloudy Slight Scum at Oil/Water Interface Sweet Odor	Clear & Bright No Free Water Present Sweet * No Microorganisms Noticed	Clear & Bright No Free Water Present Sweet
-5	MIL-L-2369	0-9A-4	Clear & Bright Sweet Odor	Clear & Bright Semi-sour Odor	Clear & Bright Semi-sour Odor	Clear & Bright Sour Odor	Opaque, Oil Very Dark Rancid Odor	** * **	**
-6	MIL-C-8188	1M-1 plus corrosion inhibitor	Clear & Bright Sweet Odor	Clear & Bright Slight Scum at Oil/Water Interface Sweet Odor	Clear & Bright Slight Scum at Oil/Water Interface Sediment on Bottom Sweet Odor	Clear & Bright Slight Scum at Oil/Water Interface Sediment on Bottom Semi-sour Odor	Oil Dark but Clear Sediment in Water Layer Semi-sour Odor	Oil Dark, Almost Opaque Deep Purple in Color Rancid * No Microorganisms Noticed	Almost Opaque Oil Very Dark Rancid

*Microscopic Exam Data (11 Months)
**Test Terminated After Six Months Due to Extreme Offensive Odor

TABLE 54

VISUAL APPEARANCE AND ODOR DATA FOR TEST SYSTEM E-1
STORAGE CONDITIONS - OPEN GLASS BEAKERS, 100% RELATIVE HUMIDITY, 70°F (21°C), INNOCULATED WITH OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright Sweet Odor	Slightly Cloudy Slight Sediment on Bottom Sweet Odor	Slightly Cloudy Slight Sediment on Bottom Sweet Odor	Slightly Cloudy Slight Sediment on Bottom Sweet Odor	Clear & Bright Slight Sediment on Bottom Sweet Odor	Cloudy Scum & Sediment on Bottom Sweet * No Microorganisms Noticed	Clear & Bright Scum & Sediment on Bottom Sweet
-2	MIL-L-7808	1N-1	Clear & Bright Sweet Odor	Slightly Cloudy Sweet Odor	Slightly Cloudy Slight Sediment on Bottom Sweet Odor	Clear & Bright Slight Sediment on Bottom Sweet Odor	Slightly Cloudy Slight Sediment on Bottom Sweet Odor	Clear & Bright Scum & Sediment on Bottom Sweet * No Live Motile Microorganisms Possible Bacteria and Microbiological Debris Present	Clear & Bright Scum & Sediment on Bottom Sweet
-3	MIL-L-7808	15E-1	Clear & Bright Sweet Odor	Slightly Cloudy Slight Sediment on Bottom Semi-sour Odor	Slightly Cloudy Slight Sediment on Bottom Semi-sour Odor	Cloudy Slight Sediment on Bottom Semi-sour Odor	Slightly Cloudy Slight Sediment on Bottom Sweet Odor	Cloudy Scum & Sediment on Bottom Sweet * Several Types of Microorganisms Present	Clear & Bright Scum & Sediment on Bottom Sweet
-4	MIL-L-7808	11E-1	Clear & Bright Sweet Odor	Slightly Cloudy Sediment on Bottom Sweet Odor	Slightly Cloudy Sediment on Bottom Sweet Odor	Slightly Cloudy Sediment on Bottom Sweet Odor	Cloudy Scum & Sediment on Bottom Sweet Odor	Cloudy Scum & Sediment on Bottom Sweet * Motile Microorganisms Present	Clear & Bright Scum & Sediment on Bottom Sweet
-5	MIL-L-23699	0-9A-4	Clear & Bright Sweet Odor	Clear & Bright Semi-sour Odor	Clear & Bright Semi-sour Odor	Clear & Bright Semi-sour Odor	Clear & Bright Sour Odor	Cloudy Scum & Sediment on Bottom Sour * No Microorganisms Noticed	Clear & Bright Scum & Sediment on Bottom Sour
-6	MIL-C-8188	1M-1 plus corrosion inhibitor	Clear & Bright Sweet Odor	Slightly Cloudy Sediment on Bottom Sweet Odor	Slightly Cloudy Sediment on Bottom Sweet Odor	Slightly Cloudy Sediment on Bottom Semi-sour Odor	Slightly Cloudy Sediment on Bottom Semi-sour Odor	Slightly Cloudy Scum & Sediment on Bottom Semi-sour * Several Types of Motile Microorganisms Present. Large Amount of Clumped Material Present Also.	Clear & Bright Scum & Sediment on Bottom Sweet

* Microscopic Exam Data (11 Months)

TABLE 55

VISUAL APPEARANCE AND ODOR DATA FOR TEST SYSTEM E-2

STORAGE CONDITIONS - OPEN GLASS BEAKERS, 100% RELATIVE HUMIDITY, 100°F (37.8°C), INNOCULATED WITH OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright	Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Oil Very Dark. Cloudy, Almost Opaque. Sediment on Bottom.	**	**
			Sweet Odor	Sweet	Sweet	Semi-Sour	Rancid	* **	
-2	MIL-L-7808	1N-1	Clear & Bright	Cloudy Sediment on Bottom.	Cloudy Sediment on Bot tom.	Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	**	**
			Sweet Odor	Sweet	Sweet	Sweet	Rancid	* **	
-3	MIL-L-7808	15E-1	Clear & Bright	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom. Rancid	Slightly Cloudy Sediment on Bottom. Rancid
			Sweet Odor	Sweet	Sweet	Semi-Sour	Rancid	*No microorganisms noticed.	
-4	MIL-L-7808	11E-1	Clear & Bright	Cloudy	Cloudy Sediment on Bottom.	Cloudy Sediment on Bottom.	Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom. Rancid	Slightly Cloudy Sediment on Bottom. Rancid
			Sweet Odor	Sweet	Sweet	Semi-Sour	Rancid	*No microorganisms noticed.	
-5	MIL-L-23699	O-9A-4	Clear & Bright	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Oil Very Dark. Almost Opaque. Patches of Crystallized Material Floating on Top. Sediment on Bottom.	**	**
			Sweet Odor	Semi-Sour	Sour	Rancid	Rancid	* **	
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	Clear & Bright	Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom	Slightly Cloudy Sediment on Bottom	Oil Very Dark. Almost Opaque. Sediment on Bottom	**	**
			Sweet Odor	Semi-Sour	Semi-Sour	Sour	Rancid	* **	

** TEST TERMINATED AFTER SIX MONTHS DUE TO EXTREME OFFENSIVE ODOR.

* MICROSCOPIC EXAM DATA (11 MONTHS).

TABLE 56

VISUAL APPEARANCE AND ODOR DATA FOR TEST SYSTEM E-3

STORAGE CONDITIONS - CLOSED GLASS BOTTLES, NO FREE WATER, 100°F (37.8°C), INNOCULATED WITH OP-172-1

TEST OIL NUMBER	OIL TYPE	QUAL NUMBER	INITIAL	1 MONTH	2 MONTHS	3 MONTHS	6 MONTHS	11 MONTHS	16 MONTHS
-1	MIL-L-7808	1M-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed	
-2	MIL-L-7808	1N-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-3	MIL-L-7808	15E-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-4	MIL-L-7808	11E-1	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Sweet	Clear & Bright Sweet
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-5	MIL-L-23699	O-9A-4	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright	Clear & Bright Semi-Sour	Clear & Bright Semi-Sour
			Sweet Odor	Sweet	Sweet	Sweet	Sweet	*No microorganisms noticed.	
-6	MIL-C-8188	1M-1 plus Corrosion Inhibitor	Clear & Bright	Slightly Cloudy Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Clear & Bright Sediment on Bottom.	Slightly Cloudy Sediment on Bottom.	Clear & Bright Sediment on Bottom. Semi-Sour	Slightly Cloudy Sediment on Bottom. Semi-Sour
			Sweet Odor	Sweet	Sweet	Semi-Sour	Semi-Sour	*No microorganisms noticed.	

* MICROSCOPIC EXAM DATA (11 MONTHS).

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