ENCLOSURE (G)

ENCLOSURE (G)

SPECIFICATIONS OF FUELS AND LUBRICANTS FOR THE JAPANESE NAVY

THE FIRST NAVAL FUEL DEPOT

August 1945

Prepared For and Reviewed With
U. S. Naval Technical Mission to Japan

December 1945

ENCLOSURE (G)

TABLE OF CONTENTS

ENCLOSURE (G)

I - GASOLINE

A. Aviation Gasolines

Aviation Base Gasoline
Date - 1937

General: It consists of hydrocarbons and shall be clear, white, free from water and suspended matter and conform to the following requirements:

1.	Reaction	neutral
2.	Anti-knock value	
	87 octane No. (T.E.L. 0.085 vol%)	min
	92 octane No. (T.E.L. 0.1 vol%)	min
3.	Distillation (°C)	
	I. B. P.	60 max
	10% point	80 max
	50% point	105 max
	90% point	150 max
	97% point	170 max
	Sum of 10, 50 and 90% point (°C)	260 min
4.	Reid vapor pressure	0.6 Kg/cm^2 max
5.	Sulphur*	0.1% max
6.	Unsaturates (absorbed by 85% sulphuric acid)	100% max
7.	Freezing point (°C)	-50 max

*When no sulphur is detected by qualitative analysis the test for sulphur may be omitted.

* * *

87# Aviation Base Gasoline
Date - 1939

General: It is the same as the aviation base gasoline specification except for the following:

Anti-knock value		
87 octane No.	(T.E.L. 0.085%)	min

* * *

70# Aviation Gasoline
Date - 1939

General: It consists of hydrocarbons and benzene or alcohol and shall be clear, water white or pale yellow, and free from water and suspended matter, conforming to the following requirements:

1.	Reaction	neutral
2.	Anti-knock value	70 octane No. min
3.	Reid vapor pressure	0.6 Kg/cm2 max
4.	Distillation (oC)	
	I. B. P.	60 max
	10% point	80 max
	50% point	105 max
	90% point	150 max
	97% point	170 max

5.	Sulphur*	0.1% max
6.	Unsaturates** (absorbed by 85% sulphuric acid)	1.0% max

*When no sulphur is detected by qualitative analysis, the test for sulphur may be omitted.

**In the case of alcohol blended gasoline: absorbed by 85% H_2SO_4: Vol% of alcohol+1.0% max.

Note: To prepare this gasoline, blending with benzene or alcohol must satisfy the following requirements:

1. Blending material: No. 1 or No. 2 benzene conforming to Japanese naval specification or absolute alcohol comforming to Japanese naval specification.
2. Blending limit - benzene ..... 30 vol% max
   abs. alcohol ..... 20% max
3. Pour point or cloud point, (°C) ..... -45 max

* * *

85# Aviation Gasoline
Date - 1937

General: It consists of hydrocarbons and tetra-ethyl lead and shall be clear, blue, free from water and suspended matter and conform to the following requirements:

1.	Reaction	neutral
2.	Anti-knock value	85 octane No. min
3.	Distillation (°C)	
	I. B. P.	60 max
	10% point	80 max
	50% point	105 max
	90% point	150 max
	97% point	170 max
	Sum of 10, 50 and 90% point (°C)	260 min
4.	Reid vapor pressure	0.6 Kg/cm^2 max
5.	Sulphur	0.1% max
6.	Content of tetra-ethyl lead	0.085 vol% max
7.	Unsaturates (absorbed by 85% sulphuric acid)	1.0% max
8.	Freezing point (°C)	-50 max

* * *

91# Aviation Gasoline
Date - 1942

General: It is the same as the 85# aviation gasoline specification except for the following:

1. Anti-knock value ..... 91 octane No. min
2. Content of tetra-ethyl lead ..... 0.1 vol% max

* * *

92# Aviation Gasoline
Date - 1943

General: It is the same as the 85# aviation gasoline specification except for the following:

ENCLOSURE (G)

1. Anti-knock value ..... 92 octane No. min
2. Content of tetra-ethyl lead ..... 0.1 vol% max

* * *

70# Aviation Cracked Gasoline
Date - 1941

General: It consists of hydrocarbons and shall be clear, water white or pale yellow, free from water and suspended matter and conform to the following requirements:

1. Reaction ..... neutral
2. Anti-knock value ..... 70 octane No. min
3. Distillation (°C)
   - I. B. P. ..... 60 max
   - 10% point ..... 80 max
   - 50% point ..... 105 max
   - 90% point ..... 150 max
   - 97% point ..... 170 max
4. Reid vapor pressure ..... 0.6 Kg/cm^2 max
5. Sulphur ..... 0.1% max
6. Unsaturates (absorbed by 85% sulphuric acid) .... 6.0% max

* * *

80# Aviation Cracked Gasoline
Date - 1941

General: It is the same as the 70# aviation cracked gasoline specification except for the following:

1. Anti-knock value ..... 80 octane No. min
2. Content of tetra-ethyl lead ..... 0.1 vol% max

* * *

B. Motor Gasolines

No. 1 Motor Gasoline
Date - 1937

General: It shall be clear water white, free from water and suspended matter and conform to the following requirements:

1. Reaction ..... neutral
2. Distillation (°C)
   - I. B. P. ..... 70 max
   - 10% point ..... 95 max
   - 50% point ..... 145 max
   - 90% point ..... 200 max
   - 97% point ..... 220 max
3. Sulphur - Straight-run gasoline ..... none
   Cracked gasoline ..... 0.2% max
4. Unsaturates* (absorbed by 85% sulphuric acid)
   - Straight-run gasoline ..... 1.0% max
   - Cracked gasoline ..... 6.0% max

*In the case of mixed gasoline consisting of straight-run and cracked gasoline the content of sulphur should be less than the calculated value based on the mixed volume ratio and the maxima of each.

ENCLOSURE (G)

No. 2 Motor Gasoline
Date - 1941

General: It shall be free from water and suspended matter and conform to the following requirements:

1.	Reaction	neutral
2.	Distillation (°C)	
	10% point	85 max
	50% point	150 max
	90% point	210 max
	97% point	225 max
3.	Sulphur	0.3% max

Previous specification: It consists of 90% of No. 1 motor gasoline and 10% of absolute alcohol. (Date - 1937, Revised - 1941)

* * *

No. 3 Motor Gasoline
Date - 1941

General: It consists of 80% of No. 2 motor gasoline and 20% of absolute alcohol and shall be free from water and suspended matter and conform to the following requirements:

1.	Reaction	neutral
2.	Distillation (°C)	
	10% point	100 max
	50% point	160 max
	90% point	210 max
	97% point	225 max
3.	Sulphur	0.3% max

* * * * *

II - KEROSENE

No. 1 Kerosene
Date - 1942

General: It consists of straight-run kerosene. It shall be clear, water white, or light purple, having no combustion residue and free from water and suspended matter. It shall also conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity, (15/4°C)	0.83 max
3.	Flash point, (°C)	25 - 30
4.	Distillation (°C)	
	I. B. P.	90 min
	10% point	150 max
	50% point	200 max
	90% point	250 max
	97% point	275 max
5.	Unsaturates (absorbed by 85% sulphuric acid)	1.0% max

ENCLOSURE (G)

No. 2 Kerosene
Date - 1935

General: It shall be colorless or light yellow, having no combustion residue and free from water and suspended matter. It shall also conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity, (15/4°C)	0.81 max
3.	Flash point, (°C)	20 min
4.	Distillation (°C)	
	I. B. P.	150 max
	10% point	175 max
	50% point	205 max
	90% point	250 max
	97% point	275 max
5.	Unsaturates (absorbed by 85% sulphuric acid	6.0% max

* * *

No. 3 Kerosene
Date - 1939

General: The consumption of the wick shall not be marked after burning this kerosene in a lamp for seven hours, and it shall produce no soot when used. It shall also conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity	0.825 max
3.	Flash point (°C)	115 min

Note: A. S. T. M. Lamp Test.

* * * *

III - GAS OIL

Gas Oil
Date - 1935

General: It shall be clear, free from water and suspended matter and conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.87 max
3.	Flash point (°C)	30 min

Note: Established in 1935

* * * * *

IV - HEAVY OIL

No. 1 Heavy oil
Date - 1939

General: It shall be suitable for diesel engine fuel, free from harmful dust on the injection apparatus, and conform to the following requirements:

ENCLOSURE (G)

1.	Water	0.5% max
2.	Reaction	neutral
3.	Specific gravity (15/4°C)	0.95 max
4.	Flash point (°C)	80 min
5.	Viscosity at 0°C	500 S.U.S. max
6.	Sediment	0.05% max
7.	Sulphur	0.5% max
8.	Ash	0.05% max
9.	Conradson's carbon	5% max

* * *

No. 2 Heavy Oil
Date - 1939

General: It shall be suitable for diesel engine fuel, free from harmful dust on the injection apparatus, and conform to the following requirements:

1.	Water	0.1% max
2.	Reaction	neutral
3.	Specific gravity (15/4°C)	0.85 min
4.	Flash point (°C)	65 min
5.	Viscosity (Redwood No. 1 sec) at 30°C	30 min
6.	Sediment	0.01% max
7.	Sulphur	1.0% max
8.	Ash	0.01% max
9.	Conradson's carbon	0.5% max
10.	Cetane No.	45 min
11.	Pour point (°C)	-5 max
12.	Calorific value, (cal/g)	10,000 min

* * *

New No. 2 Heavy Oil
Date - 1942

General: It consists of Tarakan oil and shale or Fischer oil, shall be suitable for diesel engine fuel and free from harmful dust on the injection apparatus, and conform to the following requirements:

1.	Water	0.2% max
2.	Reaction	neutral
3.	Specific gravity (15/4°C)	0.915 (0.005)
4.	Flash point (°C)	65 min
5.	Viscosity (Redwood No. 1 sec) at 30°C	30 min
6.	Sediment	0.05% max
7.	Sulphur	1.0% max
8.	Ash	0.05% max
9.	Pour point (°C)	-5 max
10.	Calorific value (cal/g)	10,000 min
11.	Conradson's carbon	2.0% max
12.	Cetane No.	38 min

* * * * *

ENCLOSURE (G)

V - BUNKER FUEL

Bunker Fuel
Date - 1939

General: It shall be suitable for bunker fuel, free from dust or sediment harmful to the burner. It also shall conform to the following requirements:

1.	Water	0.5% max
2.	Reaction	neutral
3.	Specific gravity (15/4°C)	0.96 max
4.	Flash point (°C)	80 min
5.	Viscosity (Redwood No. 2 sec) at 0°C	2000 max
6.	Sulphur	3.0% max

* * * * *

VI - BENZENE

No. 1 Benzene
Date - 1935

General: It consists of benzene, toluene and xylene, being suitable as a blending fuel for aviation gasoline, and shall be clear, water white and free from water and suspended matter. It shall also conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.870 - 0.885
3.	Sulphur	0.25% max
4.	Freezing point (°C)	-7 max
5.	Distillation (°C)	
	60% point	100 max
	80% point	120 max
	95% point	160 max
	98% point	170 max

Color test by sulphuric acid: After shaking a mixture of 90 cc of the sample and 10cc of 90% sulphuric acid, the acid layer shall not be darker than pale yellow in color.

* * *

No. 2 Benzene
Date - 1935

General: It shall conform to the requirements shown in the specification for No. 1 Benzene, except for the following:

1.	Freezing point (°C)	-15 max

* * * * *

VII - ALCOHOL

Alcohol
Date - 1937

General: It shall be suitable for blending with gasoline and shall conform to the following requirements:

ENCLOSURE (G)

1.	Purity	99 Wt% min
2.	Specific gravity (15/4°C)	0.797 max
3.	Distillation	Distillate at 78 - 80°C
4.	Reaction	neutral

Solubility: This alcohol shall form a clear solution when mixed with distilled water in any proportions at room temperature.

* * * * *

VIII - METHANOL

No. 1 Methanol
Date - 1943

General: It shall be clear, water white and free from suspended matter, and conform to the following requirements:

1.	Purity	99 Wt% min
2.	Specific gravity (15/4°C)	0.796-0.799
3.	Reaction	neutral

Note: It shall be stored in a steel vessel with a date label.

* * *

No. 2 Methanol
Date - 1943

General: It shall be clear, water white and free from suspended matter, and conform to the following requirements:

1.	Purity	90 Wt% min
2.	Specific gravity (15/4°C)	0.82 max
3.	Reaction	neutral or weakly acidic

* * *

A-Methanol
Date - 1943

General: It consists of 75 vol% of No. 1 Methanol and 25 vol% of water. It shall be suitable for aviation gasoline and conform to the following requirements:

1.	Pruity	69.5 Wt% min
2.	Specific gravity (15/4°C)	0.872 - 0.877
3.	Reaction	neutral

* * * *

B-Methanol
Date - 1943

General: It consists of 50 vol% of No. 1 Methanol and 50 vol% of water. It shall be suitable for aviation gasoline and conform to the following requirements:

1.	Purity	43.5 Wt% min
2.	Specific gravity (15/4°C)	0 927 - 0.931

ENCLOSURE (G)

3. Reaction ..... neutral

Remark: Anti-corrosive dope (pottassium chromate) must be added to it just before use in following proportions: 20 g of dope per 200 liters of alcohol.

* * * * *

IX - ETHYL FLUID

Ethyl Fluid
Date - 1937

General: Ethyl fluid to be used as an anti-knock material for aviation gasoline shall be a blue clear liquid and free from suspended matter. It shall conform to the following requirements:

1. Components:
   Tetraethyl lead - 60 Wt% min, 64 vol% min
   Ethylene dibromide - 32 Wt% min, 25 vol% min

2. Lead susceptibility: When this fluid is added to a mixture of 70 vol% of iso-octane and 39 vol% of normal heptane, the anti-knock values of the mixture shall be as follows:
   90 octane No. min 0.1 vol% tetra-ethyl lead added.
   87 octane No. min 0.1 vol% ethyl fluid added.
   Naval-sub-standard fuel "N-1" may also be used, and, in this case, the anti-knock value of this fuel shall be as follows:
   89 octane No. min. 0.1 vol% ethyl fluid added.

3. Containers: The container shall be metallic, clean, and capable of storing ethyl fluid for prolonged periods. The volume and the weight of the container must be clearly marked.

* * * * *

X - LUBRICATING OILS

A. Aero-Engine Oils

Aero-Engine Oil No.120
Date - 1941

General: It shall be suitable as an aero-engine oil and conform to the following requirements:

1. Specific gravity (15/4°C) ..... 0.92 max
2. Flash point (°C) ..... 200 min
3. Viscosity at 200°F, S.U.S. 115-125
4. Viscosity index ..... 90 min
5. Conradson's carbon ..... 1.5% max
6. Ash ..... 0.02% max
7. Pour point (without additives) (°C) ..... -5 max
8. Saponification value ..... 1.5 max
9. Acid value ..... 0.1 max
10. Stability (British Air Ministry Oxidation Test)
    Conditions of oxidation:
    Sample 45cc
    Velocity of blown air ..... 15 litres per hour
    Blowing time of air ..... two 6 hr periods

Temperature of oil	200°C
Viscosity ratio	2.0 max
Carbon residue after oxidation	2.5% max

* * *

Aero-Engine Oil No.80
Date - 1941

General: The oil shall be adequate for aero-engine oil and shall conform to the following requirements:

1.	Specific gravity (15/4°C)	0.90 max
2.	Flash point (°C)	200 min
3.	Viscosity at 200°F	75-85 S.U.S.
4.	Viscosity index	90 min
5.	Conradson's carbon	1.0% max
6.	Ash	0.02% max
7.	Pour point (without additives) (°C)	-15 max
8.	Saponification value	1.0 max
9.	Acid value	0.1 max
10.	Stability (British Air Ministry Oxidation Test)	
	Conditions of oxidation:	
	Sample	45cc
	Velocity of blown air	15 litres per hour
	Blowing-time of air	two 6 hr periods
	Temperature of oil	200°C
	Viscosity ratio	2.0 max
	Carbon residue after oxidation	2.5% max

* * *

B. Cylinder Oils

No. 1 Cylinder Oil
Date - 1935

General: It shall be suitable for the lubrication of internal engines and conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.965 max
3.	Flash point, (°C)	250 min
4.	Viscosity (Redwood No. 1) at 100°C	98 sec min
	At 150°C	38 sec min
5.	Ash	0.05% max
6.	Animal or Vegetable oil	none

* * *

No. 2 Cylinder Oil
Date - 1935

General: It shall be suitable for the lubrication of internal engines and conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°)	0.926 max
3.	Flash point (°C)	180 min

ENCLOSURE (G)

4.	Viscosity (Redwood No. 1) at 30°C	450 - 500 sec
	At 50°C	160 - 180 sec
	At 100°C	40 - 50 sec
	At 150°C	30 - 40 sec
5.	Ash	0.025% max
6.	Pour point (°C)	2.0 max
7.	Animal or Vegatable oil	none

* * *

No. 3 Cylinder Oil
Date - 1942

General: It shall be suitable for the lubrication of air compressor cylinders and conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.94 max
3.	Flash point (°C)	220 min
4.	Viscosity (Redwood No. 1) at 50°C	260 - 280 sec
	At 100°C	50 sec min
5.	Ash	0.01% max
6.	Pour point (°C)	-10 max
7.	Volatility, % wt loss (6 hrs at 135°C)	0.06 max
8.	Conradson's carbon	0.2% max
9.	Animal or Vegetable oil	none

* * *

No. 4 Cylinder Oil
Date - 1943

General: It shall be suitable for the lubrication of marine-torpedo engines and conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.90 max
3.	Flash point (°C)	200 min
4.	Viscosity at 210°F, S.U.S.	90 - 105
5.	Viscosity index	90 min
6.	Pour point (°C)	-15 max
7.	Conradson's Carbon	0.1% max
8.	Saponification value	1.5 max
9.	Acid value	1.0 max

* * *

No. 5 Cylinder Oil
Date - 1943

General: It shall be suitable for the lubrication of aero-torpedo engines and conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.91 max
3.	Flash point (°C)	200 min
4.	Viscosity at 210°F, S.U.S.	90 - 105
5.	Viscosity index	90 min
6.	Pour point (°C)	-30 max
7.	Conradson's carbon	1.0% max

8. Saponification value ..... 4.0 max
9. Corrosion (Cu strip test 3 hrs) ..... non-corrosive

* * *

C. Turbine Oils

No. 1 turbine Oil
Date - 1935

General: It shall be suitable for the lubrication of turbines and conform to the following requirements:

1. Reaction ..... neutral
2. Specific gravity (15/4°C) 0.88-0.94
3. Flash point (°C) ..... 170 min
4. Viscosity (Redwood No. 1) at 30°C ..... 250 - 430 sec
   At 50°C ..... 90 - 150 sec
   At 80°C ..... 45 sec min
5. Pour point (°C) ..... 0 max
6. Corrosion ..... non-corrosive
7. Volatility, % wt loss (6 hrs at 135°C) ..... 1.0 max
8. Conradson's carbon ..... 0.3 max
9. Animal or Vegetable oil ..... none
10. Acid value ..... 0.1 max
11. Emulsion test - demulsibility ..... 20 min
    Water content in oil after test ..... 2% max
12. Stability
    Black sludges after heating at 160°C for 12 hours shall not be formed.
    Sample 20cc
    Oil to be steamed until volume is doubled
    Standing temp. after steaming ..... 20°C
    Calculation: $\text{Demulsibility} = \frac{\text{Oil separated (cc)} \times 5}{\text{Time (min) for separating 20cc of water}}$

(Comparable to A.S.T.M. Steam Emulsion Test)

* * *

No. 2 Turbine Oil
Date - 1935

General: It shall be suitable for the lubrication of turbines and conform to the following requirements:

1. Reaction ..... neutral
2. Specific gravity (15/4°C) 0.88-0.94
3. Flash point (°C) ..... 190 min
4. Viscosity (Redwood No. 1) at 30°C ..... 500 - 650 sec
   At 50°C ..... 160 - 220 sec
   At 80°C ..... 60 sec min
5. Pour point (°C) ..... 0 max
6. Corrosion ..... non-corrosive
7. Volatility, % wt loss (6 hrs at 135°C) ..... 0.8 max
8. Conradson's carbon ..... 0.6% max
9. Animal or Vegetable Oil ..... none
10. Acid value ..... 0.1 max

ENCLOSURE (G)

11. Emulsion test - demulsibility ..... 20 min
Water content in oil after test ..... 2% max
12. Stability: There shall be no black sludge formed after heating at 160°C for 12 hours.

* * *

No. 3 Turbine Oil
Date - 1937

General: It shall be suitable for the lubrication of refrigerating machines and conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.86-0.94
3.	Flash point (°C)	170 min
4.	Viscosity (Redwood No. 1) at 30°C	120 - 180 sec
	At 50°C	60 - 80 sec
5.	Ash	0.025% max
6.	Pour point (°C)	-25 max
7.	Volatility, % wt loss (2 hrs 100°C)	2.0 max
8.	Animal or Vegetable oil	none

* * * * *

XI - SPECIAL LUBRICATING OILS

A. Precise Oil

No. 1 Precise Oil
Date - 1943

General: It shall be suitable for various precise machines in aircraft and conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.92 max
3.	Viscosity (Redwood No. 1) at 10°C	145 sec max
	At 30°C	60 sec min
4.	Pour point (°C)	-50 max
5.	Corrosion	non-corrosive
6.	Volatility, % wt loss (5 hrs at 100°C)	0.3 max
7.	Saponification value	0.2 max
8.	Acid value	0.1 max

* * *

No. 2 Precise Oil
Date - 1943

General: It shall be suitable for various precise machines in aircraft and conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.92 max
3.	Viscosity (Redwood No. 1) at 10°C	250 sec max
	At 30°C	90 sec min
4.	Pour point (°C)	-45 max
5.	Corrosion	non-corrosive
6.	Volatility, % wt loss (5 hrs at 100°C)	0.3 max

ENCLOSURE (G)

7.	Saponification value	0.2 max
8.	Acid value	0.1 max

* * *

No. 3 Precise Oil
Date - 1943

General: It shall be suitable for the lubrication of magnetic generators in aircraft and conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.92 max
3.	Viscosity (Redwood No. 1) at 10°C	600 sec max
	At 30°C	150 sec min
	At 50°C	65 sec min
4.	Pour point (°C)	-40 max
5.	Corrosion	non-corrosive
6.	Volatility, % wt loss (5 hrs at 100°C)	0.2 max
7.	Saponification value	0.2 max
8.	Acid value	0.1 max

* * *

No. 4 Precise Oil
Date - 1943

General: It shall be suitable for precise machines in the marine-torpedo and conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.92 max
3.	Viscosity (Redwood No. 1) at 10°C	600 sec max
	At 30°C	150 sec min
4.	Pour point (°C)	-40 max
5.	Corrosion	non-corrosive
6.	Volatility, % wt loss (5 hrs at 100°C)	0.2 max
7.	Saponification value	0.3-0.5
8.	Acid value	0.1 max

* * *

No. 5 Precise Oil
Date - 1943

General: It shall be suitable for precise machines in the aero-torpedo and conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.92 max
3.	Viscosity (Redwood No. 1) at 10°C	600 sec max
	At 30°C	150 sec min
4.	Pour point (°C)	-60 max
5.	Corrosion	non-corrosive
6.	Volatility, % wt loss (5 hrs at 100°C)	0.2 max
7.	Saponification value	0.7 max
8.	Acid value	0.1 max

ENCLOSURE (G)

B. Hydraulic Oils

No. 1 Hydraulic Oil
Date - 1943

General: It shall consist of refined hydrocarbons suitable for the hydraulic apparatus of aircraft, and conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.92 max
3.	Flash point (°C)	130 min
4.	Viscosity (Redwood No. 1) at 10°C	145 sec max
	At 30°C	60 sec min
5.	Pour point (°C)	-50 max
6.	Corrosion	non-corrosive
7.	Saponification value	0.2 max
8.	Acid value	0.1 max

* * *

No. 2 Hydraulic Oil
Date - 1943

General: It consists of castor oil and butanol. It shall be suitable for the hydraulic apparatus of aircraft and conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.875 min
3.	Flash point (°C)	32 min
4.	Viscosity (Redwood No. 1) at 0°C	120-150 sec
	At 30°C	45 sec min
5.	Pour point (°C)	-50 max
6.	Corrosion	non-corrosive
7.	Acid value	0.2 max

* * *

C. Anti-Corrosive Cylinder Oils

Anti-Corrosive Cylinder Oil
Date - 1943

General: It shall be suitable as the anti-corrosive agent for aero-engine cylinders, and conform to the following requirements:

1.	Reaction	slightly basic
2.	Viscosity (Redwood No. 1) at 30°C	1000 sec max
	At 50°C	350-420 sec
3.	Pour point (°C)	5 max

* * *

D. Castor Oil

Castor Oil
Date - 1935

General: The oil shall be clear, pale yellow, free from suspended matter

ENCLOSURE (G)

and conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.958-0.97
3.	Flash point (°C)	240 min
4.	Viscosity (Redwood No. 1) at 50°C	500 sec min
5.	Pour point (°C)	-10 max
6.	Iodine value	80-87
7.	Saponification value	170-190
8.	Solubility test	completely soluble

Conditions of test,
Solvents each to be used individually:
85% alcohol, density 15/4°C 0.835
92.5% acetic acid, density 15/4°C 1.069
Amount of solvent ... 15cc for 5cc of sample oil
Temperature ..... 90°C
Time of contact ..... 10 minutes

* * *

Reclaimed Castor Oil
Date - 1935

General: The oil shall be clear, pale yellow and free from suspended matter. It shall also conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.97-0.985
3.	Flash point (°C)	340 min
4.	Viscosity (Redwood No. 1) at 50°C	500 sec min
5.	Pour point (°C)	-10 max
6.	Iodine value	73-87
7.	Saponification value	170-100
8.	Free fatty acid	1.5% max

* * *

E. Rape Oils

Bleached Rape Oil
Date - 1935

General: The oil shall be clear, pale yellow and free from suspended matter. It shall also conform to the following requirements:

1.	Reaction	neutral
2.	Specific gravity (15/4°C)	0.913-0.916
3.	Viscosity (Redwood No. 1) at 50°C	110 sec min
	At 90°C	50 sec min
4.	Ash	0.025% max
5.	Pour point (°C)	-5 max
6.	Iodine value	96-105
7.	Saponification value	170-178
8.	Free fatty acid	0.6% max

ENCLOSURE (G)

Rape Oil
Date - 1935

General: The oil shall be clear, pale yellow or light orange yellow. It shall also conform to the following requirements:

1.	Specific gravity (15/4°C)	0.912-0.918
2.	Pour point (°C)	-5 max
3.	Saponification value	170-190
4.	Free fatty acid	3% max

* * * * *

XII - GREASE

No. 1 Grease
Date - 1943

General: It is composed mainly of a calcium soap or fatty acid and refined mineral oil. It shall be of uniform texture and suitable for the lubrication of ball and roller bearings. It shall also conform to the following requirements:

1.	Consistency	190 ± 20 at 25°C
2.	Dropping point (°C)	90 min
3.	Amount of mineral oil	65% min
	Characteristics	
	Flash point (°C)	130 min
	Viscosity (Redwood No. 1) at 30°C	50 sec min
4.	Free alkali	0.2% max
5.	Ash	4% max
6.	Water content	2.5% max
7.	Volatility, 100°C for 8 hrs	4% max
8.	Corrosion	non-corrosive

* * *

No. 2 Grease
Date - 1943

General: It is composed mainly of a calcium soap of fatty acid and refined mineral oil. It shall be of uniform texture and suitable for the lubrication of ball and roller bearings. It shall also conform to the following requirements:

1.	Consistency	250 ± 20 at 25°C
2.	Dropping point (°C)	85 min
3.	Amount of mineral oil	70% min
	Characteristics	
	Flash point (°C)	130 min
	Viscosity (Redwood No. 1) at 30°C	50 sec min
4.	Free alkali	0.2% max
5.	Ash	3.5% max
6.	Water content	2.0% max
7.	Volatility, 100°C for 8 hrs	4% max
8.	Corrosion	non-corrosive

ENCLOSURE (G)

No. 3 Grease
~~Date — 1943~~

General: It is composed mainly of a calcium soap of fatty acid and refined mineral oil. It shall be of uniform texture and suitable for the lubrication of ball and roller bearings. It shall also conform to the following requirements:

1.	Consistency	310 ± 20 at 25°C
2.	Dropping point (°C)	80 min
3.	Amount of mineral oil	75% min
	Characteristics	
	Flash point (°C)	130 min
	Viscosity (Redwood No. 1) at 30°C	50 sec min
4.	Free alkali	0.2% max
5.	Ash	3.0% max
6.	Water content	1.5% max
7.	Volatility, 100°C for 8 hrs	4% max
8.	Corrosion	non-corrosive

* * *

No. 4 Grease
Date - 1943

General: It is composed mainly of a calcium soap and refined mineral oil. It shall be of uniform texture and suitable for the lubrication of fuselage ball and roller bearings, torpedo main engines, or general machineries. It shall also conform to the following requirements:

1.	Appearance	paste like
2.	Consistency	250 ± 20 at 25°C
3.	Dropping point (°C)	80 min
4.	Amount of mineral oil	80% min
	Characteristics	
	Flash point (°C)	160 min
	Viscosity (Redwood No. 1) at 30°C	130 sec min
5.	Free alkali	0.2% max
6.	Free fatty acid	0.5% max
7.	Ash	2.5% max
8.	Water content	2.0% max
9.	Sediment	0.1% max
10.	Corrosion	non-corrosive
11.	Stability	Pass Test*

*When the sample is heated to 100 ~ 105°C for 3 hours its colour shall not change and there shall not be any separation of oil or soap.

* * *

No. 5 Grease
Date - 1943

General: It is composed mainly of an aluminium soap of fatty acids and refined mineral oil. It shall be of uniform texture and suitable for the lubrication of variable pitch propellers and other high-loaded rubbing parts. It shall conform to the following requirements:

1.	Appearance	ductile and viscous semi-liquid

ENCLOSURE (G)

2.	Consistency	360 ± 20 at 10°C
3.	Dropping point (°C)	40 min
4.	Amount of mineral oil	88% min
	Charasteristics	
	Flash point (°C)	200 min
	Viscosity at 210°F, S.U.S.	115 min
	Viscosity index	70 min
	Conradson's carbon	1.05% max
5.	Free alkali	0.2% max
6.	Free fatty acid	1.0% max
7.	Free fat	0.5% max
8.	Ash	1.5% max
9.	Water content	0.5% max
10.	Sediment	0.1% max
11.	Corrosion	non-corrosive
12.	Stability	Pass Test*

*When the sample is heated at 100 ~ 105°C for 3 hours, the colour shall not change and there shall not be any separation of oil or soap.

* * *

No. 6 Grease
Date - 1943

General: It is composed mainly of a mixture of a sodium soap with an aluminium or calcium soap of fatty acids and refined mineral oil. It shall be of uniform texture and suitable for the lubrication of comparatively high loaded rubbing parts such as the side valves of aero-engines, gears, etc. It shall also conform to the following requirements:

1.	Appearance	semi-liquid paste
2.	Consistency	350 ± 20 at 25°C
3.	Dropping point (°C)	65 min
4.	Amount of mineral oil	90% min
	Characteristics	
	Flash point (°C)	200 min
	Viscosity at 210°F, S.U.S.	100 min
	Viscosity index	70 min
	Conradson's carbon	1.05% max
5.	Free alkali	0.2% max
6.	Free fatty acid	0.5% max
7.	Free fat	0.5% max
8.	Ash	1.5% max
9.	Water content	0.5% max
10.	Sediment	0.1% max
11.	Corrosion	non-corrosive
12.	Stability	Pass Test*

*When the sample is heated at 100 ~ 105°C for 3 hours the colour shall not change nor shall there be any separation of oil or soap.

* * *

No. 7 Grease
Date - 1943

General: It is composed mainly of a sodium soap of fatty acid and

refined mineral oil. It shall be of uniform texture and suitable for the lubrication at moderately high temperatures of rubbing parts such as aircraft generators, of magnetic generators, special generators, motors, etc. It shall also conform to the following requirements:

1.	Appearance	paste like
2.	Consistency	240 ± 20 at 25°C
		170 min at -20°C
3.	Dropping point (°C)	150 min
4.	Amount of Mineral oil	70% min
	Characteristics	
	Flash point (°C)	170 min
	Viscosity (Redwood No. 1) at 30°C	300 sec min
	Pour point (°C)	-30 max
	Conradson's carbon	0.3% max
5.	Free alkali	0.2% max
6.	Free fatty acid	0.1% max
7.	Free fat	0.5% max
8.	Ash	3.0% max
9.	Water content	0.5% max
10.	Sediment	0.1% max
11.	Corrosion	non-corrosive
12.	Stability	Pass Test*

*When the sample is heated at 100 ~ 105°C for 3 hours the colour shall not change nor shall there be any separation of oil or soap.

* * *

No. 8 Grease
Date - 1943

General: The grease shall be of mineral oil nature and suitable as an anti-corrosive lubricant for aircraft and other general machineries. It shall also conform to the following requirements:

1.	Appearance	paste like
2.	Reaction	neutral
3.	Consistency	220 ± 50 at 25°C
4.	Dropping point (°C)	40 min
5.	Acid value	0.1% max
6.	Saponification value	1.5% max
7.	Ash	0.02% max
8.	Water content	0.1% max

* * *

No. 9 Grease
Date - 1943

General: It is composed mainly of an aluminium soap of fatty acid and refined mineral oil. It shall be of uniform texture and suitable for the frame work of the aero-torpedo.

1.	Appearance	viscous semi-liquid
2.	Viscosity at 210°F, S.U.S.	1000 ~ 2000
3.	Consistency	280 ± 20 at -40°C
4.	Amount of mineral oil	92% min
	Characteristics of mineral oil:	

ENCLOSURE (G)

	~~Flash point (°C)~~	~~200 min~~
	Viscosity at 210°F, S.U.S.	60 ~ 70
	Viscosity index	80 min
	Pour point (°C)	-40 max
	Conradson's carbon	1.0% max
5.	Free alkali	0.2% max
6.	Free fatty acid	1.0% max
7.	Free fat	0.5% max
8.	Ash	1.0% max
9.	Water content	0.5% max
10.	Sediment	0.1% max
11.	Corrosion	non-corrosive
12.	Stability	Pass Test*

*When the sample is heated at 100 ~ 105°C for 3 hours, the colour shall not change nor shall there be any separation of oil or soap.

* * *

No. 10 Grease
Date - 1943

General: It is composed mainly of an aluminium soap of fatty acid and refined mineral oil. It shall be of uniform texture and suitable as an anti-corrosive material for the chamber of the aero-torpedo. It shall also conform to the following requirements:

1.	Appearance	paste like
2.	Consistency	310 ± 20 at 25°C
3.	Dropping point (°C)	85 min
4.	Amount of mineral oil	85% min
	Characteristics	
	Flash point (°C)	200 min
	Viscosity at 210°F, S.U.S.	60 ~ 70
	Viscosity index	80 min
	Conradson's carbon	1.0% max
5.	Free alkali	0.2% max
6.	Free fatty acid	1.0% max
7.	Free fat	0.5% max
8.	Ash	1.0% max
9.	Water content	0.5% max
10.	Sediment	0.1% max
11.	Corrosion	non-corrosive
12.	Stability	Pass Test*

*When the sample is heated at 100 ~ 105°C for 3 hours, the colour shall not change and there shall not be any separation of oil or soap.

ENCLOSURE (G)

XIII L COAL

	Burning test			Proximate composition (%)				Hardness (%)	Slack coal (%)
	Degree evap. kg water 1 hr	Ash + Clinker (%)	Clinker (%)	H_2O	Ash	Fixed C	Total S		
Standard Briquette	10 min	10.0 max	4.0 max	2.5 max	10.0 max	70.0~ 78.0	1.0 max	50.0 min	
Briquette No. 1	10 min	10.0 max	4.0 max	1.5 max	8.0 max	72.0~ 78.0	1.0 max	50.0 min	
Briquette No. 2	8 min	15.0 max	4.0 max	3.5 max	15.0 max	57.0~ 63.0	2.0 max	50.0 min	
Lamp coal No. 1	10 min	10.0 max	4.0 max	1.5 max	5.0 max	78.0 min	1.0 max		25.0 max pass through the sieve of 1 inch
Lamp coal No. 2	8 min	15.0 max	4.0 max	4.0 max	15.0 max	45.0 min	2.0 max		10.0 max pass through the sieve of 1 inch
Lamp coal No. 3	6.5 min	20.0 max	5.5 max	4.0 max	20.0 max	40.0 min	3.0 max		10.0 max pass through the sieve of 1 inch

ENCLOSURE (G)

Slack coal
Date - 1939

H_2O (%)	5.0 max
Volatile matter (%)	25.0 min
Fixed carbon (%)	40.0 min
Ash (%)	25.0 max
Total sulphur (%)	3.0 max
Calorific value (cal/gr)	6,000 min

* * *

The following specification, established in 1918, was temporarily adopted.

	Burning test			Proximate composition (%)				Hardness (%)
	Degree evap. kg water 1 hr	Ash + Clinker (%)	Clinker (%)	H_2O	Ash	Fixed C	Total S	
Briquette No. 1	10 kg	8.0 max	2.0 max	1.5 max	8.0 max	75.0 min	1.0 max	50.0 min
Briquette No. 2	9 kg	15.0 max	3.0 max	2.5 max	15.0 max	60.0 min	2.0 max	50.0 min