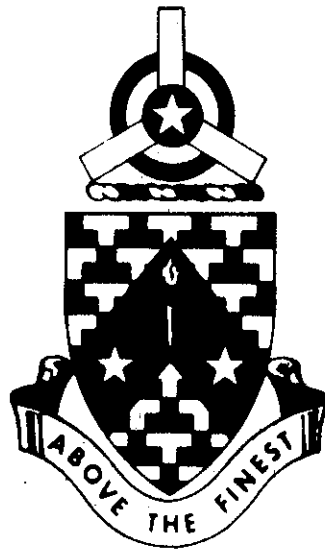


PROGRAMED TEXT

AVIATION LUBRICANTS

AM-16



APRIL 1969

UNITED STATES ARMY
PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

PROGRAMED TEXT

PROGRAM TEXT

FILE NO: AM-16

PROGRAM TITLE

Aviation Lubricants

POI SCOPE: Discussion of Army aircraft lubricants and requirements of engine oil. This includes the publications used to determine a specific aircraft's lubricant requirements.

INSTRUCTOR REFERENCES:

TM 55-403 Page 115-121
TM 55-1520-206-20 Page 5-46 thru 5-56
TM 55-1520-206-10 Page 2-30
Army Aviation Digest (August 65)

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Aviation Lubricants

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PREFACE

Improper lubrication of aircraft parts and components can lead to costly maintenance repairs and even complete material failure. It is, therefore, essential that you select the proper type and grade of lubricants to service your aircraft systems.

This programed text has been designed to teach you the functions of a lubricant and how to determine the recommended type and grade of lubricant to be used in various aircraft systems.

Complete this programed text at your own rate. This program is self-teaching and easy to follow. You simply read the information presented on each page. After reading the information, you will normally be asked to answer a question.

After making the response, turn to the top of the next page and confirm your answer. If you make a mistake, try to determine where you erred. Once you have done this, continue reading and repeat the same process until the text is complete.

PERFORMANCE OBJECTIVES

You will be able to determine the proper lubricant for your aircraft using the Operator's Manual Servicing Diagram and will know how to distinguish one lubricant from another.

FRAME 1

Lubricants are artificial or natural substances having greasy or oily properties. They can be used to reduce friction between moving parts and/or reduce and prevent rust or corrosion on metallic surfaces. Lubricants are produced from oils which are extracted from animal, vegetable and mineral matter. They may be in the form of solids, semi-solids or liquids.

Which of the following items is not normally a lubricant?

- a. Graphite
- ☒ b. Water
- c. Grease
- d. 3 in one oil

TURN TO PAGE 3 FOR FRAME 2.

ANSWER:	AN	CA/SSU	SAE
a.	1065	<u>65</u>	<u>30</u>
b.	1080	<u>80</u>	<u>40</u>
c.	1100	<u>100</u>	<u>50</u>
d.	1120	<u>120</u>	<u>60</u>

FRAME 8

When the Army converted to dispersant lubricants, the lubricants became classified into types as directed by specification *MIL-L-22851A. Type I is nothing more than an additive concentrate which is added to grade 1100 or grade 1065 oil to form an ash dispersant lubricant. The concentrate will impart oxidation stability and dispersant properties to the oil. Type I is an additive only and cannot be used alone.

Type II is produced by adding Type I concentrate to grade 1100 oil and is used as a summer grade oil.

Type III is produced by adding 1 part Type I concentrate to grade 1065 oil, and is used when the average temperature is below normal (winter).

Can Type I be used as an engine lubricant?

- a. Yes
- ☒ b. No

*NOTE: Mil-L denotes a military lubricant.

TURN TO PAGE 4 FOR FRAME 9.

ANSWER: b. Water

FRAME 2

Engine lubricants are used to lubricate components, systems and parts; must reduce the friction between the parts in contact; they must cool the part; and seal the unit being lubricated. Lubricants also clean the surfaces and carry away foreign matter.

The four requirements of a lubricant would be best applied in the lubrication of

- a. meshing bevel gears and ring gears.
- ☒ b. piston rings and cylinder walls.
- c. unsealed roller bearings.
- d. bell crank bearings.

TURN TO PAGE 5 FOR FRAME 3.

ANSWER: b. No

FRAME 9

When making an emergency selection of engine lubricating oil during a cross-country flight, you must select the best commercial lubricant which most closely conforms to the recommended lubricant.

If the selected lubricant is a substitute for MIL-L-22851 oil, it may contain ashless dispersant additives but must not contain detergent additives. Ashless dispersant is designed to hold newly formed sludge in suspension and does not soften or disturb caked sludge which has previously settled out.

A detergent oil can not be used as a substitute for ashless dispersant or non-detergent oils because it will

- a. not lubricate properly.
- ☒ b. soften sludge and disturb caked sludge.
- c. evaporate at high temperatures.
- d. suspend newly formed sludge.

TURN TO PAGE 6 FOR FRAME 10.

ANSWER: b. Piston rings and cylinder walls.

FRAME 3

Vegetable base oils wear away steel rapidly because they loosen the bonds of the iron surfaces. Animal base oils are stable only at normal operating temperatures. Mineral base oils do not corrode metal surfaces, and perform well through a wide range of temperatures.

Which of the following listed oil bases would yield lubricating oils best suited for use in aircraft engines?

- a. Vegetable
- b. Animal
- ☒ c. Mineral

TURN TO PAGE 7 FOR FRAME 4

ANSWER: b. soften sludge and disturb caked sludge.

FRAME 10

TB 55-9150-200-25

TV AVN 2 specifies the engine and transmission oils, fuels, and additives that will be used in Army aircraft. It also contains tables and references which list the specifications for foreign fuels and lubricants.

If you were planning a XC flight into a foreign country, what publication would you carry to enable you to select the correct lubricant for your aircraft?

- a. Operator's Manual
- ☒ b. TB 55-9150-200-25
- c. TM 55-1520-206-10
- d. TV AVN 23-16

TURN TO PAGE 8 FOR FRAME 11

ANSWER: c. Mineral

FRAME 4

The theory of lubrication is based on the actual separation of the metallic surfaces by means of an oil film. As long as the oil film is not broken, the internal friction of the lubricant takes the place of the metallic sliding friction.

Is the following statement True or False?

Lubricants reduce friction between metal surfaces by adhering to the surfaces and forming an oil film between the two metal surfaces, thus reducing friction.

- a. True
- b. False

TURN TO PAGE 9 FOR FRAME 5.

ANSWER:

~~1. TB~~ 55 9855 150-25

FRAME 11

Using the OH-23D Servicing Diagram (extracted from the Operators Manual (-10) and attached as Panel A, page 15) and the lubricant reference card (page 16), determine if the lubricant listed in column 1 can be utilized in the helicopter system listed in column 2. (Circle yes or no in column 3.)

COLUMN 1	COLUMN 2	COLUMN 3
a. Grade 1100	OH-23D Transmission OAT 10°C	☒ Yes / No
b. Type II	OH-23D Engine OAT 24°C	☒ Yes / No
c. Type II	OH-23D Engine OAT 9°C	Yes / ☒ No
d. Aero Shell w 100	OH-23D Engine OAT -1°C	Yes / ☒ No
e. Enco E-80	OH-23D Transmission OAT 2°C	☒ Yes / ☒ No

TURN TO PAGE 10 FOR FRAME 12.

ANSWER: a. True

FRAME 5

Extreme temperatures will have some effect on the lubricating capabilities of an oil. Therefore, the temperatures at which the lubricant will lose its friction reducing capabilities must be determined. The pour point is the temperature at which a lubricant will congeal and will not circulate. The flash point is the temperature at which the lubricant will produce a flammable vapor in sufficient quantity to flash or momentarily ignite when it is exposed to a flame. It is necessary to use a lubricant which is stable both physically and chemically. That is to say, it will maintain the same lubricating properties over a wide range of temperatures and pressures.

Which probable cause stated on the right, would produce the problem stated on the left?

PROBLEM

On a cold day, the starter would drag to a stop when the pilot attempted to start the engine

PROBABLE CAUSE

The lubricant's temperature was:

- ☒ a. below its Pour Point.
- b. above its Flash Point.
- c. causing the lubricant to break down chemically.

TURN TO PAGE 11 FOR FRAME 6.

- ANSWER:
- a. Yes
 - b. Yes
 - c. No
 - d. No
 - e. No
-

FRAME 12

Grease products are made up of petroleum oils and some kind of soap.

Greases are generally used in areas that are difficult to lubricate or reach, areas that are exposed to high pressures and temperatures and areas exposed to low speeds, shock loading and intermittent operation.

To determine the type, frequency, method and location of grease application on various helicopter components, refer to the lubrication chart in the -20 series for that type helicopter.

Which of the following listed items could not effectively be lubricated by grease?

- a. Ball Bearings
- b. Rod-End Bearings on Push-Pull Tubes
- ☒ c. Engine Crankshaft

TEXT COMPLETED.

TURN TO PAGE 16 FOR SELF EVALUATION
EXERCISE.

ANSWER: a Below its pour point.

FRAME 6

Lubricants are graded by SAE Numbers (Society of Automotive Engineers), Army Navy Numbers (AN) and commercial aviation grades (CA) which is the same as the grade designation given by the Seconds, Saybolt Universal Text (SSU).

The AN grading numbers contain 4 digits. The first digit identifies the series of the lubricants.

For example: 1 - Aviation Engine Oils

2 & 3 - General Purpose Oils

4 - Compound Oils

The 2d, 3d, and 4th digits represent the SSU and the CA grade.

For example: 1100 - Aviation Engine Oil Grade 100

1120 - Aviation Engine Oil Grade 120

2040 - General Purpose Oil Grade 40

What is the CA grade for AN 1080?

- a. 800
- b. 8
- ☒ c. 80
- d. 108

TURN TO PAGE 13 FOR FRAME 7

ANSWER: c. engine crankshaft.

a. Below the pour point.

Alcanta are graded by SAE Numbers (Society of Automotive Engineers).
Numbers (AN) and commercial aviation grades (CA) which in the same
trade designation given by the SAE, SAE Universal Tests (SU).

AN grading numbers contain 4 digits. The first digit identifies
the oil. The second digit is a grade number. The third and fourth
digits are used to identify the oil. The first digit identifies
the oil. The second digit is a grade number. The third and fourth
digits are used to identify the oil.

3 & 3 - General Purpose Oil
A - Compound Oil
61-11 VVA VT

3d, 3d, and 4th digits represent the SU and the CA grade.

examples: 1100 - Aviation Engine Oil Grade 100
1110 - Aviation Engine Oil Grade 120
2060 - General Purpose Oil Grade 40

is the CA grade for AN 1080?

800
8
80
108

THIS IS A COPY OF THE

TURN TO PAGE 13 FOR FRAME 7

ANSWER: c. 80

FRAME 7

To determine the equivalent SAE grade for a given CA or SSU grade, divide the CA or SSU grade by 2.

For example: AN 1080 is equal to CA or SSU 80.

CA or SSU 80 divided by 2 = 40 SAE grade

NOTE: CA grade 65 is equal to SAE grade 30.

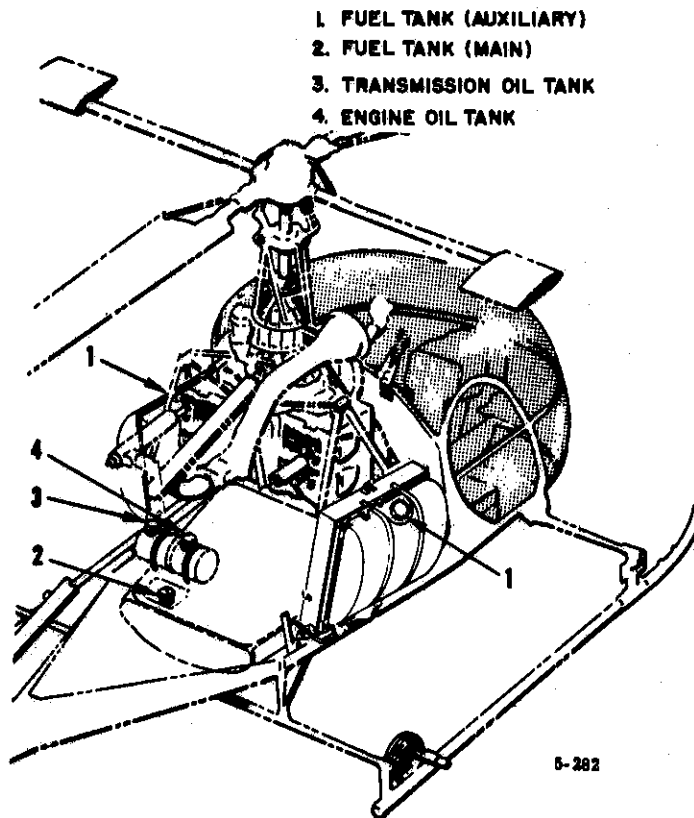
What are the equivalent grades for the given lubricants listed below?

AN	CA/SSU	SAE
a. 1065	<u>65</u>	<u>30</u>
b. 1080	<u>80</u>	<u>40</u>
c. 1100	<u>100</u>	<u>50</u>
d. 1120	<u>120</u>	<u>60</u>

TURN BACK TO PAGE **2** FOR FRAME 8.

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PANEL A



Index No.	Model	Agent	Specification	Capacity
1	OH-23D	Gasoline, Aviation	MIL-G-5572, Grade 80/87 Alternate Grades 91/96, 100/130, or 115/145	20 US Gallons (each tank)
1	OH-23F	Gasoline, Aviation	MIL-G-5572, Grades 100/130 or 115/145	20 US Gallons (each tank)
2	OH-23D	Gasoline, Aviation	MIL-G-5572, Grade 80/87 Alternate Grades 91/96, 100/130, or 115/145	46 US Gallons
2	OH-23F	Gasoline, Aviation	MIL-G-5572, Grades 100/130 or 115/145	46 US Gallons
2	OH-23G	Gasoline, Aviation	MIL-G-5572, Grades 100/130 or 115/145	46 US Gallons
3	All Models	Lubricating Oil, Transmis- sion Above 0°C (32°F)	MIL-L-6082, Grade 1100 or MIL-L-22851, Type II	4.5 US Quarts
3	All Models	Below 0°C (32°F)	MIL-L-6086, Grade M	4.5 US Quarts
4	All Models	Lubricating Oil, Engine Above 21°C (70°F)	MIL-L-6082, Grade 1100 II	8 US Quarts*
4	All Models	-12°C (10°F) to 21°C (70°F)	MIL-L-6082, Grade 1065 III	8 US Quarts*
4	All Models	Below -12°C (10°F)	Commercial Aircraft Quality Straight Mineral Oil SAE 20-20W	8 US Quarts*

*Capacity is 11 US Quarts during operation with one or both auxiliary fuel tanks.

Servicing diagram (typical)

SELF EVALUATION EXERCISE

AVIATION LUBRICANTS

1. Use panel A and the lubricant reference card to complete the self evaluation exercise. (Lub Ref Card Below)
2. Panel A is on page 15.
3. To indicate your answer, place a check mark next to your selected choice.

LUBRICANTS FOR ARMY AIRCRAFT PISTON ENGINES

When the appropriate -10 indicates MIL-L-6082 Grade 1100, you should now use: *MIL-L-22851A Type II, LAD OIL

If not available, you may use any of the following to top off your oil supply.

MILITARY

MIL-L-6082 Grade 1100
MIL-L-6082 Grade 1100 with 2%
Cyclohexanone added (Found
only at USAF Bases and
commonly called Air Force
high detergent oil.)

COMMERCIAL

Aero Shell W-120, or W120(1)
or W-100
Esso Aviation oil E-120 or E-100
Enco Aviation oil E-120 or E-100
Valvoline Super Aero 7000

As a last resort use any 50 or 60 weight non-detergent aviation oil.

When the appropriate -10 indicates MIL-L-6082 Grade 1065 oil, you should now use: *MIL-L-22851A Type III, LAD OIL

If not available, use any of the following:

MIL-L-6082 Grade 1065

Aero Shell W-80
Esso Aviation W-80
Enco Aviation Oil E-80

*The container may be labelled MIL-L-22851, MIL-L-22851(WEP) or MIL-L-22851A, depending upon the date of packaging.

"LAD" refers to Lubricant Ashless Dispersant.

Commercial Oils by Type

Nomenclature	Type II	Type III
Aero Shell	W-100 or W-120	W-80
Esso Aviation	E-100 or E-120	E-80
Enco Aviation	E-100 or E-120	E-80
Humble Aviation	E-100 or E-120	E-80
Valvoline Super Aero	7000	

1. On a cross-country flight, you land at Ranger, Texas to refuel. On your post-flight inspection you notice that your engine oil supply is two quarts low.

Which of the following listed lubricants would you use to replenish the supply in your OH-23G model helicopter when the seasons average outside air temperature is 24°C?

- a. SAE 40
 - b. SAE 30
 - ☒ c. CA 100
 - d. CA 65
-

2. Your next flight leg takes you to Dyess Air Force Base and again you discover that your transmission oil is one quart low and your engine oil tank is one quart low.

Which lubricant would you select from those listed below when the seasons average outside air temperature is 19°C?

TRANSMISSION

- a. Grade 1065
- ☒ b. Grade 1100
- c. MIL-L-7808

ENGINE

- ☒ a. Grade 1065
 - b. Grade 1100
 - c. MIL-L-7808
-

3. If you landed at a civilian airport and you had to select between a commercial high detergent oil or a commercial non-detergent oil of grade SAE 50, which would you select for your aircraft if MIL-L-22851A type II was recommended?

- ☒ a. Non-detergent SAE Grade 50
 - b. High detergent CA Grade 100
-

4. If your mechanic or crewchief added 5 quarts of type I oil to your helicopter engine oil tank, would you take-off and complete your assigned mission? Your aircraft requires MIL-L-6082 Grade 1100 oil.

- ☒ a. Yes
 - ☒ b. No
-

5. Which publication would NOT be used to locate various information on aircraft lubricants?
- a. Operator's Manual
 - b. TB 55-9150-200-25
 - ☒ c. TB AVN 23-16
 - d. -20 Series TM
6. Type II oil is produced by adding Type I additive concentrate to which of the following lubricants?
- a. Grade 1065
 - b. 7808
 - c. 5606
 - ☒ d. Grade 1100
7. Type III oil produced by adding Type I additive concentrate to Grade 1100.
- a. True
 - ☒ b. False
8. The prime factor which determines the use of Type II or Type III lubricating oil is the
- a. aircraft's maximum altitude.
 - b. lubricants viscosity.
 - ☒ c. seasons average outside air temperature.
 - d. none of the above.

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SELF EVALUATION EXERCISE ANSWER SHEET

1. c. CA 100
2. b. Grade 1100
a. Grade 1065
3. a. Non-detergent SAE 50
4. b. No
5. c. TB AVN 23-16
6. d. Grade 1100
7. b. False
8. c. Seasons average outside air temperature.