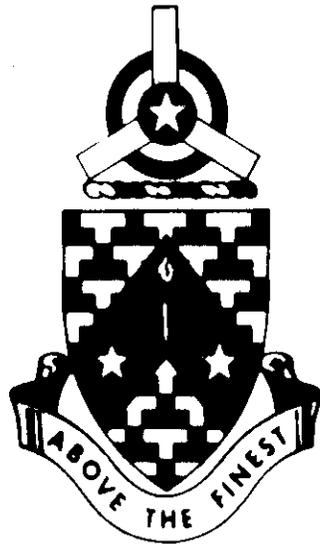


# PROGRAMED TEXT

AVIATION FUEL

AM-14



NOVEMBER 1968

**UNITED STATES ARMY  
PRIMARY HELICOPTER SCHOOL  
FORT WOLTERS, TEXAS**

# PROGRAMED TEXT

## PROGRAM TEXT

**FILE NO:**

AM-14

**PROGRAM TITLE**

Aviation Fuel

**POI SCOPE:** Explanation of octane, performance numbers, colors, grades, and contaminators of aviation fuels.

## INSTRUCTOR REFERENCES:

TM 1-260

**PREPARED BY:**

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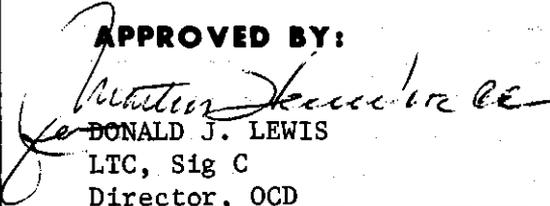
**DATE:**

November 1968

**REVISED BY:**

**DATE:**

**APPROVED BY:**

  
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Director, OCD

**DATE:**

January 1969

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## PREFACE

Improper type or contaminated fuel can cause a loss of power, engine damage or engine failure. As an army aviator or student pilot you are responsible to see that your aircraft is properly fueled with the right type of fuel and to insure that it hasn't been contaminated.

It is essential that you know the different types of aviation gasoline and how to recognize contaminated fuel so that you will not jepordize your aircraft or passengers.

## PERFORMANCE OBJECTIVES

At the conclusion of this programed text the student will be able to correctly differentiate between the various grades of aviation gasoline by octane rating and color, determine the cause and cure for detonation and recognize the most common cause of aviation fuel contamination.

FRAME 1

There are two types of fuel normally used in army aviation. They are aviation gasoline, of which there are four grades, and jet fuel of which the army uses one grade (JP-4)

Aviation gasoline is composed of iso-octane and heptane. The percentage of iso-octane in the fuel determines the octane rating. To obtain fuels with ratings over 100 octane, tetraethyl lead is added. This addition of tetraethyl lead makes the fuel performance greater than 100 octane; so the numbers used to describe the fuels' characteristics are called performance numbers and are always over 100.

Which of these numbers are octane ratings, and which are performance numbers?

1. a. 96 oct
- b. 86 oct
- c. 115 per

ANSWER: a. 18:1 (Remember the ratio is air to fuel)

---

FRAME 4

Aviation gasoline has a harmless dye added to it so the fuel can be identified by color.

We mentioned in Frame 1 that there are four grades of aviation gasoline. These are; 80/87, 91/96, 100/130, and 115/145.

NOTE: There are two numbers used in each group. The first number is an index to the fuels' performance in a lean mixture, and the second number indicates its' characteristics in a rich mixture.

For example:      lean mixture 80/87    rich mixture  
                         acts like 80                acts like  
                         octane                        87 octane

To identify the fuel by color remember the phrase Red Berries Get Picked.

<u>RED</u>	<u>BERRIES</u>	<u>GET</u>	<u>PICKED</u>
80/87 (Red)	91/96 (Blue)	100/130 (Green)	115/145 (Purple)

What is the lean performance number of green fuel?

- a. 91/96 blue
- b. 100/130 green
- c. 100/130 green
- d. 115/145 purple

ANSWER: a and b are octane ratings and c is a performance number.

---

FRAME #2

The octane rating or performance number is the index of a fuels' resistance to detonation.

Detonation is primarily caused by high cylinder head temperature. As the air fuel mixture in the cylinder is compressed, to the critical pressure, heat builds up in the cylinder and the fuel air mixture is ignited prematurely, causing uncontrolled burning, or detonation.

Other causes of detonation are: prolonged too high power setting; too low a fuel grade, and too lean a mixture. It might be noted, though, that these conditions all lead to excessive cylinder head temperature.

In the cockpit, detonation would show as high cylinder head temperature, low oil pressure, high oil temperature, and loss of engine power. If detonation continues for any length of time, severe engine wear takes place, which could lead to complete engine failure.

Which of the following are symptoms of detonation?

- a. High oil pressure
- b. Low oil pressure
- c. High oil temperature
- d. Low oil temperature

ANSWER: b. 100

---

FRAME 5

Water in the fuel system of an aircraft can be very dangerous. Even if the fuel cell is tightly closed, water can form by condensation of water vapor in the air that is trapped in the fuel cell. To minimize this condensation, the fuel cell should be kept filled with fuel as much as possible to keep trapped air to a minimum.

When a fuel sample is taken, water in the fuel will show up as clear beads on the bottom of the container. If water beads are present, the fuel should be drained until no more water shows in the sample.

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If condensation has taken place in an aircraft fuel cell, can it be seen as clear beads on the outside of the fuel cell?

a. Yes

b. No

ANSWER: b. low oil pressure and c. high oil temperature

---

FRAME 3

The fuel air mixture is another factor that can lead to detonation. The fuel air mixture in an aircraft engine can range from 18 parts air to 1 part fuel by weight (a lean mixture) to 12 parts air to 1 part fuel (a rich mixture). The mixture normally used in aircraft engines is set at 14 to 15 to 1.

The leaner the mixture used in the aircraft engine the lower the critical pressure in the engine. This means that detonation will occur more readily with a lean mixture than with a rich mixture.

Which mixture would you consider to be the most prone to detonation?

- a. 18:1
- b. 15:1
- c. 12:1
- d. 1:8

TURN TO PAGE 2 FOR FRAME 4

ANSWER: b. No

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FRAME 6

It is important to carefully check your fuel for contamination as it could cause a partial or total power loss. To find a proper type of fuel alternate to use if the normal fuel is not available, refer to the servicing diagram in TM 55-1520-<sup>296</sup>10 (Operator's Manual) for your aircraft. As a rule of thumb, if the fuel for your type aircraft is not available, the next higher grade may be used.

If there is any doubt in your mind whether or not the fuel in your aircraft is contaminated, don't fly the aircraft until you have had the fuel checked by qualified maintenance personnel.

Can you safely use blue fuel in your aircraft if the manual calls for 100/130?

a. Yes

b.  No

red 80/87    blue 91/96    green 100/130    purple 115/145

CONTINUE ON TO THE SELF EVALUATION EXERCISE PAGE 7

ANSWER: b. No

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SELF EVALUATION EXERCISE

1. When the critical pressure of a fuel is reached in the cylinder of a piston type engine, the fuel-air mixture will \_\_\_\_\_.
  - a. Not burn.
  - b. burn slowly.
  - c. detonate.
  - d. burn rapidly.
  
2. As the octane value of a fuel decreases, the detonation tendency will
  - a. remain the same.
  - b. increase.
  - c. decrease.
  - d. none of the above.
  
3. The ability of a fuel to resist detonation may be increased by
  - a. increasing the percent of heptane in the fuel.
  - b. adding tetraethyl lead.
  - c. increasing the air in the air fuel mixture.
  - d. all of the above.
  
4. The color of 100/130 fuel is green.
  
5. The color of 80/87 fuel is red.
  
6. What is the rich performance number of green fuel?
  - a. 115
  - b. 130
  - c. 100
  - d. None of these

*lean mix.  
100/130*

7. What publication can be used to determine the fuel or fuel grade alternate by referring to the servicing diagram?
- a. TM 55-1520-\_\_\_\_-20 (Organizational Maint)
  - b. TM 55-1520-\_\_\_\_-10CL (Check List)
  - c. TM 55-1520-\_\_\_\_-10 (Operator's Manual)
  - d. TM 55-403 (Fundamentals of Army Aircraft Maint)
8. The best method to reduce contamination due to water condensation is to
- ~~a. keep fuel cells tightly sealed.~~
  - b. store fuel in steel tanks.
  - c. store fuel in aluminum tanks.
  - d. keep fuel cells filled as much as possible.
9. If your aircraft used 100/130 and <sup>green 11/15/14 B</sup> you found purple fuel in your tank, is it safe to fly?
- a. Yes
  - b. No
10. Which of these are indications of detonation?
- a. High cylinder head temperature
  - b. High oil pressure
  - c. Low oil temperature
  - d. All the above

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ANSWERS FOR SELF EVALUATION EXERCISE

1. c
2. b
3. b
4. Green
5. Red
6. b
7. c
8. d
9. a
10. a

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