

UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS 76067

STUDENT HANDOUT

POWERPLANT AND RELATED SYSTEMS TH-55A
AM 15-55

PREFACE

This programed educational television production has been prepared to teach you the locations, functions and nomenclature of the various sub-systems which make up the powerplant of the TH-55A helicopter.

A good understanding of the function of each of these sub-systems will enable you to inspect the system in order to determine if your helicopter is air-worthy. If any discrepancies are located during your inspection, you must be able to identify the part or component of the system which has the discrepancy in terms understood by maintenance personnel. You must therefore recall the correct nomenclature of each sub-system and part or component which constitutes the system.

Periodically a question will appear on the TV screen. You will be given 10 seconds to select an answer for this question. At the completion of the 10 seconds, the answer will be given to you. Attempt to respond to every question before the answer is given.

PERFORMANCE OBJECTIVES

At the completion of this programed educational television production, you will be able to:

1. Locate various components and parts related to the powerplant of the TH-55A helicopter.
2. Recall the function of each component or part.
3. Identify each component or part of the TH-55A powerplant by its proper nomenclature.

Powerplants and Related Systems TH-55A

1. The chemical energy of a fuel can be converted into useful mechanical energy if:

- a. It is burned in a vacuum.
- b. It is burned in a controlled environment.
- c. Its energy is harnessed and utilized to power a mechanical device.

2. The engine in your automobile is cooled by water which circulates through passages in the engine block. The Lycoming H10-360-B1A is cooled by what means?

- a. Water.
- b. Air.
- c. Climate.

*Horizontal
fuel injection
360 cubic inches*

3. The purpose of the engine mounts are:

180 BHP

- a. To absorb transmission movement.
- b. To absorb engine vibration.
- c. To align the engine with the transmission.
- d. To align the lower drive shaft coupling.

4. A correctly installed engine mount absorber _____ be free to move.

- a. should
- b. should not

5. To determine the serviceability of the induction system, you should insure that the _____ is operating freely.

- a. induction manifold
- b. bypass valve
- c. manifold pressure valve

6. What function would this drain valve serve other than draining the fuel from the cell?

- a. Check fuel quantity.
- b. Drain water and sediment from fuel cell.
- c. Relieve fuel pressure.

7. When would it be advisable to drain the fuel from the fuel cell?

- a. After each flight.
- b. Before each flight.
- c. Once a day.

8. If the engine driven fuel pump fails in flight, the fuel pressure should or should not remain at 14 to 30 PSI?
- a. Should.
 - b. Should not.
9. What occurs when the manual mixture control on the instrument panel is pulled completely outwards?
- a. Mixture becomes richer.
 - b. Mixture becomes leaner.
 - c. Fuel flow stops
10. Will the engine operate if the engine driven fuel pump is inoperative?
- a. Yes.
 - b. No.
11. When the engine is idling, the manifold pressure would be higher, or lower than the present atmospheric pressure?
- a. Higher.
 - b. Lower.
 - c. Same.
12. He must open or close the throttle to compensate for the increase in the engines power requirements.
- a. Open.
 - b. Close.
13. When checking the throttle system on the flight readiness inspection you should insure that the throttle linkage actuates the throttle valve when the throttle grip is _____.
- a. closed
 - b. turned
14. When the throttle is set at a position above the override position application of the collective pitch should automatically actuate the:
- a. manifold valve.
 - b. throttle valve.
 - c. pressure valve.
15. When the throttle is in the override position, application of the collective pitch throughout its travel range _____ actuate the
- a. should
 - b. should not

16. Could complete failure of the aircrafts electrical system affect the operation of the aircrafts ignition system?

a. yes

b. no

17. State the purpose of the distributor.

a. distributes fuel to cylinders.

b. directs high voltage current to spark plugs

c. distributes power evenly

18. While performing a flight readiness inspection on an aircraft, you notice that the right hand magneto has not been properly secured and is free to move slightly in the mounting flanges. Would you accept the aircraft as flyable for your mission?

a. Yes

b. No

19. Will the efficiency of your aircrafts engine decrease if the ignition harness is in a poor condition?

a. Yes

b. No

20. What are the main advantages of dual ignition?

a. greater reliability

b. more even burning

c. safety

d. cleaner engine wear

21. During engine shutdown, if the magneto switch is placed in the "off" position and the "P" lead of the right magneto has been cut, what will occur?

a. engine will stop

b. engine will continue to run

c. rotor RPM will increase

22. When performing the high RPM magneto check, an aviator noticed that he had a 50 RPM drop while operating on the left magneto, and a "0" RPM drop while operating on the right magneto. Should he accept the aircraft for flight?

a. Yes

b. No

23. The TH-55A magneto switch, should be turned to the _____ position for starting.
- a. right
 - b. left
 - c. both
24. What is the source of spark energy for engine starts?
- a. impulse coupling device
 - b. starting vibrator
 - c. alternator-generator
25. What four functions does the lubricant in a lubricating system serve?
- a. reduces friction
 - b. cleans the engine
 - c. provides smooth control movement
 - d. seals the combustion chamber
 - e. cools the engine
26. What type of lubrication system the TH-55A utilize?
- a. wet sump
 - b. dry sump
27. What is the oil capacity of the TH-55A helicopter engine?
- a. 4 quarts
 - b. 6 quarts
 - c. 8 quarts
28. The component of the lubrication system that controls the temperature of the system is?
- a. the oil cooler
 - b. the automatic temperature control unit;
 - c. the heater unit.
29. The component cooling the pressure of the oil is?
- a. the oil pressure guage
 - b. a pressure sensitive valve
 - c. a pressure stablizer unit

25 psi

60-90 psi

30. Engine oil pressure must be indicated within _____ seconds after starting.

- a. 15 seconds
- b. 30 seconds
- c. 45 seconds
- d. 60 seconds

SELF EVALUATION EXERCISE

1. Circle the correct word. An engine is a device which converts (mechanical/chemical) energy into useful (mechanical/chemical) energy.

2. The engine in the TH-55A helicopter is a lyc engine.

<u>LYCOMING</u>	<u>4 cylinder</u>	Radial	<u>Air cooled</u>
FRANKLIN	6 cylinder	Inverted "V"	Liquid cooled
CONTINENTAL	8 cylinder	<u>Opposed</u>	Air/liquid cooled

3. Circle the correct word. Broken cylinder fins would (decrease/increase) air cooling effect.

4. Circle the correct word. Reference is made to the location of engine components by viewing the engine from the (front/rear).

5. Two purposes of the engine mounts are b and d.

- a. to absorb transmission movement
- b. to absorb engine vibration
- c. to align the engine with the transmission
- d. to align the lower drive shaft coupling

6. Circle the correct word or words. A correctly installed engine mount absorber (should/should not) be free to move.

7. Circle the correct words. To determine the serviceability of the induction system, you should insure that all intake pipes are secure and that the (bypass valve/carb air temperature control) is operating freely.

8. The capacity of the fuel tank of the TH-55A is

- a. 25 gallons.
- b. 30 gallons.
- c. 25 or 30 gallons depending on the model.

9. Moisture which may accumulate in the fuel tank may be drained prior to flight by means of a drain valve located

- a. adjacent to the fuel shut-off valve.
- b. under the engine sump case.
- c. under the carburetor bowl.
- d. under the auxiliary fuel pump.

10. Circle the correct word or words. If the engine driven fuel pump fails in flight, the fuel pressure (should)/should not? remain at 14 to 30 PSI.

11. What occurs when the manual mixture control on the instrument panel is pulled completely outwards?

- a. Mixture becomes richer.
- b. Mixture becomes leaner.
- c. Fuel flow stops.

12. Will the engine operate if the engine driven fuel pump is inoperative?

- a. Yes
- b. No

Circle the correct word or words in questions 13 through 20.

13. When the engine is idling, the manifold pressure would be (higher/lower) than the present atmospheric pressure.

14. When an aviator pulls up on the collective pitch stick for the purpose of flight, he must (open/close) the throttle to compensate for the increase in the engine's power requirements.

15. When the throttle is set at a position above the override position, application of the collective pitch control (will/will not) automatically actuate the throttle valve.

16. When checking the throttle system on the flight readiness inspection, you should insure that the throttle control linkage (does/does not) actuate the throttle valve when the throttle grip is turned.

17. Complete failure of the aircraft's electrical system (will/will not) affect the operation of the aircraft's ignition system.
18. The TH-55A has a (dual/single) ignition system.
19. The TH-55A magneto switch should be turned to the (right/left/both) position for starting.
20. To render a magneto inoperative, the "P" lead circuit is (opened/closed). ✓
21. During the high magneto check, a "0" RPM drop was observed while operating on the right magneto and a 20 RPM drop while operating on the left magneto. Are the magnetos operating satisfactorily?
- a. Yes
b. No
22. Circle the correct words. The source of energy for engine starts is a (starting vibrator/induction coil) operated on current from a 24 volt battery.
23. Exhaust system leaks cause
- a. fires and crew poisoning.
b. loss of power.
c. loss of carb heat.
24. TH-55A engine oil capacity is
- a. 4 quarts.
b. 6 quarts.
c. 8 quarts.
25. Circle the correct words. The TH-55A has the (wet sump/dry sump) type lubrication system.
26. The TH-55A has provisions for monitoring engine oil pressure and engine oil temp.
27. Engine oil pressure must be indicated on the pressure gauge within _____ seconds after starting.
- a. 10
b. 20
c. 30

28. The chip detector warning light is checked for operation by placing a metal test object across the electrodes.

- a. True.
- b. False.

29. How is the fuel quantity indicating system checked for proper operation?

- a. Visually checking fuel level thus confirming gauge reading.
- b. Pushing a "press to test" button and insuring that the pointer returns to the original position.
- c. Reading the fuel quantity on the fuel track metering device.

30. The purpose of the servo control unit is to

- a. meter fuel and atomize and vaporize fuel/air mixture.
- b. meter, cool and distribute fuel.
- c. meter, vaporize and atomize fuel air/mixture.

ANSWERS TO SELF EVALUATION EXERCISE

1. chemical, mechanical
2. LYCOMING, four cylinder, opposed type, air cooled.
3. decrease
4. rear
5. b and d
6. should not
7. by-pass valve
8. c
9. a
10. should
11. c
12. a
13. lower
14. open
15. will
16. does
17. will not
18. dual
19. both
20. closed
21. b
22. starting vibrator
23. a
24. c

ANSWERS TO SELF EVALUATION EXERCISE (cont)

25. wet sump

26. temperature

27. c

28. b

29. a

30. c

1. Isolation, Isolation

2. 1000 RPM

3. Isolation

4. Isolation

5. Isolation

6. Isolation

7. Isolation

8. Isolation

9. Isolation

10. Isolation

11. Isolation

12. Isolation

13. Isolation

14. Isolation

15. Isolation

16. Isolation

17. Isolation

18. Isolation

19. Isolation

20. Isolation

21. Isolation

22. Isolation

23. Isolation

24. Isolation

25. Isolation

26. Isolation

27. Isolation

28. Isolation

29. Isolation

30. Isolation

SUMMARY

During this period you have seen all of the systems and sub-systems of the powerplant on the TH-55A helicopter.

You now know that it is powered by an internal combustion engine. It is a Lycoming, four cylinder, horizontally opposed air-cooled engine and displaces 360 cubic inches, developing 180 brake horsepower.

The engine mount system utilizes two mount bolts, each having a set of rubber absorbers and spacers to isolate vibrations. The engine is mounted in such a manner as to absorb engine vibrations and align the lower coupling drive shaft.

The induction system consists of a filter assembly, a by-pass valve, air ducts, intake manifold passages which pass through the oil sump and four intake pipes.

Air enters through an opening at the intake position, passes through the filter, down through the air duct and to the servo control. After the air flows through the servo control, it is directed to the engine cylinders by four intake pipes.

The fuel system consists of the fuel tank, fuel shut-off valve, fuel drain, auxiliary fuel pump, fuel strainer, engine driven fuel pump and fuel lines to interconnect the components.

The fuel pressure gauge must indicate 14-30 PSI and the fuel tank and fuel strainer must be drained prior to each flight.

The servo control measures the fuel flow and air flow to the cylinders, providing maximum engine efficiency under various altitudes, temperatures, engine speeds and power requirements.

The pressure injection system on the TH-55A sprays fuel directly into the intake ports on the cylinder, where the fuel and air is mixed and combustion takes place.

The twist-grip throttle on the collective opens or closes the throttle in the injector servo control throat which controls the air flow to the engine cylinders which controls the amount of power produced by the engine.

The ignition system consists of two engine driven magnetos, ignition harnesses, two sets of spark plugs, a magneto switch, a grounding lead for each magneto and a starting vibrator.

The aircraft electrical system and ignition system are independent of each other.

The dual ignition system on the TH-55A causes two magnetos to fire two spark plugs for each cylinder. This provides more even burning. Also, if any part of one ignition should fail, the other system will continue to operate until the failed system can be repaired.

Each ignition system is checked prior to takeoff by operating the engine on each system individually looking for no more than 225 RPM drop with no engine roughness.

The exhaust system consists of two manifolds which route engine exhaust gases to the rear right hand side of the helicopter.

A secondary function of the exhaust system is to provide a source of hot air to heat the cabin during cold weather operation.

The TH-55A cooling system consists of the impeller assembly, scroll assembly, shroud assembly, oil cooler and ducting.

The impeller assembly draws air into the shroud and directs it over the cylinders. If any of the fins on the cylinders are broken, the cooling of the engine will be affected.

The lubrication system on the TH-55 is a wet sump system with an eight quart capacity. The correct level for flight is 6-8 quarts.

An oil filter screen protects the oil from impurities and the external oil cooler is utilized to remove the heat from the oil.

An automatic temperature control unit controls the flow of oil through the oil cooler. The oil either flows through the core of the cooler, or around it, depending on the temperature of the oil.

The oil pressure gauge must read between 60-90 PSI in flight and 25 PSI at idle RPM. You must get an indication of a rise in oil pressure within 30 seconds after starting or the engine must be shut down.