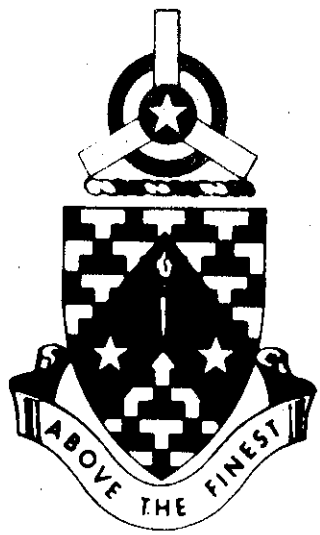
PROGRAMED TEXT

AIRCRAFT SYSTEMS CHECK
TH-55

AM-21-55



OCTOBER 1968

UNITED STATES ARMY
PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

PROGRAMED TEXT

PROGRAM TEXT

FILE NO: AM 21-55

PROGRAM TITLE

Aircraft Systems Check TH-55

POI SCOPE: Identification of common engine troubles, procedures for checking engine performance, and exercise using trouble shooting charts.

INSTRUCTOR REFERENCES:

Primary Flight Training Manual
269A/TH-55 HMI

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TABLE OF CONTENTS

PROGRAMED CONFERENCE **PROGRAM TITLE:**
FILE NO: AM 21-55 Aircraft Systems Check TH-55

PREFACE

This programed text has been designed to teach you the system checks of the TH-55 helicopter. It deals specifically with the starting and run-up procedures as outlined in the pilot's checklist. It begins when the pilot activates the aircraft battery switch to start the engine, and concludes when he is ready for take-off.

Complete this text at your own rate. Read and follow the information given on each page.

PERFORMANCE OBJECTIVES

Given the TH-55 trouble-shooting charts, simulated instrument indications and/or simulated system malfunctions, you will use the given trouble-shooting charts to determine the probable cause for the system malfunctions while performing the aircraft systems check.

FRAME #1

Maintenance and technical manuals (TM's) are available for all Army aircraft. These publications are used by maintenance personnel as a reference when inspections or repairs are being made on the aircraft. Contained within the maintenance manuals are "Trouble-Shooting" charts, which are devised for use when a malfunction is encountered in one of the aircraft's systems, such as electrical, fuel, engines, etc.

Two charts give a list of malfunctions or indications of trouble, a probable cause and a corrective action to be taken to eliminate the malfunction.

Throughout this programed text you will be required to refer to several trouble-shooting charts to find information and answers. These are electrical and powerplant trouble-shooting charts found in the -20(Organizational Maintenence Manual).

GO ON TO NEXT FRAME ON PAGE 3

ANSWER: d. 1200 - 1600 RPM

FRAME #7

The aircraft is equipped with a 28 volt, 50 Ampere alternator which charges the battery and provides current for all electrical loads during flight. A voltage regulator controls alternator output and also causes the alternator to begin to operate between 1100 and 1400 engine RPM. Turn radio switches "ON".

What causes the alternator to begin operation at approximately 1100 to 1400 RPM?

a. Battery

b. Rectifier

c. Voltage Regulator

d. Generator

FRAME #2

Using the trouble-shooting chart labeled Annex A on page 12 answer the following:

Indication of trouble:

Engine will not start, or does not continue to run after starting.

Probable cause:

a. Auxiliary fuel pump inoperative

b. Water in fuel

c. Exhaust stack missing

ANSWER: c. Voltage Regulator

FRAME #8

ROTOR ENGAGEMENT

Make sure that the oil pressure is stabilized. Collective control should be down and frictioned. Cyclic and pedals should be in the neutral position. Engine RPM should be at 1600 RPM. Turn beacon light on.

Place clutch control switch in "HOLD" position and observe main rotor. Move control switch to "ENGAGE" and watch for rotor movement. Regulate engagement rate by moving switch from "ENGAGE" to "HOLD", then back to "ENGAGE" as required. From 3 to 4 times is considered proper technique. Engine RPM should not go below 1100.

When engine RPM and rotor RPM needles join on the tachometer, place clutch switch in "ENGAGE" position and close switch guard. Clutch warning light should go out. Gear box warning light should go out. Increase RPM to 1850 RPM.

ANSWER: Auxiliary fuel pump inoperative

FRAME #3

When the battery switch is placed in the "ON" position, the 24 volt battery provides power for starting, and power for the operation of the instruments and pumps. Power is not supplied to the starter until the "START" button is depressed.

Refer to Annex B on page 13, for the following question.

If the battery switch is placed in the "ON" position, but no indication shows on the ammeter, what is the probable cause?

a. Faulty connections

b. Battery low on water

c. Wires wet

FRAME #9

Accomplish warm-up at 1850 RPM. Move generator/alternator switch to "OFF" position to check operation of alterantor. Reading on ammeter should drop. Return switch to "ON" position. Reading on ammeter should show an increase. You now know that the alternator is working properly.

Turn fuel boost pump switch to "OFF" position. Fuel pressure should remain between 14 and 30 PSI and engine should continue to run smoothly. Return switch to "ON" position. You now know that the engine driven fuel pump is operating properly.

If fuel boost pump switch is put in the "OFF" position and the engine quits you know that:

a. There is dirt in the fuel.

b. Auxiliary fuel pump is inoperative.

c. Insufficient fuel is the problem.

d. Engine driven fuel pump is inoperative.

ANSWER: a. Faulty connections

FRAME #4

After the battery switch is put in the "ON" position and the warning lights have been checked, turn the fuel boost switch "ON". Fuel pressure should be between 14-30 PSI. The fuel boost switch activates the auxiliary fuel pump, which supplies fuel to the engine from the fuel tank through the auxiliary fuel pump, filter, engine driven fuel pump, and into the fuel injection system.

The auxiliary fuel pump is designed and installed to assist in starting the engine and to prevent engine stoppage if the engine driven fuel pump fails.

When the engine is not operating and fuel is supplied to the fuel injection system by the auxiliary fuel pump, has the fuel been filtered?

a. No

b. Yes

ANSWER: d. Engine driven fuel pump is inoperative.

FRAME #10

To perform the high-speed magneto check, insure collective control is full down. Stabilize RPM at 2900 and make magneto check by switching first to "LEFT" position, then "BOTH", then to "RIGHT" position, then back to "BOTH". Do not turn magneto switch to "OFF" position during check. Duration of check in each position should be from 2-4 seconds.

A drop of 225 RPM in each position is allowable, if it is not accompanied by engine roughness.

Which of the following situations constitutes a malfunction?

a. Magneto switch on "LEFT" position, 200 RPM drop.

b. Magneto switch on "LEFT" position, 180 RPM drop, engine backfiring.

c. Magneto switch on "RIGHT" position, 225 RPM drop.

ANSWER: b. Yes

FRAME #5

After sufficient fuel pressure is indicated, crack throttle approximately 1/8 inch and put magneto switch on the "BOTH" position. Prime engine, when needed, by placing mixture in "FULL RICH" position for 1 to 3 seconds, then return mixture to full lean position. Close throttle.

Priming is accomplished on a cold engine to allow raw fuel to enter the cylinders in a correct amount. Move the mixture control to rich, 1 or 3 times, for easier starting in cold temperatures. A hot engine should not be primed, as this could cause flooding.

Priming is accomplished by placing the mixture control in the "FULL RICH" position for how long?

a. 5-10 seconds

b. 3-5 seconds

c. 1-3 seconds

ANSWER: b. Magneto switch on "LEFT" position, 180 RPM drop, engine backfiring.

FRAME #11

A sprag clutch is incorporated in the drive assembly. This clutch allows the engine to disengage from the main rotor system. This allows the helicopter to autorotate and land safely without power. In order to check the clutch, close throttle rapidly to split needles on tachometer. Needles should split immediately and engine should idle between 1200-1400 RPM. If needles fail to split, the helicopter should not be flown, as a clutch malfunction is evident. After needles rejoin, return RPM to 1850.

The purpose of the sprag clutch is to:

a. Allow engine to operate easier.

b. Allow main rotor to turn faster.

(c.) Allow a "Free-Wheeling" action in the main rotor system.

END OF PROGRAM

TURN TO PAGE 14 FOR SELF EVALUATION EXERCISE

ANSWER: c. 1-3 seconds

FRAME #6

After priming is accomplished, if required, engage starter by pushing starter button. As soon as engine starts, place mixture control in full rich position. Stabilize engine RPM between 1200 RPM and 1600 RPM. Monitor engine oil pressure gauge for a reading of not less than 25 PSI within 30 seconds after starting. In extremely cold weather, the gauge should register a visible rise within 30 seconds. If no oil pressure is evident within 30 seconds after starting engine, shut engine down immediately and determine the cause.

After starting, engine RPM should be stabilized between

a. 900 - 1100 RPM

b. 1000 - 1200 RPM

c. 800 - 1000 RPM

d. 1200 - 1600 RPM

STOP. RETURN TO PAGE 2 FOR FRAME #7.

fac 11 e.

Table 3-1. Powerplant troubleshooting (cont)

Annex A

Condition	Probable cause	Required action
ENGINE WILL NOT START, OR DOES NOT CONTINUE TO RUN AFTER STARTING	Defective MAG switch or clutch engagement micro switch.	Check MAG switch and clutch engagement micro switch.
	Overpriming.	Set MAG switch to OFF fuel boost PUMP switch OFF, MIXTURE control to IDLE CUT-OFF, throttle fully open; crank engine.
	Clogged or inoperative engine intake manifold drain plugs.	Remove engine intake manifold drain plugs. Clean in solvent and replace.
	Insufficient cranking speed.	Check battery.
	Moisture or oil on distributors.	Clean distributor fingers and blocks with acetone, using clean cloth. Wipe clean with dry cloth.
	Auxiliary fuel pump inoperative.	Check auxiliary fuel pump operation. Install new pump if necessary.
	Internal trouble with magnetos.	Turn engine over with starter and check spark jump. A strong spark should jump when a wire from high tension terminal is held 1/4 to 3/8 inch from a grounded surface. Replace magneto if spark is weak.
	Spark plugs wet, fouled, incorrect gaps, or cracked ceramic insulation.	Install serviceable plugs.
	Spark plug lead connectors oily, dirty, or cracked.	Clean dirty connectors with acetone. Replace damaged connectors.
	Burned spark plug leads.	Make continuity and high-voltage tests on harnesses. Replace wires if necessary.
	P-lead (from magneto ground connection to instrument panel switch) grounded.	Check wiring between magneto connections and switch.
	Air leaks or restrictions in induction system.	Remove carburetor air duct from carburetor. Check air filter for foreign matter. Make sure that air duct is clear. Check security of carburetor on engine and see that all intake pipe nuts are tight. Examine engine to see that no primer lines are loose or disconnected.
	Blown or leaking intake manifold gaskets and hoses.	Replace gaskets and hoses.

Table 8-1. Troubleshooting - electrical system **Annex B**

Condition	Probable cause	Required action
BATTERY DOES NOT SUPPLY POWER WHEN BATTERY SWITCH IS TURNED ON. (No indication on ammeter.)	Dead battery.	Check specific gravity of battery. Recharge or replace battery.
	Faulty switch.	Replace switch.
	Faulty ammeter.	Check ammeter; replace if defective.
	Faulty connections.	Check continuity of wiring and tighten or replace broken connections.
NO GENERATOR OUTPUT. (GENERATOR SWITCH TURNED TO ON AND BATTERY SWITCH ON WITH ENGINE AT 1100-1400 RPM minimum).	Poor generator brush contact.	Check/replace defective brushes.
		Clean brush holders and replace weak brush spring.
	Dirty commutator.	Clean commutator.
	Faulty generator switch	Check/replace.
	Defective generator wiring.	Check/repair.
	Faulty voltage regulator.	Replace regulator
	Defective generator.	Repair generator.
STARTER CLUTCH HOUSING BREAKS DURING ATTEMPTED ENGINE START	Retard "P" lead not making contact.	Check/secure lead.
	Retard timing incorrect.	Check/re-time ignition.
	Starting vibrator imperative.	Check/replace vibrator.
	Low battery voltage	Check/charge battery.
	Loose wiring.	Check/secure clean wiring.
	Damaged starter ring gear.	Inspect/replace gear.
	Damaged starter drive gear.	Inspect/replace gear.
	Faulty starter clutch.	Check/replace clutch.
	Mismatched ring and drive gear.	Check match of gears.
	Improper installation.	Inspect/reinstall correctly.
	Starter solenoid malfunctioning.	Check/replace solenoid.
AMMETER SHOWS HEAVY DISCHARGE WHEN ENGINE IS AT SLOW IDLE OR STOPPED.	Voltage regulator malfunctioning.	Check/repair/replace regulator.

SELF EVALUATION EXERCISE
AIRCRAFT SYSTEMS CHECK TH-55

Refer to Annex A for Questions 1 and 2.

1. During starting procedure, you find that the engine will not start. What is the probable cause of the malfunction?

   a. Missing spark plugs

   b. Insufficient cranking speed

   c. Air bubbles in fuel lines

2. After starting engine, you find that the engine will not continue to run. What is the probable cause?

   a. Air leaks or restrictions in induction system

   b. Dead battery

   c. Carburetor ice

3. The electrical system of the TH-55 utilizes how many volts?

   a. 8 volts

   b. 12 volts

   c. 26 volts

   d. 24 - 28 volts

4. What should the fuel pressure be when the fuel boost pump switch is in the "ON" position, and the engine is not running?

   a. 14-30 PSI

   b. 20-40 PSI

   c. 5-10 PSI

5. Why is priming accomplished on a cold engine?

   a. To mix fuel with oil so that it will run easier.

   b. Make sure throttle is working.

   c. To make starting easier.

6. When the engine starts, you must monitor the oil pressure gauge. The engine should be shut down if there is no indication of oil pressure in how many seconds?

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

7. What controls the alternator output?

   a. Battery
   b. Generator
   c. Bus bar
   d. Voltage regulator

8. For main rotor engagement, what should engine RPM be?

   a. 1600 RPM
   b. 2200 RPM
   c. 1800 RPM
   d. 1500 RPM

9. The high speed magneto check is made at what engine RPM?

   a. 2400 RPM
   b. 2600 RPM
   c. 3200 RPM
   d. 2900 RPM

10. If no engine roughness is evident during the high speed magneto check, what is the maximum RPM drop allowable?

    a. 150 RPM
    b. 200 RPM
    c. 225 RPM
    d. 180 RPM

idle 1100 - 1600

warm up 1850

11. What allows the main rotor to become free-wheeling?

a. Pitch change links

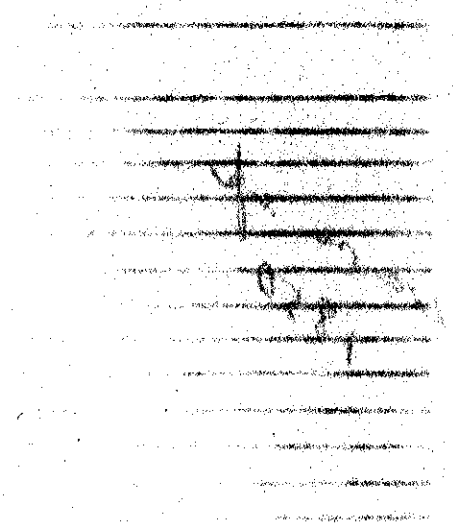
b. Main rotor mast

(c) Sprag clutch

12. If, during the operations check of the free-wheeling system, the needles do not split immediately, may the helicopter still be flown?

(a) No

b. Yes



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SYSTEMS CHECK TH-55

ANSWERS TO SELF EVALUATION EXERCISE

1. b. Insufficient cranking speed
2. a. Air leaks or restrictions in induction system
3. d. 24 - 28 volts
4. a. 14 - 30 PSI
5. c. To make starting easier
6. d. 30 seconds
7. d. Voltage Regulator
8. a. 1600 RPM
9. d. 2900 RPM
10. c. 225 RPM
11. c. Sprag clutch
12. a. No

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