UNITED STATES ARMY AVIATION SCHOOL
Department of Maintenance Training
Fort Rucker, Alabama

File No. 5/69 1758-6

PERFORMANCE OBJECTIVES

POWER PLANT, UH-1

1. KNOWLEDGES:

   a. Given a list of the engine mounts, the student should be able to match the location of each with 100% accuracy.

   b. Given a list of engine accessories, the student should be able to list the engine power source from which each of the accessories is driven with at least 5 of the 7 correct.

   c. Given a schematic of the T-53 engine, the student should be able to match each of the lettered sections to its proper nomenclature and purpose with 100% accuracy.

   d. Given a list of the ignition system components, the student should be able to match each component to its proper purpose with at least 3 of the 4 correct.

   e. Given a schematic of the engine controls, the student should be able to match each component to its proper nomenclature with 100% accuracy.

   f. Given a list of engine instrument indications, the student should be able to write the name of the instrument on which the indication is monitored and list the source of power for each with an accuracy of at least 75%.

   g. Given a worksheet consisting of a completed GO-NO-GO take off data placard, the student should be able to write the answer to each of the listed questions on the use of the placard with an accuracy of 100%.

   h. Given a list of the anti-icing components, the student should be able to match each component to its proper purpose with at least 3 of the 4 correct.

   i. Given a list of engine symptoms caused by various bleed band malfunctions, the student should be able to match the malfunctions to the symptoms with at least 3 of the 4 correct.

   j. Given a matching type worksheet consisting of a column of situations and/or conditions which may be encountered while starting the T-53 engine and a column of actions to be taken, the student should be able to match the action to be taken to the situation and/or condition with at least an accuracy of 80%.

2. SKILLS: None.

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STUDENT OUTLINE

POWER PLANT, UH-1

1. T-53 engine.

   a. Location.

   b. Description.

      (1) Type.

      (2) Models.

      (3) Design principles (notes on film).

         (a) TF 46-2985, "Army Aircraft Gas Turbine Engine Operation", Part I, (notes).

         (b) TF 46-2987, "Army Aircraft Gas Turbine Engine Operation", Part III, (notes).

   c. Components.

      (1) Air inlet section.

         (a) Purpose.

         (b) Location.

         (c) Description.

         (d) Components.

N_1 drives
① fuel control
② starter generator
③ Oil pump
④ tach gen. % RPM

1. NI accessory gearbox.

N_2
① Overspeed Governor
② Torquemeter boost pump
③ N_2 Tach generator

2. NII accessory gearbox.

3. Hollow struts. support outer housing mounts for engine (mount accessory drive pad)

4. Torquemeter assembly.

5. Planetary gear assembly. N_1 & N_2 are independent, no connections

(2) Compressor section.

(a) Purpose. housing has 3 mounting pads different pads allow use in different a/c

(b) Location. Go back for N_1 accessory drive gearbox mounts drives 4 accessories

(c) Description. ① fuel control, upper left hand corner, drive pad

(d) Components. ② starter generator, 6 o'clock ④ tach generator tells in % not actual RPM
③ oil pump

1. Axial compressor.

also mounted is an oil filter

2. Centrifugal compressor. N_2 system drives
① overspeed governor - controls fuel
② torquemeter boost pump picks up oil, boosts from 50-60 to 150 psi to tell torque in drive shaft

(3) Diffuser section. increases pressure

(a) Purpose.

(b) Location. (Outlet Case) ③ N_2 tach generator, driven after gear reduction

air inlet section * air inlet guide vanes — fixed, don't move, straighten out flow of air before entering compressor, hollow, anti icing with bleed air

torque meter provides reads of amount of torque on drive shaft

→ 3.22 - 1 gear reduction

* axial & centrifugal compressor bearing 5 stage axial 1 stage centrifugal
6-1 compression ratio L-11
7.1 on L-13
after air intercooler sect.

compressor sect.

(c) Description.

(d) Components.

1. Support assembly.

1 stage centrifugal stator vanes, fixed row of blades, 1 between each stage of compression, straightens flow of air exit guide vanes flow out, made of magnesium

N1 Turbine wheel, last wheel on shaft to centrif. comp., air is most compressed here no 1 or 2 bearings support N1 wheel

2. Bleed air reservoir.

stores air for bleed air heater, engine oil cooler, "D" fuel pump, mainly anti icing

① decreases velocity increases pressure
② directs flow of air back into combustion chamber
③ provides means of mounting engine

(4) Combustor section. air diffuser sect.

(a) Purpose. chamber where mixing & burning of fuel and air

(b) Location.

(c) Description. 360° annular reverse flow type chamber

2/3 air used for cooling & flame control

(d) Components.

1. Combustor drain. allows excess fuel to drain after flooding

2. Scoop and shroud. is to direct flow of air into combustion chamber and house flame

3. Curl assembly.

4. Starting fuel system.

5. Main fuel system. turned on operates boost pump solenoid valve opens on ignition & starter

8 & 4 start fuel nozzles

6. Spark igniters.

66% N1 fuel control will deliver 150 PSI to combustion chamber 40% N1 at 40 sec. start trigger release, stop ignition and unregulate fuel

(5) Exhaust diffuser. slows down gases for a new ~~turbo~~ effect - increases spacing 288 inches

E diffuser – consists of inner & outer housing supported by 4 hollow struts (has an oil jet) mounts thermal couples and #3 & #4 bearings, has small air holes for external

(a) Purpose.

(b) Location.

(c) Description.

d. Air flow. swirl assembly changes air & gas flow 180°

N, nozzle, stator vane

* Air Route
① air guide vane
② compressor section
③ Diffuser
④

2. Engine support systems.

a. Ignition system. ignites fuel & air mixture during start

(1) Purpose. energized by starter trigger switch
delivers 28 volts D.C.

(2) Description. exciter current builds to 2500 V.

(3) Components.

(a) Ignition unit.

(b) Harness. goes ~~through~~ harness

(c) Spark splitter. sends 2500 V to each igniter plug & prevents one from grounding out the other

(d) Igniter plug. to provide arc for spark for ignition

b. Electrical system.

(1) Purpose. power to engine components & provide power from components to cockpit

(2) Description.

c. EGT thermocouples.

(1) Purpose. senses exhaust gas temperature

normal egt 620°-630°
EGT - [illegible] independent of electric system
exceed 650 more than 5 minutes hot start requires inspection
exceed 760° is hot start, requires hot end inspection

(2) Location.

~~(3) Operation.~~

L-11 L-1
L-13 7-1 comp ratio

tach gen. self sustaining N_2 = [illegible] meter 28 v. AC.

d. Anti-icing system.

(1) Purpose. Ice Detector is actually anti icing [illegible]

(2) Operation.

(3) Components.

(a) Detector unit. forward of air inlet section
28 v.D.C. [illegible] as a heater,
failsafe valve, spring loaded to open

(b) Interpreter section

(c) Warning lights.

(d) Hot air valve. takes hot compressed air from diffuser section

e. Inner stage airbleed system.

(1) Purpose.

(2) Location.

(3) Operation.

(4) Components.

6 hollow struts - 1 carries oil
exhaust temp rises with icing
N_1 variable
N_2 constant
during starting will be completely open
accel & decel " op. will be open & closed
70-80% completely closed

bleed band - minimizes buildup of back pressure during starting and accel.

L-13-4
1-2 [illegible]

L-11 stationary static open 51.5% open
full open 78-80%

f. Variable inlet guide vanes. Only in L-13 engine

(1) Purpose. controls angle of entering inlet air for more efficient flow in relation to compressor RPM

(2) Location.

(3) Operation. stuck in closed position would not develop enough shaft horsepower

(4) Components.

3. Engine controls and instruments.

a. Controls.

(1) Purpose.

(2) Location.

(3) Types.

(a) NI (gas producer).

1. Description. controls flow of gas to combustion through fuel control
4 positions open-closed-start-flight idle-operate 28VDC electric solenoid
hold & maintain (1) linear actuator (2) droop cam compensator

2. Components.
compensates for movement of collective
correlates N_2
Rpm when going to 6600 from 6000

3 attempts in 1 hr. wait 3 min. after 1 att. [illegible]

(b) NII (power producer).

1. Description. overspeed gov. prevents overspeed

min. voltage is 14v. during starting abort start if its lower

2. Components.

torque (N_2) redline at 50

gas producer N_1

(4) Operation.

b. Instruments.

(1) Dual tachometer.

(a) Location.

(b) Power.

(c) Calibrated.

(2) Torquemeter gage.

(a) Location.

(b) Power.

(c) Torque.

(3) Gas producer gage.

(a) Location.

(b) Power.

(c) Calibrated.

(d) Placard (GO; NO-GO).

1. Purpose.

2. Operation

(4) EGT gage.

(a) Location.

(b) Calibration.

4. Demonstration of engine operation.

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PERFORMANCE CHECK

POWER PLANT, UH-1

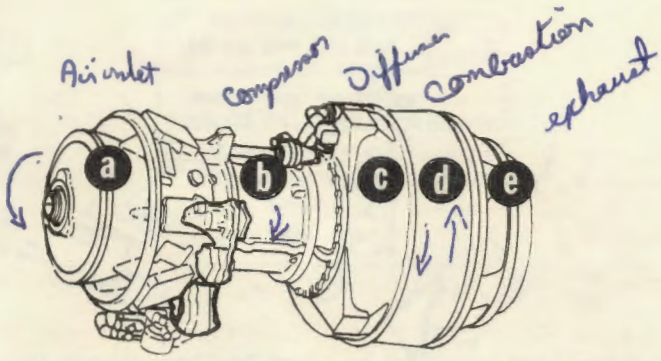
1. Identify the location of the three rigid engine mounts at right and match with the proper component by placing the letter in the space provided.

a.	3	Tripod	(1) Left-hand front mount
b.	2	Bipod	(2) Right-hand rear mount
c.	1	Support tube	(3) Left-hand rear mount

2. List the engine power source (N_1 or N_2) from which each of the following accessories is driven:

ACCESSORY	POWER SOURCE
a. Torquemeter boost pump	N_2 28 volt AC
b. Gas producer tachometer	N_1
c. Power turbine tachometer	N_2
d. Fuel control	
e. Power turbine overspeed governor	
f. Oil pump	N_1
g. Starter/standby generator	N_1

3. Match the lettered sections of the T-53 engine to their proper nomenclature and purpose by placing the letter in the space provided.

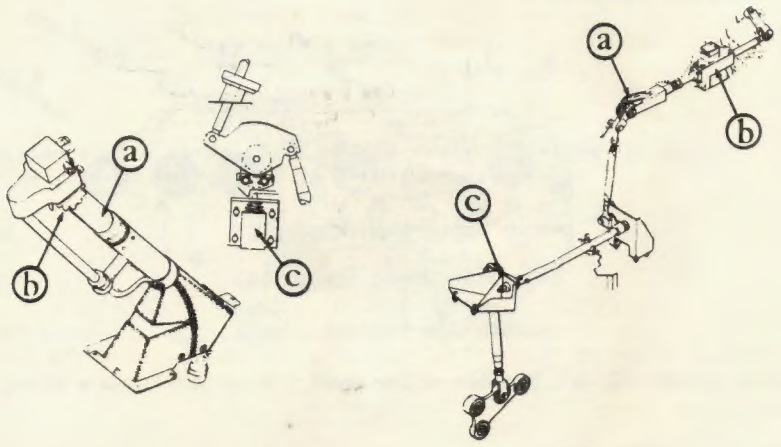


	NOMENCLATURE	
____	Combustor	Chamber for mixing and burning fuel and air
____	Exhaust diffuser	Inner and outer housings, slowing down exhaust gases for no thrust effect
____	Compressor	Decreases velcoity; increases pressure
____	Air inlet	Provides streamlined air passage for compressor
____	Diffuser	Increases pressure six atmospheres

4. Match the ignition system units at right by number to the statements at left which gives its location or properly describes it.

2	a. Provides gap between conductors to produce spark	(1) Ignition exciter unit
1	b. Increases voltage to 2500 volts, then discharges current	(2) Igniter plugs
4	c. Transitions current progressively through the ignition system	(3) Spark splitter
3	d. Located in ignition harness, preventing failure of both plugs in case one malfunctions	(4) Ignition harness

5. Match each of the lettered components to the current nomenclature by placing the letter in the space provided.

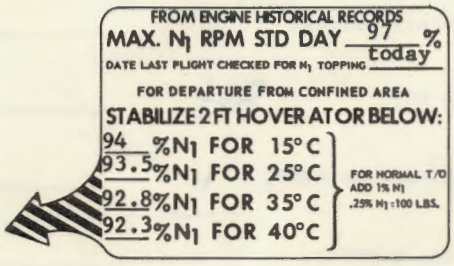


N_1 CONTROLS		N_2 CONTROLS	
B	Friction adjustment	C	Linear actuator
C	Flight idle solenoid	B	Droop compensator
A	Twist grip	A	Shear pin

6. From the following list, name the instrument that will record the information and list the source of power for each.

	INSTRUMENT
a. N_2 and rotor rpm	a. Dual engine rotor tach Source of power: N_2 gen. tach
b. Exhaust diffuser temperature	b. T-GT Source of power: miniVolts
c. Indication of shaft horsepower	c. torquemeter Source of power: 28 AC
d. Percent of N_1 rotor rpm	d. Gas producer tach Source of power: N_1

7. Write the correct answer to each of the following questions in the space provided using the GO-NO-GO placard.



a. Prior to take off from a confined area, it was noted while at a 2 foot hover that the N_1 speed was 94% and OAT was 35°C. Could the aircraft complete the take off? Yes or (No)

b. While at a hover it was noted that the N_1 speed was 93.8% and the OAT was 35°C. Could the aircraft complete a normal take off? (Yes) or No

c. While at a hover it was noted the N_1 speed is 95% and the OAT is 35°C. How much weight would have to be removed prior to take off from a confined area?
(400) lbs

8. Match the components of the anti-icing system to the proper purposes by placing the letters in the spaces provided.

COMPONENT		PURPOSE
a. Interpreter	(C)	Senses icing condition
b. Hot air valve	(A)	Controls engine icing caution light
c. Detector	(B)	Allows air to flow to the inlet case of the engine
	(A)	Controls engine ice detector caution light

9. Match the bleed band malfunctions to the listed engine symptoms by placing the number in the space provided.

SYMPTOMS		MALFUNCTION
a. Slow acceleration rate	(1)	(1) Band stuck closed
b. Loss of power in flight	(2)	(2) Band stuck open
c. Engine surge during acceleration at low rpm	(1)	
d. Engine surge during acceleration at high rpm	(1)	

10. Match the corrective action to be taken to the listed situations and/or conditions.

		ACTION TO BE TAKEN
a.	During start the battery voltage drops to 12 volts	3
b.	During the start the EGT exceeds 760°C.	3,4
c.	During the start EGT reaches 400°C on the UH-1B.	1
d.	During start EGT rises rapidly, N^1 speed slow, short starter engagement time during start.	3
e.	When N^1 speed reaches 40% or starter engagement time has reached 40 seconds	5

ACTION TO BE TAKEN

1. Turn off start fuel
2. Full open twist grip
3. Abort the start
4. Make appropriate 2408-13 entry
5. Release the starter trigger